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SENATE AND ASSEMBLY

OF THE

TWENTY-NINTH SESSION

OF THE

LEGISLATURE OF THE STATE OF CALIFORNIA.

VOLUME VI.

SACRAMENTO:
STATE OFFICE, : : : : : A. J. JOHNSTON, SUPT. STATE PRINTING.
1891.

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REPORT

OF THE

PARK COMMISSIONERS

OF THE

CITY AND COUNTY OF SAN FRANCISCO.

SACRAMENTO:
STATE OFFICE, : : : : J. D. YOUNG, SUPT. STATE PRINTING.
1890.

REPORT.

PARK OFFICE, January 1, 1890.

To his Excellency R. W. WATERMAN, *Governor, Sacramento, Cal.*:

SIR: The undersigned, the Park Commissioners of the City and County of San Francisco, have the honor, in accordance with Section 5 of the Statutes of 1889, providing for the maintenance and support of public parks, to report, through your Excellency, to the Legislature of the State of California, as follows:

The section referred to provides that a detailed statement of receipts and expenditures shall be made to the Board of Supervisors and to the State Legislature, January and July of each year. At the end of the fiscal year, it has been the custom of this Board to submit a report more or less elaborate, the last report having been printed in pamphlet form, and giving in detail not only the receipts and disbursements, but explaining in full the various improvements made during the preceding year, as well as those contemplated for the succeeding year, and containing all information which would seem to be of any value or interest. Therefore, it is hardly necessary that this present report should be other than a financial statement, as the usual custom will be followed out, in making an elaborate and detailed report, in July next.

There have been planted in the park during the last six months, twenty thousand one hundred and sixty-four shrubs and trees, and thirty-nine thousand four hundred herbaceous and flowering plants. There have also been planted three thousand three hundred cypress, four thousand eight hundred pine, four hundred leptosperum, two thousand three hundred genista of sorts, three thousand eight-hundred and twenty-two of acacia, and four hundred and seventy-two vines and trailing plants, with five hundred and seven other varieties of trees, palms, and succulents, making a total number of fifty-nine thousand five hundred and sixty-four.

An addition has been built to the conservatory, which, with the old music stand, has been repainted, making a decided improvement in the picturesqueness of that portion of the park. Nine thousand feet of water pipe have been laid since our last report, and the sewerage and drainage system has been put in such thorough repair that little or no damage has been occasioned during the present winter, notwithstanding the unprecedented storms. Irreparable injury would have been occasioned to the roadways and flower-beds by the large rainfall, had not an almost perfect system of underground subdrainage been inaugurated and carried out during the last few months. The foot path now being constructed is almost completed to the ocean beach. The increased number of pedestrians has necessitated the reconstruction and widening of practically all of the foot paths, especially those leading from the various termini of the street railways to the principal points of interest in the park. Point Lobos and Buena Vista park roads have been kept in fairly good condition. With the growth of the park, it has been necessary to provide larger stables. The present structure having been built some fourteen years since, and being totally inadequate for the purpose, we have let a contract for a large and substantial stable. The question of providing proper roads for those riding on bicycles and like machines is one which we hope will soon be settled with satisfaction to all. That the bicyclist should be afforded proper facilities is beyond question, but that the facilities afforded should not interfere with or be a cause of danger to pedestrians, as well as those driving, is also beyond question.

A pleasant attraction has been the addition to our deer park of two handsome elk, donated by Alvinza Hayward, Esq. The speed road, the history and condition of which is elaborated upon in our last report, will soon be open to the public. Originally constructed or designed, with a width of one hundred feet, it is now the intention of the Board to devote fifty feet on the south side for the use of those desiring to speed their horses, and the remaining fifty feet will be used as a family drive by those desiring to witness the speeding, and more particularly as a new and shorter road to the ocean. Parallel to the speed road is now being constructed a foot path twelve feet or more in width, so that those walking may have equal facilities with those driving, for its enjoyment. The constantly increasing travel over the park roads has made it very difficult to preserve the excellent condition in which they have always been maintained. This difficulty is increased by the want of proper macadam or road material in the park quarries. Among other contemplated improvements, it is the intention of your Board to enlarge the present music concourse, making a driveway around the band stand, and to construct a bridge across the main driveway bordering the concourse on the north and at its exit for vehicles, so that pedestrians may cross from this point to Conservatory Valley free from the present danger. An additional force of men has been placed at work reclaiming the western part of the park. Commencing at the ocean, large quantities of Arundo Arenaria (Holland or sea grass) are being set out, and particular attention is being paid to the planting of the great highway, which is designated as "all that portion of the lands within the limits of the City and County of San Francisco, above the ordinary high water mark of the Pacific Ocean (as the same existed on the seventh day of July, 1846) which lies south of a line drawn due south 81 degrees and 35 minutes east, magnetic, through Seal Rock, and west of a line easterly not less than two hundred feet from ordinary high water mark."

It is the hope and belief of this Commission that the thorough planting of this highway, protected by proper fences and trees, will ultimately result in the formation of an enbankment, which may, in the future, with proper improvement, be used for a boulevard or driveway, and will prevent the further encroachment of drifting sand. A judicious thinning of the plantations has much improved the forestry of the park, the trees now being exceptionally healthy, and giving promise of excellent growth. It may be remarked incidentally, that we realize the necessity of rapidly extending the improvements and attractions of the park in a westerly direction, as the eastern portion of the park, which is already in a state of high improvement and cultivation, is becoming too crowded for either the safety or convenience of the public with whom the park is each day growing more popular, and is consequently of more benefit, as is shown by the constantly increasing number of visitors.

The total addition to the Park Improvement Fund, from July 1st to date, is	$60,844 81
The disbursements have been	44,398 32
Leaving a balance of	$16,446 49

The principal items of expenditure have been:

For labor	$30,038 00
For material	14,360 32

These items may be segregated as follows:

Cost of waterworks and drainage	$3,632 77
Roads and walks	12,738 87
Tree planting, grounds, and reclamation	11,240 27
Maintaining conservatory	3,839 74
Nursery	4,070 50
Policing	3,893 78
Structures	4,892 39
	$44,398 32

All of which is respectfully submitted.

R. P. HAMMOND, Jr.,
JOSEPH AUSTIN,
W. W. STOW,
Board of Park Commissioners, City and County of San Francisco.


MAP
showing the
GOLDEN GATE PARK
CONTAINING 1040 ACRES
A PORTION OF THE GREAT HIGHWAY
AND
THE AVENUE
Scale 4000 to 1 inch
1890.
PACIFIC OCEAN
THE GREAT HIGHWAY
THE SPEED ROAD
MAIN DRIVEWAY TO OCEAN AND CLIFF HOUSE
A DRIVE CONSTRUCTED BY CITIZEN'S RELIEF COMMITTEE
PROPOSED ESPLANADE
BUNKER HILL
STRAWBERRY HILL
MAIN DRIVE
LAURA GLEN
PROPOSED ARBORETUM
Proposed Recreation Grounds
DEER GLEN
PUBLIC LAWN
QUARRY
CASINO
CONSERVATORY VALLEY
LAWN
HAYWARD VALLEY
SHARON'S
CHILDREN'S QUARTERS
OLYMPIC CLUB GROUNDS
South Drive
THE AVENUE DRIVE
FULTON
GROVE
HAYES
FELL
OAK
PAGE
HAIGHT
WALLER
KATE
FREDERICK
CARL
STANYAN
SHRADER
COLE
CLAYTON
ASHBURY
MASONIC
LOTT
LYON
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NINETEENTH ANNUAL REPORT

OF THE

BOARD OF PARK COMMISSIONERS

OF

SAN FRANCISCO,

FOR THE YEAR ENDING JUNE 30, 1890.

SACRAMENTO:
STATE OFFICE, : : : : : : : J. D. YOUNG, SUPT. STATE PRINTING.
1890.

PARK COMMISSIONERS.

W. W. STOW, President.
R. P. HAMMOND, Jr.
JOSEPH AUSTIN.

John McLaren .... Superintendent.
V. V. Bloch .... Secretary.
Wm. Ham. Hall .... Consulting Engineer.
Harold Wheeler .... Attorney.

OFFICE OF THE COMMISSIONERS OF GOLDEN GATE PARK,
BUENA VISTA PARK, MOUNTAIN LAKE PARK,
SAN FRANCISCO, CAL., June, 1890.

To the Legislature of the State of California, and to the Honorable Board of Supervisors of the City and County of San Francisco:

The Park Commissioners herewith present a report of their management of the grounds under their charge for the year ending June 30, 1890.

W. W. STOW, Chairman,
R. P. HAMMOND, JR.,
JOSEPH AUSTIN,
Park Commissioners.

PARK COMMISSIONERS AND OFFICERS

FROM THE ORGANIZATION IN 1870.

The Act for the establishment of the grand parks of San Francisco was approved by Governor Haight, April 4, 1870.

On the nineteenth of the same month Governor Haight issued commissions, to run for four years, to the first Commissioners provided for in the Act.

On the third day of May following the Commissioners met at No. 320 California Street, and organized the Board as follows:

1870—S. F. Butterworth, President, D. W. Connelly, C. F. MacDermot. A. J. Moulder, Secretary. Abraham Seligman (appointed August first), Treasurer. W. H. Hall (appointed August fifth), Surveyor. Patrick Owens (appointed November seventeenth), Park Keeper.

1871—J. Seligman & Co. (appointed April tenth), Treasurer. W. H. Hall (appointed August fourteenth), Engineer.

1872—S. F. Butterworth, resigned January twelfth; Eugene L. Sullivan elected to vacancy. C. J. Brenham, appointed Commissioner, May tenth, vice Connelly, deceased. J. T. Fleming, elected Secretary, June twenty-eighth, vice Moulder, resigned. S. F. Butterworth, elected Commissioner, December thirty-first, vice Brenham, resigned.

1873—Wm. Alvord, appointed Commissioner, September tenth, to succeed MacDermot.

1874—Eugene L. Sullivan, President, S. F. Butterworth, Wm. Alvord, Commissioners, appointed by Governor Booth, April twenty-second.

1875—Louis McLane, elected Commissioner, June twenty-ninth, vice Butterworth, deceased.

1876—W. B. Pritchard, elected Superintendent.

1878—T. B. Mortee, elected Secretary, January second. Eugene L. Sullivan, President, Wm. Alvord, Louis McLane, reappointed May first, as Commissioners. Oliver Eldridge, elected Commissioner, November seventh, vice E. L. Sullivan, resigned. Same date Louis McLane became President of the Commission.

1881—F. P. Hennessey, elected Secretary, January eleventh. F. P. Hennessey, appointed Acting Superintendent of Parks, May first, vice Pritchard, resigned; E. H. Sheldon, elected Secretary in July.

1882—Wm. Alvord, President, Frank M. Pixley, John Rosenfeld, appointed Commissioners. Frank M. Pixley, elected President in July. Leland Stanford, elected Commissioner, vice Wm. Alvord. Joseph L. Howell, elected Secretary in July. R. S. Smith, elected Secretary in September.

1883—Valence V. Bloch, elected Secretary in June, vice Smith, resigned. General Irwin McDowell, appointed Commissioner, vice Leland Stanford, resigned.

1884—Alfred Poett, elected Engineer in September.

1885—Charles Goodall, appointed Commissioner, vice Irwin McDowell, resigned.

1886—R. P. Hammond, Jr., President, W. H. Dimond, Joseph Austin, appointed Commissioners.

1887—John McLaren, elected Superintendent.

1889—W. W. Stow, appointed Commissioner in September, vice W. H. Dimond.

1890—W. W. Stow, elected President, May twenty-eighth, vice Hammond, resigned.

REPORT OF COMMISSIONERS.

GENERAL REMARKS.

Public parks as lungs for great cities, places for recreation, for rest, to study the beautiful and cultivate the taste, notwithstanding their great cost, have met and refuted every objection, and are counted to-day as indispensable agents in modern civilization. No city is fully equipped without some grounds for public resort, and almost every village or hamlet inhabited by enlightened races has some free spot which all have the right to enjoy.

Man, in his primitive stages, roamed the groves and fields, the parks laid out by the hand of nature. As he progressed, and the rights of property were recognized, parks, as preserves for deer and other animals, were maintained as appendages to the homes of the wealthy.

Picturesque houses and lodges arose among the natural scenery in keeping with it, and here, aided by the beautiful and harmonious surroundings, men drew some of their best inspirations, enobled themselves with deeds of heroic patriotism, and gave impetus to the progress of the world.

As population increased, forest fires and the wants of man decreased the area of trees; a long pastoral stage was destructive also by browsing of animals. Settled life, the demands of increasing population for food, the building of great cities, decreased the acreage of woodland and swept away with too often vandal hands the most beautiful alternating scenery of forest and wildwood, valley and glen, until a longing for nature in her primitive conditions—perhaps a sense transmitted by heredity from some ancestral hunter whose soul had absorbed the imperishable delights of forest shades and purling brooks—inspired the preservation of remnants of the natural scenery left, or led to the construction of artificial woodlands and glades within, or contiguous to, great centers of population. The terraced gardens of Nebuchadnezzar were said to have owed their origin to his nostalgic Medean queen, whose childhood home was in the wild and wooded mountains. The Academia of Athens, where Socrates spoke wisdom to the youth of the city, and Plato made famous, was the artificial production of a son of Miltiades; the creation of a minature world on a rough and forbidding site, perhaps no better fitted by nature for cultivation than the drifting sand dunes of the park by the Golden Gate.

UTILITY OF PARKS.

The fact is an unvarying and patent one, that the denser the population the greater the death rate. This fact is emphasized by another, that the rate of deaths is, under fair conditions, higher in large cities than in outlying rural districts, and that, too, when medical intelligence and attendance and trained nurses are at hand in the cities. The ratio of intemperance and crime is also greater in the cities, and in proportion to their crowded, filthy, and unhealthy character. It was found that in a densely packed district in New York the annual death rate was forty-six per thousand, while in the rural districts it did not exceed sixteen. It is estimated that children born in compact metropolitan quarters do not have half the chances to live as children more favorably situated. As the old walls of cities are leveled, and new avenues are opened to the sun and air; as ancient burial grounds are laid out into parks and gardens, and modern sanitary knowledge and measures are extended and applied, a wonderful lowering of mortuary rates is apparent. But after all, according to eminent London physicians, but few perfectly healthy children are born in that modern Babel. In greater or less degree unhealthfulness is a concomitant of all cities. They are necessities in the world's progress and economy, and their lesson is a warning to young towns of promise to care for the future as they go along.

The benefits derived from breathing and recreation grounds in cities are so well understood that money is less grudged by taxpayers for the purpose of extending and beautifying them than for almost any other purpose. New York, for instance, expended last year on Central Park, containing eight hundred and forty-three acres, $1,135,200. The State Legislature also appropriated an additional $750,000 for completing Central Park and improvements on Riverside and Morningside Parks. An attempt to reduce the area of the outside parks beyond the Harlem River was met by a vigorous protest from the "Citizens' Park Association," composed of many of the most distinguished and wealthy men of the metropolis, although these parks, comprising a total of three thousand eight hundred and forty-three acres, are yet in quite a state of nature, and may call, in a few years, for an unlimited expenditure of money for changes and ornamentation.

The influence of parks in collecting and growing the trees, shrubs, plants, and flowers of other lands, and the animals of other climes, are not to be underestimated. Knowledge and culture are extended by travel, but the great majority have not the means to visit other countries. The bringing together of the fauna and flora of the world so as to be seen by the multitude compensates, in a great degree, for want of travel, and produces the same educational and cultivating influences. Not less is the reflex influences upon rural life and manners. Cities live upon the vitality of the country. In their beautiful, natural, and artistic public grounds the visitor from the country catches inspiration from the surprises of a world in miniature, and carries back with him a refining taste. He procures a tree here and a plant or flower there; he imitates on his own grounds, if possible, some bits of artistic skill he has enjoyed, and produces around his home a thing of beauty which is a joy forever. In this way parks are civilizing in their work and compensatory to the country from which the cities have their life.

The observations of all who have given attention to the subject are of the same tenor, that every city owes to itself, not alone for the physical but for the moral health of its citizens, to maintain beautiful grounds open and inviting to all. All park literature is conclusive on this subject. The young, with characters not yet formed, are attracted to salutary places of resort, and away from the dens of intemperance and vice. An ambition to appear cleanly and respectable in such places is created and stimulated, and daily exemplified in our parks. Where everything

THE FERN FOOT PATH.

is beautiful and in order, the rudest boy forgets his jack-knife and his heedless vandalism, and imbibes an interest in the preservation of the harmony of things, that appeals to his awakened soul. In this way is laid the foundation of character where dry precepts fail. The surprises of a park; the alternation of forest and meadow; the opening at intervals of charming vistas; the profusion of plants and flowers here and there in infinite variety, and all in consonance with a refined taste; the happiness of children on the lawns; strains of ennobling music; works of art and the like, all come to the most wayward of our kind as a revelation that there is something better than the abodes of crime and mischief, and are great aids in shaping the future life of the man or woman. Home influence, the kindergarten, the school, and the public park are handmaidens in the formation of character.

PARKS OF THE WORLD.

A brief comparison of the parks of a few cities of the world will establish the general estimation in which they are held by all civilized nations:

	Population.	Park Acreage.
London	3,832,000	22,000
Paris	2,270,000	58,000
Berlin	1,122,000	5,000
Vienna	1,103,000	8,000
Brussels	380,000	1,000
Amsterdam	350,000	800
Dublin	250,000	1,900
New York	1,840,000	4,900
Philadelphia	975,000	3,000
Chicago	725,000	3,000
Brooklyn	665,000	900
St. Louis	400,000	2,232
Boston	400,000	2,000
Baltimore	355,000	832
Cincinnati	325,000	539
San Francisco	325,000	1,181
Washington	225,000	1,000

The census to be taken the present year will change the population figures in all the American cities, but the park acreage will remain about the same as given. It will be seen that Paris, which is ranked by many writers as the center of civilization, is better equipped with lungs than any of the cities in the list. Yet the old part of Paris was regarded until late years as abominable for health. The usual death rate formerly was fifty per thousand. The immense improvements for sanitary purposes which have been made in the last fifteen years have reduced the rate to less than one half. Where once were districts of solid buildings with only long and narrow alleys, or few air channels for ventilation, grand avenues have been driven, regardless of expense, through massive walls miles in length, old buildings have been demolished, and public squares laid out and beautified. The city is thus supplied with breathing places where once were compact blocks, the breeding places of filth, immorality, disease, and death. The opening of passages through the city, letting in both sun and air, is telling wonderfully on the health and elevation of its citizens. It is thus that experience and necessity have forced the present generation to repair the errors of ancestors. It is the resort of the pleasure seekers of the world, and the citizens of all climes pay homage to its varied attractions. All great cities have made the same mistakes. The genius of that great man, De Witt Clinton, devised a system of parks in the City of New York, which was ignored by the authorities. His plan would have given the city a grand park where nature seemed to have designed one to be. The land was sold for a song that to-day is worth hundreds of millions, and in the stead of a natural lake and salubrious surroundings, we have one of the unhealthiest parts of the city. Had the sheet of water on which John Fitch launched the first steamboat ever built in America been allowed to remain, it would have been a historical landmark preserved. "Collect Pond" was filled, and now "The Tombs" appropriately designates the spot, and the district is known by the name of "The Swamp." The opening of large and elegant parks in the new parts of the city does not wholly repair the damage. It is found in all cases, as well in the Bois de Bologne as in the Central Park in New York, that the great parks, away from the densest parts of the population, are visited more largely by the rich, who drive in carriages, than by the poor, who go on foot. The children of the poor, and even those of some means, cannot be taken to the parks far away on account of the consumption of time and money. There is a necessity, therefore, for breathing places easy of access all through our cities. Happily, the City of San Francisco is so laid out and on such a site that the cooling breezes from the vast Pacific daily fan away and dissipate the germs of disease, and the necessity for great squares is not so pressing as in most other cities of the globe. Yet, let us not flatter ourselves that the time may not come when a new generation will resort to extreme measures to atone for our blindness and neglect. It may be seriously questioned if at least two breathing places should not have been preserved in this city south of Market Street. As population grows dense, and the conditions of the laboring classes hardened, we may expect here to see the same economy as in the cities of the old world, and the enjoyment of public grounds near at hand of prime necessity to the children of the poor. However, the ever present cable car lines furnish pleasant, cheap, and expeditious transit to and from our great park, thus equalizing the facilities of the entire population for enjoying its advantages.

It will be seen, by a comparison of acreages given to parks, that San Francisco has provided for the future to some extent. She has a larger acreage than most cities of her rank. But occupying the place that she does on thousands of miles of extended coast with but few harbors, and none so favorably designed by nature as her own, for the center of a vast population, it must be evident that she has none too much area for lungs to a great city.

SAN FRANCISCO PARKS.

The larger parks of San Francisco, now the property of the city, consist of Golden Gate Park, Buena Vista Park, and Mountain Lake Park, comprising an area, in all, of one thousand and eighty-five acres.

Buena Vista Park lies south of the entrance to the Golden Gate Park, and a few blocks distant. It consists of thirty-two acres of a prettily wooded hill, and on which little, so far, has been expended, except to clothe it with trees. As its name denotes it affords magnificent views. From the most elevated points one can have a grand panoramic sight of

the city, Oakland, and the Contra Costa hills beyond, on one side, and the ocean on the other; in fact, the whole of the peninsula on which San Francisco rests. Golden Gate Park lies like a grand garden below. Buena Vista Park is a promising possibility of the future, as the needs of the coming generations, in a vast metropolis, shall require. The policy of the present is only to hold and preserve it, it being apparent that the appropriation allowed by law may be better made tributary to the general interest if devoted to improving Golden Gate Park.

Mountain Lake Park lies a mile and a half north of Golden Gate Park, and with the little lake on it, and some additions of land from the Government, will make a valuable adjunct to the grand park. It is already connected by roads with it, and as an extension will help to give the visitor, driving through the park grounds, the impression of a wide territory devoted to recreation purposes beyond the actual fact.

Golden Gate Park.—The great park of San Francisco, denominated the Golden Gate Park, has an area of one thousand and forty acres, stretching from its entrance, which is two miles west of the City Hall, to the shore of the Pacific.

The site was originally one of the most unpromising ever selected for such a purpose. It was largely a desert of shifting sand dunes, moving inward by ocean winds. Long reaches of sand cliffs, the sand curling over like breakers, held principal possession. The thought among the masses was general that the waste of sand was impossible of reclamation, and that money used in the attempt would be squandered. The site, however, was not without its merits. It abounded in hills and depressions. Its inequalities of surface impressed the landscape gardener from the first. There were some hills of rock and clay, the needed material to pave the roads and paths, and stay the drifting sands. Behold the change! The sand waves over the whole area have been checked. The scrub oaks, lupins, and willows, natives of the soil, where limited places allowed them to grow, are yet present, but the whole area is now planted with exotic trees and shrubs fitted to the conditions, and about one hundred and fifty acres of the whole is a scene of verdure and variety equal to any park in the world. Here will be seen vegetable life from Siberia, Japan, China, Australia, Africa, South America, and the islands of the ocean. There is no park known in which so great a variety has been successfully cultivated. The beech and sugar maple are about the only trees of the temperate zone that resist acclimation.

The visitor to the Golden Gate Park enters a scene of loveliness. A mountain rises on the south clothed with a planted forest, the more barren parts of the ridges and slopes presenting the appearance of vegetation struggling with difficulties, while the depressions and richer parts are dark with thrifty growths of cypress and pines. This mountain does not belong to the park, but probably will in the future be one of the recreation grounds of the city.

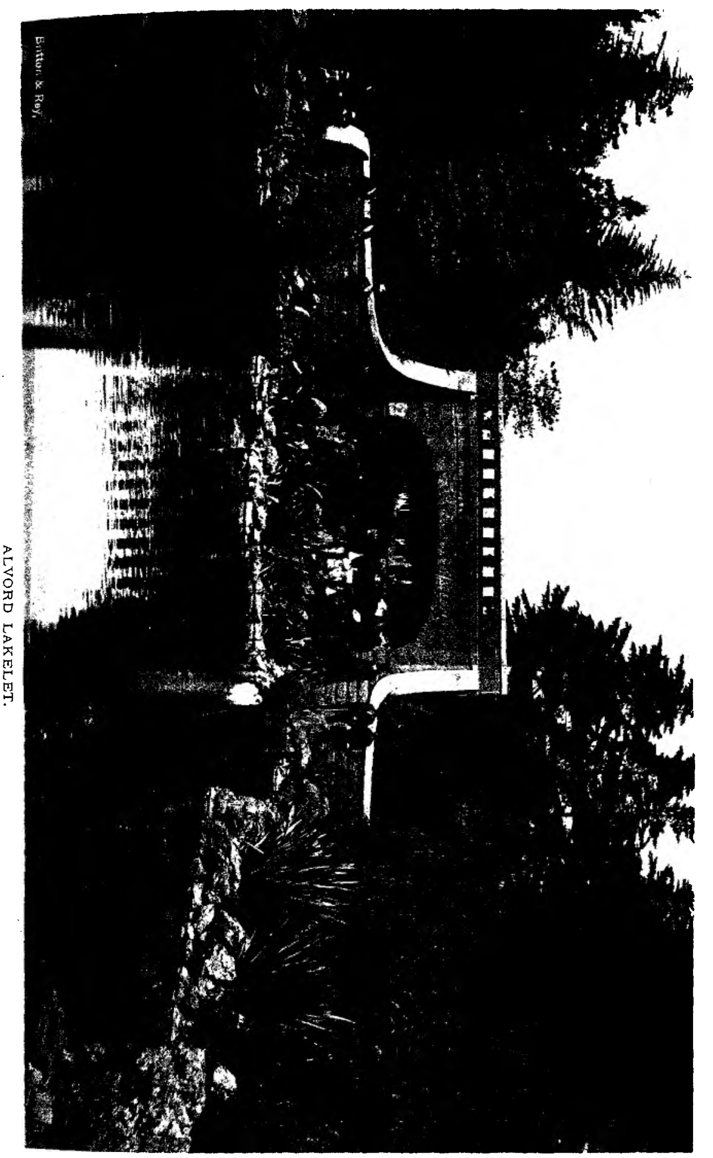
A trip through the park, in carriage, and especially on foot, is one of pleasant surprises. There is something to arrest and delight the eye at every step. The curving roads, bridle paths, and walks lead one to vistas of lawn and flowers, over meadow and glade, amid shrubbery and woodland, the sloping banks as you pass covered with artistic figures in many colored plants and flowers. The succession of objects, from extreme cultivation to tangled wildwood, is infinitely pleasing and impressive. Nature has not been driven to contract its limits by art. Mistakes have been made, it is true, such as not planting the taller variety of trees upon the tops of the hills and the shorter at the bases, so as to increase the contrast and heighten the effect. But remedies will come in time. Most of the parks of the world have been subject to change, as critical taste has demanded and adaptability demonstrated. Another mistake was that of commencing the work of reclamation of the sand dunes at the eastern end, instead of at the source of supply along the ocean beach; and yet lack of funds made this advisable, and to bring recreation grounds near the people. But the sand drifts have been laid at last, and forest trees are springing up all over the wide waste once deemed irreclaimable.

The great work has been facilitated by planting a sea beach grass from the coasts of Europe, called *Arundo arenaria*, and the wild lupin, indigenous to the country. These, taking root, and staying the sand, the surface is soon prepared to receive other trees, hardy in their nature, to be followed by others as conditions allow, until the whole park is made as beautiful and attractive as its highly improved parts are at present.

Notwithstanding the millions that have been expended on other parks of the world to produce depressions and altitudes, the inequalities of surface without which all ornamentation might be gorgeous but tame, we know of no public grounds that afford from their highest points the variety and grandeur of views that can be had from the hills of Golden Gate Park. They embrace a circle fifty miles in diameter. Old ocean glistens, rolls, and roars along its western marge. The Cliff House, sitting on the declivity of rocks, and Sutro Heights, with its embattlemented walls above, one day we trust to be added to the city's treasury of territory, the Golden Gate, Fort Point, the hills of Marin, dominated by Tamalpais, a sweeping view of inland water, the gateway to the heart of California, Oakland, the hills beyond, grand old Diablo, and the islets of the bay—these are some of the gracious greetings to the eye of the visitor who ascends the hills of our park to take in the objects in the vast expanse. We repeat, no other park in the world can equal its wealth of view and variety. We have no running crystal streams or waterfalls, so helpful in toning the thoughts and nerves, and needful for change, but we can make them, and to produce them will add to the glory and triumph of genius and public spirit of that hopeful civilization whose center on the Pacific must be by the Golden Gate. A people who can make a desert burgeon and blossom can be relied on to add all the accessories refined taste demands.

Unlike Central Park of New York, which is closed during the night, our park is never shut. The entrances are open to visitors day and night, and patroled by policemen, who see that no depredations are committed and order maintained. And it is a gratifying fact to record that vandalism and pilferings are rare. There is little on this score to complain of in comparison with the reports from the other parks of the world. It speaks well for the character of our people, and is an encouragement to taxpayers that their efforts are not to be wasted by destructive tendencies.

It is to be observed that our cosmopolitan population demands different enjoyments. The difficulty to please all is increased the more the



ALVORD LAKELET.

homogenity of the people is broken. The aim has been to afford such pleasures in the park as are possible, and not objectionable to any. It is gratifying to report that little objection is made to the established order, the rational elements sustaining the judgment of the park management.

HISTORY.

The project of providing for San Francisco a grand park was discussed and urged by the public press of the city and some of its far-seeing citizens, a considerable time before legislative steps were taken to provide the lands for it. The city having been secured in its title to what were called the "outside lands," consisting of four square leagues, and the limits of the city extended to the shore of the ocean on the west, and the boundaries of San Mateo County on the south, measures were taken by the municipality and the Legislature to extinguish the claims of persons holding possession of outside lands, and to free from all incumbrances such parts of the territory of the city as might be designated for public purposes.

By an order of the Board of Supervisors made in 1868, a survey was made of all that part of the area of the city lying west of Devisadero Street, a map made, and selections of reservations made thereon for public use. The order provided that the cost of extinguishing private titles on the reserved parts should be assessed on the balance of the "outside" lands. This order of the Board of Supervisors was afterwards confirmed by an Act of the State Legislature.

The lands set apart by the Supervisors included Golden Gate Park, and the avenue to it, Buena Vista Park, Mountain Lake Park, and the Great Highway. The locations of these three parks are well understood. The Great Highway is the strip of land lying west of a line easterly not less than two hundred feet from ordinary high water mark of the Pacific Ocean, and along the entire ocean front of the city, and is to be occupied by the boulevard to be.

Congress in 1886 ceded to the City of San Francisco the Seal Rocks, which, by an order of the Board of Supervisors, the next year became a part of the public reservations. The Point Lobos road the same year became a part of the same. The first Park Commission was created by the Legislature and their qualifications and duties defined in 1870. Various modifications of the law were made from time to time, but the experience demonstrated that the Commission were too restrictive in their action. As the park grew and called for broader management, it was found necessary to give greater scope and power to the Commisioners.

The Act to accomplish this passed both Houses of the State Legislature without a dissenting voice, in February, 1889, and is the authority under which the present Commissioners act. Similar powers were granted the Commissioners at first, but they were shorn of them by subsequent restrictive Acts, until a restoration came by the Act aforesaid.

The Commissioners are now vested with general authority in park management.

OBJECTS OF INTEREST.

The Lake.—Entering the park, at the termination of Haight Street, the discovery is soon made of a miniature lake in a depression to the left. It is ragged and irregular in outline, with rugged promontories and islands, the shores rocky and walled, the sloping banks grassed and planted with shrubbery, trees, and flowers, and the whole surrounded by a wire fence with divisions to secure and keep apart the swans, ducks, and other aquatic birds, that have become acclimated and seem to be content with their new home. Two varieties of swans and six of ducks enjoy themselves on the premises.

The Bridge.—Hard by the lake, and over the walk to the Children's Playground, we meet a bridge of solid stone, the archway hung with artificial stalactites.

From the lake, through the arch, is caught a charming vista of the Children's Playground beyond. Over the bridge above passes one of the finest drives in the park, along its southern border.

The Children's Quarters.—Passing the baseball grounds, one of the most useful and interesting objects in the park is encountered, that of the building and playgrounds for the children. The site is well selected, and the building, the result of a donation of $50,000 from the late Senator Sharon, is a fine two-story building, occupying a site slightly elevated above the surrounding grounds. The lawn is the largest piece of green sward in the whole park. Roses, plants, and little clumps of shrubbery are scattered over the lawn, relieving it of monotony. The whole is sheltered from the prevailing winds by rises of ground surmounted and clothed with oaks, pines, shrubbery, plants, and flowers.

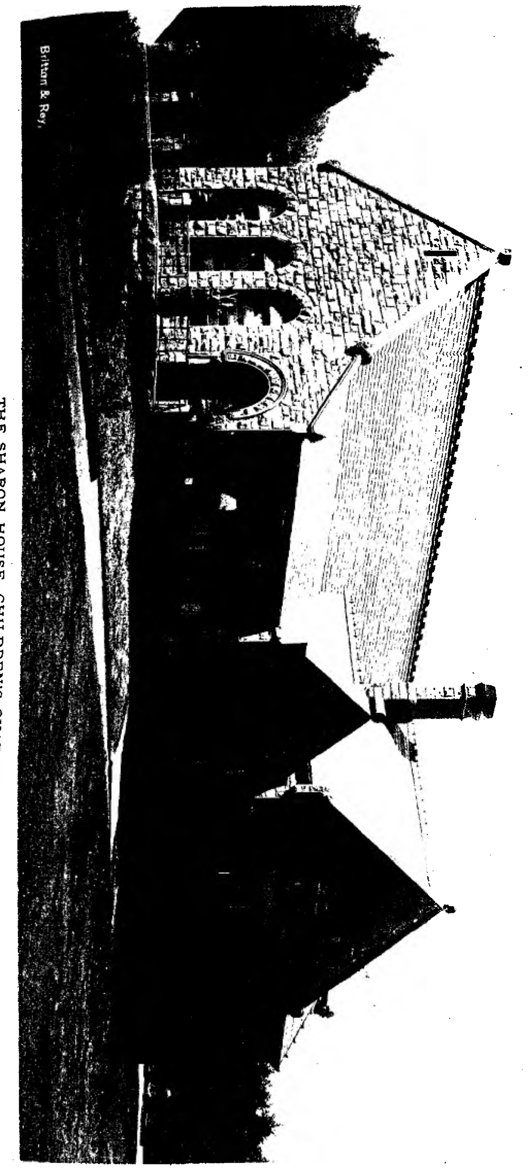
Altogether it is a charming spot, and probably the most complete and extensive provision for children to be found in any park in the world.

The house is of a gray stone, with a slate roof. The lower story is used as a play-room in case of storms, or for those who prefer indoors; the second story is a restaurant, where lunches are provided for children and their attendants for little more than cost. Broad verandas, for the accommodation of people, are features of the building, which have to be seen to be appreciated.

On all fine days (and they are many during our long and dry seasons) the children can be seen in great glee enjoying the swings, spring-boards, merry-go-rounds, riding donkeys, driving goats, and profiting by the various devices provided for giving them pleasure. The visitor who desires to see a scene of joy and animation has but to betake himself to the children's grounds on a Saturday afternoon or Sunday. Young life in its gala dress and hey-day of delight, cannot be seen to greater advantage. To add to the attractions of the locality, not far away the boys are exhilerated in the game of baseball. If our millionaire citizens would frequent these grounds on Saturdays and Sundays, and witness the great pleasures enjoyed by the little ones, and their admiring parents, they would add to their own happiness by providing the means for enlarged quarters and increased diversions.

The Music Grounds, since their enlargement, have a seating capacity for six thousand persons. They are protected on the south and west by terraced ridges covered by trees and shrubbery and fronted with plants and flowers. The stand for the musicians is one of the features of the park. It is a semi-circular concave structure to catch and give back the sound, it being difficult to secure volume of sound in open space.

This artificial sounding board, and the walls of foliage in the rear,



THE SHARON HOUSE—CHILDREN'S QUARTERS.

CHILDREN'S PLAYGROUND. (SHARON QUARTERS.)

are great aids in giving resonance. Trees of several varieties, mostly elms, have been planted on the auditorium, and in a short time shelter from the sun will be secured. The observation may here be made that the music stand is so placed that the audience fronts to the west, and even when the trees are grown there will be some discomfort from the sun in the faces of listeners in the middle and afternoons of the days. The difficulty might be avoided by fronting the music stand to the south, Changes are being considered. In this connection it may be mentioned that a bridge of graceful construction is contemplated and needed for foot passengers across the driveway from the music grounds to the Conservatory. On Saturdays and Sundays the carriages are so numerous that the crossing is positively dangerous, and the danger is increasing with the increasing number of patrons of the park in vehicles.

The music on Saturdays and Sundays comes from forty-five pieces, and is given to immense gatherings, and with good effect. The tastes of people differ widely in the choice of music. Some are thrilled by fife and drum and martial sounds, others by sweet and simple airs, while others still find greatest enjoyment in operatic strains. The wish of the management of the park is to satisfy all as far as possible, always aiming to please, while at the same time the music shall be a little in advance of average taste, that it may be educational with progressive influences.

The Peacock Meadow is met at the right soon after entering the park by its main entrance. It consists of about two acres of lawn, interspersed with little islands of trees and foliage, affording the fowls the shelter and other requirements of their nature. The meadow is kept closely shorn, and the grass is fresh and of a lively green. The whole is surrounded by a wire screen fence three feet in height. There are ten fowls in all, and their presence and showy character are interesting features in the park scenery.

Statue of Halleck.—Further on towards the Conservatory, in a little embayment of lawn between hills and covered with trees and verdure, in a spot well chosen, is the statue of Henry W. Halleck, one of the pioneers of the State, and from 1862 to 1864 General-in-Chief of the armies of the United States. The statue is of a gray granite, of colossal size, standing on a pedestal of a few feet in height, and the whole was the gift of General H. W. Cullom, Halleck's Chief of Staff, who would commemorate a Californian who rose to distinction in the war that preserved the national life.

The Statue of President Garfield, further on towards the Conservatory, is larger, more elevated and pretentious. It is of bronze on a pedestal of granite, surmounting a round and regular artificial hill, and from every near point of view the colossal figure is thrown against the sky. The statue has the build, contour, and the features of the martyred President to such a degree as to be readily recognized by those who knew him. The site is, however, too regular and artificial to be natural, which is the charm of art. It is proposed by the Garfield Committee, who have some $2,000 left of unexpended funds, to enlarge and otherwise modify the base so as to produce a more substantial effect.

The Key Monument, in the rear of the auditorium of the music stand, the cost of which came from a bequest of James Lick, is much visited and studied. The work consists of a base, on which rest Corinthian columns at the corners supporting a dome above an open space, in which in a sitting position is the statue of the poet in bronze, with pencil in hand, and in a thoughtful mood. The whole monument is crowned by a bronze figure of Liberty, with staff and banner. Four bronze eagles with expanded wings occupy the corners of the frieze, with marble heads of buffaloes between. Three steps lead up to the square and perpendicular base, which is paneled with large slabs, on which are inscribed the words of the "Star Spangled Banner." The base is entirely of marble. This is probably the best effort at statuary in the park.

Golden Gate Park has little of art in form, but more will come in time. Central Park of New York has about thirty pieces, besides medallions, sketches, etc. It is to be hoped, however, that the passion may never come to make our park a pantheon, remembering that art is subject to criticism, but vegetation pleases all.

The Conservatory is the finest and most pleasing structure in the whole park. It needs but to be seen to be admired. A look at the cut will convey a better idea of its form and proportions than a description. It was destroyed by fire in 1882, and rebuilt the next year by a munificent donation of the late Charles Crocker. The whole is of wood and glass, two hundred and fifty feet in length, and an average breadth of seventy-five feet.

The vestibule in the middle, facing the south, is furnished with fountains and seats for visitors. From that the grand central dome is entered, to find a fountain throwing water to the height of thirty feet. Here are choice specimens of vegetable life from New Zealand, Australia, China, Japan, the Cape of Good Hope, Isle of Bourbon, in fact, from all the torrid world. The heat and smell is that of the burning zone. The thermometer may not show a great extreme, but the hygrometrical condition of the atmosphere makes it oppressive.

Here are everywhere suggestions of the tropics. Bananas in fruit twenty-five feet high, rank plants and creeping vines in every conceivable variety. There are ponds in which the Victoria regia is in bloom. All the delicate and gorgeous flowers of softer skies surfeit the eye at every step. There are plants whose leaves rival the flowers in their variety and coloring. Here are rocky ponds with pretty fish, and islets on which plants and vines find homes as congenial as their native habitat. A reference to the catalogue can only, without a visit, give the wealth of tropical vegetation the Conservatory contains.

The Deer Glen.—Away to the west of the music stand, across the intervening ridge, is a long depression, some thirty feet in depth. Nature seemed to shape it for a lake, but failed to provide the water. The west end is covered with a dense mass of native oaks, and a part of the steep slopes are spotted with clumps of trees. The wildness of the spot affording coverts for deer, open hillsides, and water in the lowest places, suggested the utilization of the place for the purpose. Here, surrounded by a strong fence nine feet high, the upper half of large wire six inches apart, are placed twenty deer of four varieties, and a

CONSERVATORY.

pair of elk, the gift of Alvinza Hayward, Esq., remnants of the thousands of antlered monarchs of early California wilds. The animals are well acclimated, are tame, and beginning to produce their kind. The deer park is an attractive spot, from its wildness and its inhabitants. Most persons love animals, and to see these captives from their native haunts, basking on the sunny slopes, or suggesting the gift of some delicacy at the fence, is one of the pleasures of the park. All is natural and clear of art that tires.

The presence of elk and deer recalls the project which has been entertained of collecting a menagerie on some part of the public grounds. The experience in Central Park of New York is that such an adjunct is quite expensive, though not beyond the means of our city. There are improvements enough demanded on the grounds to occupy the thoughts of your Commissioners and Superintendent for the present, and the menagerie will come when more pressing needs are disposed of. Moreover, an insuperable barrier at present is found in the fact that there is not any spot in the park suitable for a zoölogical garden, connected with any sewerage facilities of the city.

The Aviary or Pheasantry is a new feature just completed and occupied by its feathered beauties. It is composed of a building of four wings, to accommodate the four varieties of pheasants—the English, the Ring, the Gold, and the Silver varieties. The wings are of woven wire on three sides. Corners in the central dome are devoted to perches and nests. The birds seem already to be well homed and thriving.

The Casino has been removed, as proposed in our last report, a few rods farther south, to higher and more commanding ground, overlooking the Grand Drive and a large part of the ornamented acres of the park. The building has been raised and a large and commodious lower story added. Broad balconies also, affording rest and fine, varied, and extensive views. The hill, on which the building is located, has been trunicated, sloped, and otherwise beautified.

The Casino is now dispensing good things to the public at moderate cost, and its accommodations are equal to all demands.

The Speed Track, constructed by a fund of $33,000, subscribed by public spirited citizens, and expended by a committee appointed by them, is in good condition and open every day for use. Its whole length is six thousand feet. No races for coin are allowed by park regulations upon it. Nor are limitations on speed exacted.

A walk, or foot path, is in course of construction along the south side of the track the entire length of it. It is now graded and hastening to completion. The space between the walk and track has also been graded and planted to trees and shrubbery. The long slope between the walk and the new drive has also been shaped and in like manner planted. The intention is to construct some observation points overlooking the speed track and the new drive.

IMPROVEMENTS CONTEMPLATED.

Strawberry Lake.—It is proposed to construct a lake about two acres in extent, on the east shoulder of Strawberry Hill (so called from the wild strawberries now in fruit all over its sides), about one hundred and ten feet from the summit. The plan is briefly this: To force the water from the waterworks in the valley, not far away, to the crest of the hill four hundred and twelve feet above, and into a pool on the summit. From thence the overflow will descend in a cascade to the present reservoir about fifty feet. Another cascade about fifty-five feet in height will discharge the overflow of the reservoir, which holds about a million gallons, to the contemplated lake, which will have an altitude of three hundred feet, affording ample pressure for distributing pipes over all the park area. The new sheet of water it is proposed shall hold at least two million gallons, and be about three feet deep. In this way the great defect of Golden Gate Park, that of the want of waterfalls, running streams, and lakes, is to be remedied. The supply of water in the wells, after a test, is undoubtedly ample, and it is only a question of a little extra expense in raising the water, to add to the grounds the feature of which they stand most in need. With a pool on the summit of Strawberry Hill, walks around it, and the top of the hill covered with tall trees to increase in effect the elevation, this part of the park must be attractive and popular. By the plan proposed, the water is made in sheets, streams, and falls, to please the æsthetic, and afterwards distributed for irrigation, thus to increase the area of verdure and beauty. It is believed this plan will be approved by every person of taste who gives it his attention. The absence of water in our park is the one object most missed by strangers.

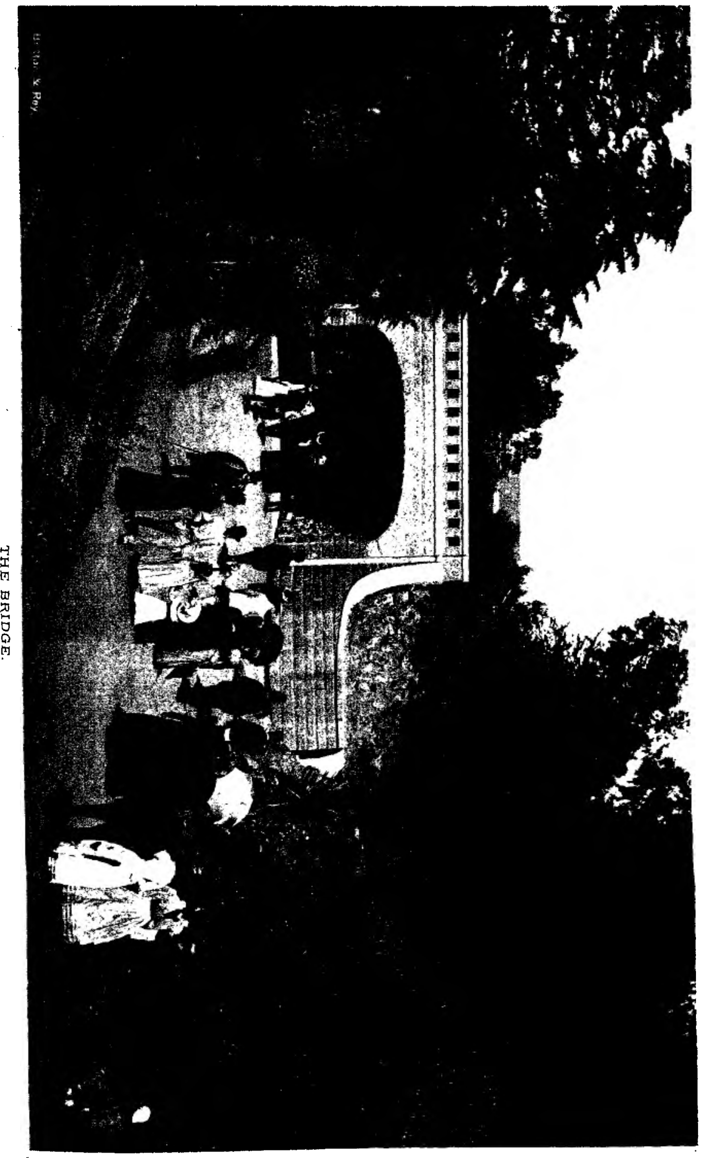
A Bridge for pedestrians, to connect the Conservatory with the music grounds, is quite necessary. For women and children to cross the main driveway on Saturdays and Sundays is quite hazardous. It is proposed to throw a light and graceful structure of iron or steel across the drive and relieve the difficulty. By careful study a structure may be devised which shall be as ornamental as useful.

Young Men's Recreation Grounds.—The Commissioners have had surveyed and staked, grounds where young men of fifteen years and over can find recreation. The plot lies immediately west of the Children's Quarters and opposite to Seventh Avenue. Here it is proposed to provide baseball grounds and a bicycle track around the whole three fourths of a mile in length. In this connection it is well to suggest that some spot may soon be chosen for games for young ladies.

A Fountain.—The auditorium of the old music stand near the Conservatory presents a vacant space without an apparent use. In winter the spot is frequently covered with water. The surface of clay retains the rainfall, which is increased by the drainage of the surrounding slopes. It needs to be drained, but to accomplish the purpose a tunnel will have to be cut through the quarry to Deer Glen, where the water can be utilized. As the park is without an open fountain, it is proposed to construct a large and massive and showy fountain one hundred and fifty feet in diameter to occupy the old music auditorium, furnished with fish, aquatic plants, and the like. The waste water will supply the deer with the fresh article they need in the heat and drought of summer.

Enlargement of Entrance.—The increasing number of carriages demands the widening of the main park entrance. The same difficulty

THE BRIDGE.



occurred at the entrance of Central Park, New York, a few years since. It is not always possible to foresee the wants of the public. The change required is easy of accomplishment and will call for no large sum of money. Some trees and shrubbery will have to be sacrificed for roadway and paths, but there is space enough left on which substitutions can be made without impairing appearances or shocking the feelings of old habitues of the grounds. At any cost, however, the enlargement will soon be imperative.

A New Distributing Reservoir is projected, to be placed on the hill at the Hayes-Street entrance. This improvement will allow the catchment of water during the night and its easy distribution over the front part of the park by day, instead of making demands upon the main pipes from a distance, when they are engaged in supplying the western part of the grounds.

The New Drive.—The late rainy season was the most extraordinary one, for unsettled weather, ever known, or, certainly, the most inclement since the advent of Americans. In consequence hundreds of laboring men were precluded from gaining their livelihood in the open air. Our public spirited and generous fellow citizens, fully appreciating the condition of affairs, came forward and subscribed upwards of $30,000 to give employment in the park to the needy. The credit of taking the initiative in this humane movement must be given to Archbishop Riordan, who subscribed $1,000 for a starter. The popular movement began in a mass meeting at which a committee of two hundred was appointed to canvass for donations. In a few days the large sum was ready for use, and an Executive Committee, consisting of Levi Strauss, Father Montgomery, M. P. Jones, C. B. Stone, David Bush, F. S. Wensinger, Albert Gallatin, J. J. Haley, with William M. Bunker at its head, began the gratuitous work of putting meritorious laborers on the construction of a new drive in Golden Gate Park. The work began on March eleventh, and without any unnecessary delay. Over four hundred men were on the ground the first day, and the force was increased daily as fast as the active and efficient Superintendent, Mr. McLaren, could block out the work, until more than eleven hundred were employed. The road created is of a substantial character, and a credit to the management and the liberality of our citizens. It adds a needed and important feature to the park. It is a fact worthy of comment, that there was the utmost harmony among the multitude thrown together on this public work, a proof that the money subscribed was worthily distributed.

The new drive springs out of the south drive, a few hundred feet from the rocky cut on the main road, runs along the crest of a ridge westerly, parallels the speed track towards the ocean, and finally turns, after running two miles, into the main road. The new drive is sixty feet in width, has a light grade, and an average elevation above the shore of about two hundred feet. The whole is being handsomely bordered, and is already one of the attractions of the park.

The large sum of money contributed by our citizens was disbursed by a committee appointed by the contributors, and in little more than a month. The spirit manifested by the committee, sometimes attending in the rain to the work, and paying off the men, was above all praise. The names and the deeds of those who came forward on this occasion will live in the archives of the Park Commission. They have done a humane and noble work.

The new drive was not, however, brought to a finish. About two miles of main pipe, besides branch distributing pipes, are required to supply the road and its sides with water, to lay the dust and for irrigation. The total cost to complete the work is estimated at about $7,500.

Path Connections.—It is desirable that a bridle path, to connect the old with the new bridle path around the north side of Strawberry Hill, should be constructed. The distance is about one fourth of a mile, and, also, the foot path or walk from the westerly end of the speed track should be extended to the ocean. These improvements it is proposed to complete in the near future.

The Great Boulevard along the ocean shore merits and has received attention. A great work has been done on it since our last report. During the last winter, so severe upon the laboring classes, two hundred extra laborers at a time were employed in grading the boulevard, and were paid out of the park funds. Twenty-six hundred feet along the ocean front of the park were graded and planted with trees. A fence to protect the trees from the ocean winds has been built the entire distance, and on the ocean side of the beach grass planted a hundred feet in width to stay the drifting sands. The park is now safe against any further supply of sand from the beach.

The Great Highway is planned to be two hundred feet wide, extending from the Cliff House Rocks south a distance of three miles. It is to consist of a driveway eighty feet wide, a walk twenty feet wide, with a space of fifteen feet wide between the drive and walk. The whole is to be lined with trees. Raised but a few feet above high tide, and commanding a magnificent prospect of ocean, it will be, when completed, one of the noted boulevards of the globe. The work so far done on it has been confined to the half mile of sea frontage of the park. To complete the balance of the road and its concomitants calls for the generosity of some wealthy gentleman ready to distinguish himself by doing a proper service to his less fortunate fellow citizens.

The Trees again require to be thinned. A considerable work of this kind was last year expended among them; but they need more attention. To preserve the natural symmetry of trees, and to save some in their proper places, it is better to thin than allow the desirable ones to suffer by the choking process. Timely assistance of nature is the rule of the culturist. Forests may be said to be gregarious, or social in their habits. Trees like association. They do not like to live alone. The shade and protection of one invites the growth of another and of a different species. Some are foster-children of others. In the mining region of the Sierras young forests spring up to take the places of those destroyed. The trees come up as if by magic, and as thickly as grain in a well sown field. In a few years large numbers succumb to the superior vigor of others, and the thinning process by the natural method goes on until the comparatively few left have room for complete development. Nature's way must be copied in the production of our park forestry. We must plant thickly and numerously; but we must not wait

to discover what the natural destruction would be, lest those trees that survive shall be out of shape and out of place to produce the most pleasing masses of foliage. In some parts of the park thinning should have commenced earlier; but we have to learn by stages. Constant study and good judgment are always in need when parks are created for generations to come. In the growth of forests the most care is to be taken. Other adjuncts to public grounds are easily changed or replaced. Trees are for centuries.

The Arboretum.—As in our last report, we renew the hope that with the coöperation of the State Board of Forestry Commissioners to establish on park grounds an arboretum, and on a scale to test the adaptability of our soil and climate to the acclimation and growth of many foreign varieties, and also to make a specialty of trees indigenous to the Pacific Coast. There is a space of about twenty acres north of the pumping works, having a variety of soil and exposure, sloping, dry, and sunny hillsides, sheltered spots, and rich, low, or marshy land, which seems to be a site well adapted for an arboretum. A large water pipe runs through the grounds already, and near the source of supply. At no very heavy expense the land could be prepared. An extensive collection of trees would be of service to the student, and might be made of practical importance in giving variety to the park, as well as educational in its effects, in teaching the people of the State what trees to cultivate besides the pines and oaks indigenous and often too common.

Police.—With the increased number and length of roads, bridle paths, and walks, comes an increased demand for police force to insure proper order. It is pleasant to report that visitors seem to appreciate the liberties enjoyed in the park, and are little disposed to overstep the rules established for the park government. The small mounted force is kept well in motion over so large a space. Thanks are due to the Chief of Police and Police Commissioners for the efficient help in maintaining order on Saturdays and Sundays when the crowds are greatest.

THE PRESIDIO.

The Presidio is a Government reserve for military purposes, and properly does not come within the scope of our report. But as one of the breathing places of the city, by the kind and liberal action of officers in command, and as a possible addition to the park territory of the city in the future, it is worthy of a passing notice.

The reservation consists of about fourteen hundred acres of land, as well adapted for recreation grounds as probably any section of the peninsula. The soil is good, there is every variety of slope and exposure, lofty headlands overlooking the Golden Gate, the bay, and the shores and hills beyond, affording some of the grandest views of cliffs with billows dashing at their base. Little valleys lie embayed among grassy mountain sides, sandy beaches appear, up which the blue waves steal with a silver ripple, and then there is the little village of the Presidio, with its parade ground and its garden of flowers. General McDowell, a late Commander, and once one of our Park Commissioners, was a lover of the beautiful, and made great improvements in the way of tree planting, and building of drives to grand and picturesque scenery. A long and winding avenue from the old road takes the visitor over the hills by the way of Fort Point, and on in the direction of the Marine Hospital and the Cliff House several miles, opening to view all the beauties of the reservation. It has been appropriately named McDowell Avenue, from the General, who perfected and brought the drive to its present finish. The possibilities of the reservation are fully seen in passing over McDowell Avenue. Thousands of trees of numerous varieties have been planted in many parts of the grounds, and they seem to thrive wonderfully.

In the order and rows in which they are set, the military spirit is recognized. It is, however, to be observed that some of the late plantations show clumps and irregularities in conformity with taste as observed in landscape gardening.

But the visitor will be delighted on a drive through the Presidio with the pleasing variations from the style of other public grounds.

The work is now going on of property owners along Lombard Street, connecting that street with Van Ness Avenue and Black Point, and forming an avenue to the Presidio. The Government is understood to assist in the enterprise. In this manner a good drive will be opened to the reservation, and on the McDowell Avenue to its western terminus. By extending the drive by Point Lobos Creek, near the Spring Valley dam, and on to Twenty-fourth Avenue, a connection may be made with the drives of Golden Gate Park, a little to the west of Strawberry Hill, or by taking the Point Lobos road via the Cliff House, the park may be entered from the west. This continuation would afford a new, easy, and delightful drive, taking in and viewing all the large public grounds within the city limits. At present, the people of the city are obliged to drive to the western part of the Presidio reservation and return. The reservation is open at all times to the public, and is, for all practical purposes, one of the recreation places of the city. Your Commissioners have favored the gift of trees, shrubbery, plants, etc., from the park grounds, in a spirit of reciprocity for the general public use for which the grounds are tendered by the various officers who have, from time to time, been in charge.

MUSIC AUDITORIUM.


Britton & Rey.

KEY MONUMENT AND MUSIC CONCOURSE.

REPORT OF THE SUPERINTENDENT.

GOLDEN GATE PARK, June 30, 1890.

To the honorable the Board of Park Commissioners:

GENTLEMEN: I herewith submit my report for the year ending with the above date, with a brief statement of the condition of the grounds of the Golden Gate Park and the changes and improvements made therein during the past year.

Improving the north side of the avenue was one of the first important changes made. The work was commenced by thinning and clearing out all the weak, deformed, and leaning trees; then the old leaky sheet-iron water pipe that caused so much trouble and delay the previous season, was taken out and replaced with new pipe of the best quality, four inches in diameter. After the pipe laying was finished, a heavy coating of loam and compost was spread over the entire surface of the ground, and spaded in. This heavy piece of work was rendered necessary by the thick growth of pine and gum trees exhausting the original soil. Great care was taken in thinning the trees, to preserve the best trees for permanent growth. Handsome specimens of trees and shrubs of many different species were planted in groups and masses, rather than by putting a few of each kind in each block, believing that a finer effect is attained by planting in masses of one species with its varieties, rather than by mixing too many in one group. For instance, the lower block is planted entirely with the varieties of fir and spruce, the next with magnolia, laurel, and rubber trees; one entirely with palms, bamboos, grass, etc., and so on, each block having a distinct character rather than a continuation of mixtures. After finishing the tree and shrub planting, a verge of grass sod was laid along the entire length of the avenue, and along the back outline of the lawn space; the whole was leveled and seeded with Kentucky blue grass. The walk north of the avenue was reconstructed, remacadamized, and bordered with different kinds of plants—one with violets, another with periwinkle, another with mahonia, and so on. Along the fences north and south of the avenue, a row of acacia has been set out, making a hedge over one and a half miles in length. This hedge is intended to be kept trimmed on the street side and allowed to grow freely on the park side, so as to present a more natural and irregular outline towards the drive, and hide the ugly wooden fence so conspicuous at present.

IMPROVEMENT OF THE GREAT HIGHWAY.

About the beginning of February work was commenced on the grading of the boulevard along the Great Highway. It has been graded to an average width of one hundred and eighty feet, and for the entire width of the park fronting the ocean, a distance of two thousand six hundred feet. A shelter fence was then constructed by putting in fence posts, connected with rails, on which one by three-inch pickets were nailed. This fence is ten feet in height, and the pickets are four inches apart. Sixty-five feet on the east side has been thickly planted with trees, next to which eighty feet is left for a drive, then a belt of evergreens is planted, then twenty feet for a footpath; and between the walk and the shelter fence, acacia, cypress, and leptospermum have been planted thickly, so as to get up a shelter as quickly as possible. Water pipe has been laid the whole length, so that the trees can be irrigated when required. From the foot of the cliff to the four-league line, a distance of nearly three miles, and one hundred feet wide, sea-bent grass has been planted, so as to reclaim the shifting sands and raise the embankment by collecting the sand blown in from the ocean. This grass, if it takes root well, will catch the sand, and, holding it, eventually raise the embankment high enough to continue the construction of this grand drive its entire length.

OVERLOOK DRIVE.

This handsome drive was planned, surveyed, laid out, and graded in the short time of five weeks, as many as one thousand one hundred men being employed on the construction of this road at one time. The survey and superintendence was carried out under the direction of your honorable Board. The grading and part of the macadamizing was paid for by the Citizens' Committee appointed for the purpose of relieving the distress amongst unfortunate unemployed. I desire here to thank the members of that committee for the many suggestions given me, and the courtesy shown by them to me at all times during that busy month.

The road commences at the bend immediately west of Strawberry Hill, and runs in a northwesterly direction, cutting through a very fine grove of the *Pinus maritima*, on passing which and gaining the hilltop a magnificent panoramic view is beheld. The great Pacific emerges into view, flanked with the hills of Marin County to the north, with Point Bonita, Sutro Heights, and the Cliff House in the foreground. To the left the hills of San Mateo County and the bold hills of western San Francisco, between which and the ocean are the undulating hillocks forming the western boundary of the park, covered with a fine growth of healthy young pines and acacia, contrasting with the hard, sterile, and forbidding sand dunes north and south, and showing the effect of the skill and perseverance that has converted this barren, sandy desert into a fine piece of forest land. After leaving this high point, where in addition to the fine marine view a peep of the Speed Road can be obtained, with its fast horses vying with each other to get first to the end. The road then leads down amongst a thick growth of pines, where another high point is reached and an excellent view of the Speed Road is seen; then down again to the big bend, where the road suddenly turns to the northward, where it joins the old drive about five hundred yards west of the tank house. This new road is about two miles in length, and when finished will be sixty feet broad. To connect the main drive west of the railroad bridge with the Great Highway it was necessary to lower the grade of the drive four feet at the junction. This was done by taking off the macadam and taking out the surplus sand, using the same macadam to finish the work.

The next improvement effected was the construction of a walk west of the Cut. This walk was rendered necessary by the increased number

VIEW OF SPEED ROAD NEAR THE OCEAN.

of people who frequent the westerly end of the park on foot, and especially on Sundays. From the crowded condition of the drives by carriages, it was not safe for persons on foot. The intention was to carry this walk to the ocean, but it has only been completed to the hollow west of Broom Point. This walk, instead of running exactly parallel with the drive, leaves it at times, and, winding through the pines, joins the main drive at its northerly bend, again leaving it when the drive bends to the south. Some heavy cuttings had to be made in three or four places, the sand from which was used in filling up to grade off the hollow places along the line. This walk has been graded and graveled for a distance of two thousand five hundred feet and is twelve feet broad.

The main drive from the Cut to Broom Point has been widened about twenty feet. In widening this road care was taken to round off as much as possible the sharper bends, so that people driving can see farther ahead, thereby lessening the chances of accident.

The walk leading from Geary Street to the north ridge road, the walk leading from McAllister Street to the north ridge road, and the walk connecting the Hayes-Street walk with the Conservatory, and also the one leading to the music grounds, have been reconstructed, water pipe and hydrants put in, drains and conductors laid, loam hauled, fine shrubs planted, edgings of grass put down, and otherwise put in fine order, making a proper connection between the improved portions of the park and the entrances at these points.

The walk also connecting the bridge and the Children's Quarters has been constructed during the year, and the border planted with shrubs and flowering plants.

The walk connecting the Children's House with the music stand having, from the increased number of visitors, been found too narrow, has been widened five feet, making it twenty-five feet wide. Even this extraordinary width for a path is sometimes found overcrowded, and should travel continue to increase will necessitate making this walk still wider.

POWELL-STREET ENTRANCE.

The grounds in the vicinity of the Powell-Street entrance have taken considerable work. After the grading was finished, a walk was constructed connecting the new waiting-room, built by the Ferries and Cliff House Railroad Company, and the main drive at Sixth Avenue. A branch walk was also graded and graveled leading westward toward Strawberry Hill; trees and shrubs have been planted, water pipe put in, loam hauled, and a verge of grass laid along the walks.

DRAINAGE.

Over two thousand five hundred feet of sub-underground drains have been put in during the year, principally at the western end of the park.

SPEED ROAD.

The rains of the winter of 1888 having washed out, in many places, deep gashes in the Speed Road, as instructed by your honorable Board, the roadbed was put into condition by filling up the washouts, putting in surface drains, digging trenches, and planting a dividing edge along the center, building the necessary fences, constructing entrance gates, laying water pipe, putting up goosenecks, etc.

Running along the speed drive at a distance of from five to fifty feet from the south line, a foot path has been graded, the slopes shaped, holes dug, and trees planted along the entire distance. About fifty thousand trees and shrubs of various species are here set out, and doing very well. In a few years they will completely cover the bare sand slopes in that neighborhood.

A walk one and one half miles in length and twelve feet broad has been graded, commencing at a point a little west of the Cut, and running south of the Speed Road, and nearly parallel with it. This will make a very popular walk to the westerly end of the park. The slopes south of this walk vary in width from twenty to fifty feet, and the space between this walk and the Speed Road, which vary in width from five to seventy feet, have been planted with a variety of shrubs and trees, such as the pine, eucalyptus, cypress, willow, ash, redwood, sequoia gigantea, and Japan cedar. Among other shrubs planted were barberries, laurels, acacia, box, leptospermums, and pittosporums.

THE NEW STABLE.

The old stable being too small, besides being entirely rotted out, a new stable to accommodate the increased number of horses required has been built. It contains thirty-four single stalls and two box stalls. The floor is made of bituminous rock with drains on each side. The loft is commodious and has storage room for one hundred tons of hay. There are also bins for holding oats, barley, and other feed, with slides and conductors to the feed box below. Another small stable has been put up at the west end of the park, behind the tank house. This is for stabling horses doing work in that district, and to save the animals the two-mile walk to and from their work.

THE NEW FORCING HOUSE.

A new forcing house has been constructed during the year. It is ninety-six feet in length with a width of twenty-five feet, and is substantially built of wood and glass, with foundation of brickwork. Hot water pipes heat the structure when required. The water is heated by one of the Hutchin's boilers discarded some years ago. The structure has a handsome appearance and is admirably adapted to the purpose for which it was built.

CASINO.

As contemplated a year ago, the Casino has been moved from its former position to the knoll overlooking the main drive, about one hundred and fifty feet south of the old site. The building also has been enlarged and improved by adding an extra story to its height, and by repainting and refurnishing.

The grounds surrounding the new Casino have also been graded, walks laid out, trees and shrubs planted, the slopes shaped, loamed, and seeded, and otherwise improved.

DRINKING FOUNTAINS.

Several drinking fountains have been procured, and set up in different places within the park.

MAINTENANCE OF THE PARK.

The general maintenance of the park grounds, drives, walks, and forests, has received due attention. The roads, owing to the excessive rainfall of the past winter, required an extra amount of labor to keep in good repair, especially those on Buena Vista Park and the Point Lobos road. Nearly all of the drives in the Golden Gate Park have been remacadamized, the lawns have been mulched with compost, and the flower beds and borders manured and replanted. The Conservatory has been kept in first class order, and is well filled with choice exotics. The deer herd is in a healthy condition, and now numbers twenty head. A handsome pair of elk has been added to the herd, the gift of Alvinza Hayward, Esq. The peafowls continue to be quite an attraction. The birds are healthy, and seem to be quite at home, going in and out of the inclosure, but always returning to the roosting tree at night.

The children's grounds and the music grounds are all in fair order, and will compare favorably with the best kept private grounds.

As was contemplated a year ago, large quantities of loam and manure have been hauled at every opportunity to form compost for growing trees, shrubs, flowers, and grass. Over two thousand cubic yards of loam and manure have been hauled and mixed together, part of which has been used in tree planting and other improvements.

NURSERY.

The nursery continues in a very satisfactory condition, as will be seen from the list of trees and plants raised and planted out during the year, and by the appended list of stock on hand.

THE CONSERVATORY AND OLD MUSIC STAND.

These places have had during the year a thorough overhauling, all broken glass replaced, and two coats of paint given, which not only adds very much to the appearance of these structures, but helps in their preservation.

FORESTRY.

The older groups, groves, and belts of trees, thinned out during the past few years, are improving, except in a few localities, notably opposite the three flagstaffs. Some will have to be replaced, owing to neglect of timely thinning. Those on the avenue are very much improved, and some of them are developing into handsome specimens. The younger plantations are all in vigorous health, and making splendid growth.

SUGGESTED IMPROVEMENTS.

Arboretum.—I would again call your attention to the advisability of establishing, as soon as possible, an arboretum, where trees from all countries, and especially trees indigenous to the Pacific Coast, can be grown, compared, and tested as to their adaptability for park work. I suggest that the southerly slope surrounding the pumping works be laid out, stakes put in, holes dug and filled with loam, and from five to ten trees of each species procurable be planted; those in the nursery to be set out during the coming year. Some one should be sent out into the different counties of the State to collect and ship, in the proper season, from twenty-five to one hundred of each species and variety, native of the coast. Even the coast collection would be very interesting, for there is no quarter of this globe richer in variety of arboreal life, and especially cone-bearing trees, than our Pacific Coast. Many, again, could be procured from the East, while others still would have to be procured from foreign countries. Australian trees and shrubs do remarkably well in San Francisco, and Australia is very rich in variety of trees; many hundreds of different species of which are still untried in this country. The Cape of Good Hope also has many kinds of trees that I am sure, judging from the similarity of climate, would thrive, do well, and add greatly to the attractions of the park. It is all very well to have roads and walks, but their only use is to give comfortable walking or driving between objects worthy of inspection; and this proposed collection of the trees of the world would, if established, be a source of pleasure and profit to the park visitor.

A Lake.—No question is so hard to answer as the one asked by the visitor, "Where is the lake?" This is an improvement that ought to be taken up at once. It should be made as large as possible, and ought to occupy an elevated position, so that the water can be used in irrigating the lawns, grounds, and roads after passing through the lake. On this lake boats could be kept for hire, which in my opinion would pay for any increased supply of water required for this extra attraction. The place for this lake is the proposed site on the east shoulder of Strawberry Hill.

Conservatory Valley.—I would again draw attention to this valley. Even more than ever after the past season is seen the necessity of draining this hollow for nearly six months. The western end of this valley was a mudhole—almost the only driveway, concourse, or walk within the park that was not comfortable walking in two hours after rain. To drain this hollow it will be necessary to tunnel through the hill south of the old band stand into Deer Glen.

Macadamizing Walk South of Speed Road.—This is a work that must be attended to early next season, or if not attended to will require to be regraded before being graveled.

Widening the Avenue Driveway.—In the near future this drive will have to be widened. This can easily be done by taking up the sod, and the loam from under it, moving the whole back from ten to twenty feet as required, and using the same loam and sod to edge the widened drive. I would also suggest the elongation of the islands, so as to keep the driving into the park north of the island and the driving out on the south side.

New Drive.—There is still a very great amount of work required before this fine drive is finished. First, in many places it has not been graded the full width. After the grading is finished it will require macadamizing. Then water pipe will have to be procured and laid. Shrubs and trees must be planted, loam for which has to be hauled a long distance, after which the finishing coat of rock can be spread to complete the work.

Boulevard.—All that can be done on this improvement for some years is the putting on of macadam, for which five thousand cubic yards will be required for the foundation, and seven hundred and fifty cubic yards of finish. This will cost about $7,500.

Bridges.—A bridge connecting the music grounds with Main Point, and one connecting Main Point with Conservatory Valley, are a very much required improvement. The latter is getting to be a dangerous place on account of the crowds that pass and repass the drives.

Recreation Grounds.—One of the most pressing works is the laying out, grading, and fencing a recreation ground for young men over fifteen years. The large, open meadow on the south side of the park opposite Seventh Avenue is admirably adapted for this use. About ten acres of comparatively level land is included in the meadow. A bicycle track of three quarters of a mile could surround the grounds. A few walks could be laid out, shrubs and trees planted, and the whole made very attractive at very little expense considering the great want it would fill, and the enjoyment it would give to the young men of this city.

Very respectfully submitted.

JOHN McLAREN,
Superintendent.

POLICE REPORT.

The report of S. M. Thomson, Captain of the Park Police, shows the total number of arrests to have been ninety-eight during the past fiscal year, of which forty were for fast driving, thirteen for driving delivery wagons, nine for breaking wild horses, seven for inebriation, four for hunting with dogs, and the remaining twenty-five for minor offenses, such as insane, driving on walks, plucking flowers, cutting benches, vulgar language, etc.

FINES.

Since March 1, 1889, the park has not received the fines imposed; and the aggregate fines amount to $1,110.

PARK POLICE.

The park police consists of four mounted men and three footmen, all in uniform, and three watchmen in citizens' clothes.

REPORT OF THE SECRETARY.

The following report of the accomplished Secretary of the Commission will show the receipts and expenditures, and other facts of interest:

San Francisco, June 30, 1890.

To the honorable the Board of Park Commissioners:

Gentlemen: I have the honor to submit herewith my report for the fiscal year ending with this date:

RECEIPTS AND DISBURSEMENTS FROM JULY 1, 1889, TO JULY 1, 1890.

RECEIPTS.

From taxes	$127,057 42
From donation	2,000 00
From sale of old iron	100 00
From rent of P. & O. R. R.	100 00
From pound fees	5 00
Balance from last year	956 91
Total	$130,219 33

DISBURSEMENTS.

Construction and improvement	$70,955 62
Maintenance	43,299 24
Stock	6,140 10
Miscellaneous items	2,169 21
Salaries (Superintendent and Secretary)	3,300 00
Total	$125,864 17

Construction Account.

Structures.—Building new rose house, new stable, bird house, peanut stand, altering music stand, fence and gate Speed Road, fence Boulevard, foundation for stable, bricks, lime and cement, lumber, glass, paints and oils, and labor	$9,991 61
Waterworks.—Extension of distribution pipe system, including pipe, labor, etc.	4,943 38
Drainage.—Grounds, pipe, bricks, lime, cement, labor, etc.	302 13
Ways.—Construction of new roads, walks, etc., including all labor of grading, quarry work, and macadamizing, powder, fuse, and other materials	28,585 67
Grounds.—To labor, etc., of grading, forming, dressing, trimming, soiling, fertilizing grounds newly brought to a finished condition in this respect	10,971 24
Plantations and Forests and Reclamation.—Planting grass and trees on Boulevard, reclaiming the sand drifts, sacks and rope, labor and material	14,354 83
Conservatory—Purchase of new plants especially for the Conservatory, improvements in structure	1,296 76
Small Works.—Surveying Point Lobos road, drawing plans and specifications for sewerage of said road	510 00

Maintenance Account.

Structures.—Labor, lumber, paints and oils, glass, etc., devoted to and used in repairs and general maintenance of buildings	$753 73
Waterworks.—Labor, pipe, fittings, etc., expended in repairs	242 11
Drainage.—Labor, etc., maintenance of sewers	361 00
Ways.—Labor and material, repairing, cleaning, dressing, sprinkling, etc., roads, walks, concourses, etc.	7,332 39
Grounds and Gardening.—Labor and material, maintenance of garden and flower plots, lawns, and grounds generally	18,817 98
Forests and Plantations.—Labor, trimming, cleaning, and dressing out plantations	254 75

Conservatory.—The current cost of the Conservatory, including labor, water, and fuel	$7,642 22
Policing.—The services of the regular park police and extra men	7,610 25
Children's Quarters.—Labor, repairs to swings, whirligig, plumbing, etc.	284 81

Apportioned Account.

Nursery.—The entire nursery expense, including labor, material, and new stock	$6,971 60
Stables.—Including hay and grain, horse shoeing, attendance, etc.	6,426 54
Water.—All water supplied the park according to monthly bills	2,369 19

Stock and Miscellaneous Account.

Stock.—New live and rolling stock, etc., tools, implements, watering and other apparatus	$6,140 10
Miscellaneous.—A number of items of current expense not chargeable under either of the foregoing heads—printing ordinances, reports, demands, office expenditures, telephone, general expenditures, and freight	2,169 21

DRIVES AND WALKS CONSTRUCTED DURING THE YEAR 1889-90.

	Length.	Width.
Drives constructed	6,500 feet.	60 feet.
Drives widened	2,400 feet.	20 feet.
Walks constructed	3,700 feet.	12 feet.
Walks constructed	400 feet.	20 feet.
Walks graded but not yet macadamized	6,500 feet.	12 feet.
Walks reconstructed and improved by edging with lawn and shrubbery, regrading, etc.	6,200 feet.	12 feet.

THE LENGTH AND AREA OF DRIVES, CONCOURSES, BRIDLE ROADS, AND WALKS WITHIN THE PARK.

	Length.	Area.
Drives	16⅓ miles.	118⅓ acres.
Concourses		7⅓ acres.
Bridle roads	2½ miles.	4⅓ acres.
Walks	14 miles.	20 acres.

Superficial area of grounds, including lawns, flower beds, shrubbery, drives, and walks	323½ acres.

WATER PIPE LAID DURING YEAR 1889-90.

On hand at beginning of year, and laid during year:		
3-inch	500 feet.	
4-inch	4,500 feet.	
8-inch	1,000 feet.	
		6,000 feet.
Procured and laid this year:		
¾-inch	108 feet.	
1-inch	511 feet.	
1¼-inch	1,870 feet.	
1½-inch	1,770 feet.	
2-inch	4,405 feet.	
3-inch	3,531 feet.	
4-inch	3,255 feet.	
		15,450 feet.
Total amount of water pipe laid during year		21,450 feet.

LIST OF DONATIONS TO THE PARK DURING YEAR 1889-90.

A. Hayward, Esq.	Two elk.
Jno. L. Eckley	One deer.
Jas. McNab	One deer.
W. W. Foote	One deer.
Geo. Robinson, Esq.	One deer.

PHEASANTRY.

Captain Pitts, Steamship "Acapulco" .... One deer.
Miss Sallie Catlow .... One deer.
John Boggs .... Ten peafowls.
Captain Hooper, United States Steamer "Corwin" .... One pair of Golden pheasants.
Mrs. P. T. Barclay .... One pair of Japanese pheasants.
Messrs. Jackman & Eiserbies, Port Townsend .... One pair of Silver pheasants.
H. Williams .... One swan.
J. G. Kettle .... One kangaroo.
Hon. F. McCoppin .... Package of Australian tree seeds.
Hon. L. Mizner .... Collection of coffee plants.
Captain McAllister .... Collection of tree ferns.
Jas. Harrold, Sydney .... Collection of Australian tree seeds.
W. Greer Harrison .... New Zealand ferns.
Wm. S. Lyon .... Package of seeds.
Mr. Turbull .... Collection of shrubs.
Jesse Penton .... Collection of different trees.
T. H. Douglass, Palo Alto .... One box of plants.
C. G. Bass .... Collection of trees.
R. G. Sneath .... One box of variegated aloes.
F. A. Bishop .... One box of Australian roots (Rock Silly).
A. P. Dryden, Steamship "Alameda" .... Collection of ferns.
W. F. Whittier .... One Araucaria imbricata (monkey tree).
Chas. F. Eaton .... One box of assorted plants.
Wm. Alvord .... Fifty-two copies of the "Gardener's Chronicle."

All of which is respectfully submitted.

V. V. BLOCH,
Secretary.

TREES, SHRUBS, AND PLANTS.

TREES AND SHRUBS PLANTED IN PARK DURING YEAR 1889–90.

There have been one hundred and sixty-seven thousand three hundred and sixty-four trees and shrubs planted in the park during the past fiscal year, the following being the classification:

Abies Douglasii	33
Abies excelsa	3
Abies Menziesii	30
Abies Mertensiana	28
Abutilon; various	445
Abutilon Vexillarium variegatum	60
Acacia covena	2
Acacia cultriformis	12
Acacia dealbata	59
Acacia decurrens	3
Acacia fragrans	2,664
Acacia latifolia	24,300
Acacia linearis	32
Acaoia lophantha	19,100
Acacia melanoxylon	10,337
Acacia pycnantha	1
Acacia Saligna	10
Acacia verticillata	2,014
Acer rubrum	2
Achania malvaviscus	220
Æsculus Californica	41
Ailanthus glandulosa	34
Aloysia citriodora	12
Amygdalus communis fl. pl.	12
Aphelandra aurantiaca	50
Araucaria excelsa	2
Arbutus Menziesii	3
Arbutus Unedo	2
Artemesia	100
Azalea occidentalis	25
Berberis communis	750
Berberis communis, var. purpurea	12
Berberis Darwinii	18
Berberis glumacea	12
Betula alba	5
Betula lenta	25
Betula papyrifera	4
Bocconia Japonica	36
Bouvardia	37
Bupleurum fruticosum	18
Buxus sempervirens	217
Calistachys lanceolata	4
Cassia floribunda	1
Cassia corymbosa	260
Calothamnus purpurea	18
Calothamnus sanguinea	18
Casuarina suberosa	40
Catalpa speciosa	11
Ceanothus Africanus	117
Ceanothus Fontanesiana	1
Ceanothus Verrucosus	60
Cedrus Atlantica	10
Cedrus Deodara	3
Cedrus Libani	3
Cephalotaxus pedunculata	3
Cerasus lauro-cerasus	1,200

Cerasus mollis	1
Ceratonia siliqua	4
Cestrum aurantiacum	40
Chionanthus Virginica	2
Chorozema ilexifolia	12
Cistus ladaniferus	500
Cistus Albidus	222
Cistus salviafolius	24
Citrus aurantiaca	10
Citrus trifoliata	3
Clianthus puniceus	140
Coccoloba platyclada	150
Colletia ferox	43
Coriaria ruscifolia	120
Coriaria myrtifolia	100
Coronilla juncea	55
Corynocarpus lævigatus	1
Cotoneaster buxifolia	200
Cratægus oxyacantha, var. rosea	6
Cratægus pyracantha	130
Cryptomeria elegans	2
Cupressus elegans	22
Cupressus funebris	1
Cupressus Lawsoniana	398
Cupressus macrocarpa	3,450
Cupressus pyramidalis variegata	14
Cytisus candicans	75
Cytisus hirsutus	50
Cytisus laburnum	110
Cytisus nigricans	18
Cytisus quercifolia	25
Cytisus spinosus	130
Darwinia citriodora	30
Datura	150
Deeringia celosioides	804
Deutzia crenata	280
Deutzia scabra	12
Diosma alba	150
Diosma purpurea	20
Diospyrus Kaki	20
Dracocephalum Canariense	200
Echium stricta	275
Echium simplex	165
Edwardsia microphylla	5
Edwardsia myriophylla	17
Eleagnus Japonica	12
Entelea arborescens	62
Erica Mediterranea	150
Erica capitata	4
Eriobotrys Japonica	7
Escallonia floribunda	336
Escallonia rosea	250
Ethionema cordifolia	2
Ethionema grandiflora	2
Eucalyptus amygdalina	240
Eucalyptus Baileyana	4
Eucalyptus citriodora	120
Eucalyptus comicular	120
Eucalyptus corymbosa	10
Eucalyptus eugeneoides	300
Eucalyptus fissillis	4
Eucalyptus globulus	10,000
Eucalyptus goniocalyx	1,200
Eucalyptus goniocephala	1,320
Eucalyptus Gunnii	120
Eucalyptus leucoxylon	420
Eucalyptus macroryncha	120
Eucalyptus obliqua	30
Eucalyptus pauciflora	150
Eucalyptus Ribbonii	120
Eucalyptus rostrata	240
Eugenia myrtifolia	42
Euonymus Japonica	725
Euonymus Japonica aurea	314
Euonymus Japonica aurea; dwarf	200
Eupatorium ageratoides	100

Eupatorium triste	50
Eurybia	10
Fabiana imbricata	150
Ficus carica	9
Ficus macrophylla	1
Ficus microphylla	2
Forsythia Fortuneii	12
Forsythia Viridissima	6
Fraxinus excelsior	2
Fraxinus Oregonia	24
Fuchsia	500
Genista alba	1,325
Genista candicans	100
Genista linifolia	12
Genista scoparia	9,500
Gleditschia triacanthos	20
Gnaphalium lanatum	700
Goodia latifolia, var. medicaginea	105
Grevillea robusta	79
Habrothamnus coccinea	435
Habrothamnus elegans	120
Hakea saligna	1
Hedera helix	5,000
Hibiscus	50
Hydrangea	485
Hypericum	308
Ilex aquifolium	18
Indigofera Australis	9
Isochroma tubulosa	200
Itea Virginica	36
Jasminum fruticosum	42
Juglans Californica	20
Juglans nigra	10
Juglans regia	6
Juniperus Bermudiana	10
Juniperus compacta	1
Juniperus prostratus	1,250
Juniperus sinensis alba	500
Kerria Japonica	30
Kolreuteria paniculata	2
Lagerstræmia indica	112
Lantana superba	100
Laurus camphora	50
Laurus glandulosa	2
Laurus Indica	4
Lavatera arborea variegata	62
Leonotis leonurus	400
Leptospermum lævigatum	14,200
Leptospermum scoparium	4,000
Libocedrus decurrens	5
Ligustrum Japonicum	17
Liriodendron tulipifera	3
Lupinus	1,000
Lycium parviflorum	750
Mahernia odorata	150
Mahonia aquifolia	300
Maitenas Chilensis	42
Melaleuca ericifolia	46
Melianthus major	20
Mespilus Japonica	4
Morus alba	3
Myoporum lactum	50
Myrtus communis	480
Myrtus communis, var. mucronata	200
Neirembergia gracilis	250
Olea sativa	18
Paulownia imperialis	2
Philadelphus coronarius	145
Phillyrea latifolia	12
Phillyrea media	12
Photinia arbutifolia	10
Photinia serrulata	3
Picea grandis	12
Picea magnifica	103
Picea pectinata	6
Picea pinsapo	6

Pinus Halapensis	25
Pinus Hamiltonii	20
Pinus insignis	6,050
Pinus muricata	20
Pinus pinea	20
Pinus (sp.?)	3
Pittosporum crassifolium	18
Pittosporum eugeneoides	667
Pittosporum nigrum	948
Pittosporum undulatum	12
Plumbago capensis	225
Poinciana Gilliesii	125
Populus	3
Polygala alternata	6
Polygala Dalmasiana	150
Polygala grandiflora	18
Polygala speciosa	12
Prostanthera Seibersii	48
Prunus speciosa	12
Psoralea pinnata	49
Psoralea glandulosa	2
Raphiolepis indica	54
Retinospora obtusa	29
Retinospora pisifera aurea	2
Rhamnus Californica	1,000
Rhus cotinus	1
Ribes (sp. ?)	4
Robinia pseud-acacia	22
Robinia pseud-acacia; red	4
Roses	100
Rubus rosæfolius	6
Salix	2
Sambucus niger	5
Schinus molle	34
Sequoia gigantea	18
Sequoia sempervirens	229
Sida pulchella	550
Solanum capsicastrum	78
Solanum laciniatum	150
Solanum lanceolatum	125
Solanum pseudo-capsicum	25
Solanum robustum	150
Spartium junceum	21
Spiræa Reevesii	84
Sterculia platanifolia	1
Syncarpia laurifolia	12
Syrina vulgaris	6
Taxus variegata	4
Taxus baccata	2
Taxus baccata, var. fastigiata	4
Tamarix gallica	5,000
Tecoma capensis	37
Thea viridis	150
Thuja gigantea	3
Thuja Tatarica	50
Tilia Americana	3
Tristania conferta	18
Ulex Europeus	1,500
Ulmus Americana	2
Ulmus suberosa	41
Ulmus, white	10
Veronica decussata	801
Veronica paniculata	100
Veronica parviflora	52
Viburnum lucidum	68
Viburnum opulus	12
Viburnum tinus	175
Vinca major	18,000
Vinca major variegata	3,000
Vinca minor	6,000
Virgilia capensis	24
Vitex agnus-castus	3
Weigelia rosea	100
Widdringtonia cupressoides	12
Total	167,364

VINES AND TRAILING PLANTS PLANTED IN 1889–90.

There have been eight hundred and seventy-four vines and trailing plants planted in the park during the past fiscal year, the following being the classification:

Cobea scandens	12
Clematis; various	24
Ampelopsis Royallii	12
Ampelopsis Veitchii	18
Dolichos	12
Eccremocarpus scaber	24
Ipomea ficifolia	13
Ipomea Hardingii	4
Ipomea Learii	20
Ipomea Limbata	20
Lonicera; various	300
Mandevillea suaveolens	6
Maurandia Barclayana	12
Mina lobata	12
Momordica involucrata	6
Lophospermum scandens	96
Passiflora	37
Periploca græca	12
Solanum jasminoides	105
Tacsonia	73
Tecoma jasminoides	56
Total	874

HERBACEOUS AND FLOWERING PLANTS PLANTED DURING YEAR 1889–90.

Herbaceous and flowering plants, to the number of four hundred and eighty thousand one hundred and forty-one, have been planted and seeded during the past year. These are classified as follows:

Achyranthes Lindenii	35
Achyranthes Versch	1,900
Achyranthes Versch; dwarf	1,000
Achyranthes bicolor	1,000
Acroclinium roseum	1,000
Acroclinium album	600
Agatha cælistis	265
Ageratum Mexicanum; blue	700
Ageratum; white	1,700
Agrostemma coronaria	1,200
Alonsoa grandiflora	4,000
Alternanthera amæna; large red	3,000
Alternanthera amæna; small red	7,200
Alternanthera amæna; small yellow	8,200
Alternanthera amæna; large yellow	10,200
Alternanthera amæna; versicolor	2,200
Alternanthera amæna; amabilis	1,600
Alyssum var.	9,300
Alyssum Weisbeckia	1,300
Amaranthus atropurpurens	27
Amaranthus monstrosus	3,000
Amaranthus nobilis	6,000
Amaranthus tricolor	100
Amagallis Brewerii grandiflora	100
Anemone hybrida	300
Anemone Japonica	1,000
Anemone alba	800
Anemone elegans fulgens	300
Anthemis coronaria	200
Antirrhinum majus	1,800
Aquilegia	760

Argemone Mexicanum	260
Artemesia	200
Aster	300
Beta Chilensis	150
Balsamina	100
Begonia; various	1,800
Brachycome iberidifolia	50
Cacalia	600
Calceolaria; bronze	700
Calceolaria; yellow	1,200
Calendula	500
Campanula media	300
Campanula Sibirica	5
Campanula pyramidalis	18
Canna	350
Carnation	200
Celosia plumosa	400
Centaurea candidissima	100
Centaurea cyanus	700
Centaurea gymnocarpa	150
Centranthus macrosiphon	100
Centranthus ruber	200
Cerastium tomentosum	2,000
Chamomile	50
Chieranthus chieri	2,900
Chrysanthemum	1,800
Chrysanthemum coronarium	500
Chrysanthemum corinatum	400
Cineraria hybrida	1,000
Commelyna alba	300
Coleus	1,050
Commelyna cœlestis	1,000
Colinsia tricolor	300
Convolvulus minor	125
Convolvulus tricolor	1,700
Coreopsis	1,400
Coreopsis lanceolata	75
Cosmos bipinnata	400
Crassula	300
Crepis rubra	200
Cyclamen Persicum	75
Cynoglossum grande	100
Dahlia; single	1,200
Dahlia variabilis	200
Delphinium	4,300
Dianthus; various	2,300
Digitalis purpurea	7,400
Escheveria	15,000
Erysimum Arkansanum	100
Erythryæa	18
Eschscholtzia; double	75
Fuchsia	400
Gaillardia picta	700
Geranium, rose	400
Geranium, bronze	1,000
Geranium, Crystal Palace Gem	600
Geranium, Happy Thought	700
Geranium, Gowan	400
Geranium, General Grant	1,300
Geranium, Mountain of Snow	1,500
Geranium, common mixed	900
Geranium, Mrs. Pollock	150
Geranium pelargonium	535
Geum coccineum	1,300
Gladiolus	900
Gnaphalium lanatum	700
Glaucium corniculatum	300
Godetia	2,000
Helianthus	250
Helichrysum	800
Heliotrope	800
Heliptrum	200
Hibiscus	400
Hollyhocks	50
Hyacinths	1,000

Hesperis candidissima	265
Iberis coronaria	700
Iberis sempervirens	200
Ixia	2,300
Lathyrus odoratus	200
Lathyrus; blue	100
Lobelia cardinalis	1,500
Lobelia coccinea	300
Lobelia erinus compacta	5,300
Lobelia erinus	1,200
Lobelia compacta; white	400
Lilium candidum	50
Leucanthemum grandiflorum	200
Linum	100
Lychnis fulgens	700
Marguerite; white	2,400
Marguerite; yellow	1,800
Marguerite étoile d'or	100
Matricaria eximia	200
Matthiola	3,600
Mesembryanthemum var.	116,500
Mesembryanthemum spectabile	20,000
Mesembryanthemum tenuifolium	1,000
Mesembryanthemum tricolor	14,800
Mignonette	150
Myosotis	6,000
Myosotis palustris	50
Narcissus	800
Nicotiana tobaccum	300
Œnothera Lamarckiana	400
Œnothera biennis	400
Œnothera Taraxicfolia	500
Othoma crassifolia	300
Oxalis	1,400
Oxalis; crimson	100
Palava flexusoa	500
Penstemon	1,200
Petunia hybrida	3,200
Petunia compacta	400
Phlox decussata	500
Phlox Drummondii	600
Poppy bracteatum	36
Poppy alpinum	50
Poppy nudicale	25
Poppy Orientalis	50
Poppy somniferum	10,000
Poppy rhæs	1,000
Poppy lævigatum	200
Poppy shirley	800
Portulaca	10,000
Pyrethum parthenifolium	3,000
Ranunculus	120
Ricinus	175
Richardii Œthiopica	1,000
Rodanthe	250
Salpiglossis	1,300
Salvia Africanus	800
Salvia amabilis	400
Salvia coccinea	600
Salvia globosa	600
Salvia; various	1,200
Salvia splendens	1,500
Santolina	300
Saponaria	600
Scabiosa	800
Sedum acre	12,000
Sedum var.	10,000
Sedum arboreum	800
Sedum azareum	700
Sedum Kamtchaticum	500
Sempervirum	12,000
Sinecio elegans	900
Silene pendula	6,500
Spergula	20,000
Stillaria gramenæ aurea	5,000

Tagates perennis	500
Tagates annuus	1,100
Thymus elegantissima marginata	3,400
Tritonia uvaria	6,000
Tropoælum	1,000
Tulips	600
Verbena	1,200
Viola odorata	20,000
Viola cornuta	1,000
Viola lutea	300
Viola tricolor	3,160
Viscaria	1,600
Viscaria cardinalis	800
Watsonia	1,300
Wigandia	12
Xeranthemum	25
Zinnia elegans	1,500
Total	480,141

TREES AND SHRUBS IN PARK NURSERY; THEIR NUMBER AND VALUATION.

The park nursery has occupied much time and attention, and we now have two hundred and five thousand three hundred and sixty-one trees and shrubs in the nursery, valued at $31,274 25. We append a complete list of these, with their separate valuations:

Botanic Name.	Common Name.	Number.	Value.
Abies alba	White spruce	273	$136 50
Abies balsamæ	Balsam spruce	11	2 75
Abies Cephalonica	Cephalonia spruce	1	1 00
Abies cereula	Blue spruce	18	18 00
Abies Douglasii	Douglas spruce	612	153 00
Abies excelsa	Norway spruce	134	33 50
Abies Menziesii	Menzies spruce	316	316 00
Abies Mertensiana	Merten's spruce	20	10 00
Abies nigra	Black spruce	24	12 00
Abies Picea Orientalis	Eastern spruce	3	15 00
Abies Morinda	Himalayan spruce	63	63 00
Abies pectinata	European silver fir	47	47 00
Abies pinsapo	Spanish silver fir	49	49 00
Abutilon; various	Chinese bell flower	884	88 40
Acacia armata	Prickly acacia	430	215 00
Acacia Covenia	Coven's acacia	2	50
Acacia cultiformis	Knife-blade acacia	13	13 00
Acacia dealbata	White-leaved acacia	360	36 00
Acacia decurrens	Wattle acacia	100	10 00
Acacia fragrans	Fragrant acacia	5,600	560 00
Acacia floribunda	Profuse flowering acacia	450	45 00
Acacia homotophylla	Unchanging-in-leaves acacia	4	2 00
Acacia latifolia	Broad-leaved acacia	34,500	3,450 00
Acacia linearis	Linear-leaved acacia	6	60
Acacia lophantha	Crested acacia	20,000	2,000 00
Acacia melanoxylon	Blackwood leaves	4,760	476 00
Acacia paradoxa	Paradox leaves	87	8 70
Acacia pycnantha	Black wattle	6	3 70
Acacia pendula	Pendulous acacia	15	7 50
Acacia reclinata	Reclinate acacia	43	10 75
Acacia Riceana	Rice's acacia	25	....
Acacia saligna	Willow-leaved acacia	10	5 00
Acacia salicina	Dwarf-leaved acacia	4	4 00
Acacia verticillata	Verticillate acacia	3,220	322 00
Achania malvaviscus	Turk's cap	86	8 60
Angophora lanceolata	....	40	20 00
Artemesia	Wormwood	150	15 00
Aphelandra aurantiacum	Golden aphelandra	98	49 00
Arancaria excelsa	Norfolk Island pine	12	60 00

TREES AND SHRUBS—Continued.

Botanic Name.	Common Name.	Number.	Value.
Arbutus Unedo	Strawberry bush	9	$9 00
Arbutus Menziesii	Madrona	630	630 00
Aucuba Japonica	Japanese laurel	18	9 00
Backhausia myrtifolia		2	2 00
Banksia Cunninghamis	Cunningham's banksia	9	4 50
Bignonia jasminoides	Jasmine-leaved bignonia	59	29 50
Boldoa fragrans	Fragrant boldoa	7	7 00
Bouvardia		12	6 00
Brachychiton acerifolia	Flame tree	3	3 00
Brousonetia fruticosa		60	15 00
Brugmansia suaveolens	Trumpet flower	18	9 00
Buddlea globosa	Button bush	470	23 50
Buddlea Lindleyana		160	40 00
Bupleurum fruticosum		20	20 00
Buxus sempervirens	Boxwood	4,040	404 00
Callistaychs lanceolata	Lanceolate callistaychs	5	2 50
Calistris cypressiformis	Cypress-like calistris	1	1 00
Callistemon rigidus		300	30 00
Callistemon saligna	Willow-leaved calistemon	286	71 50
Callistemon suaveolens		400	40 00
Calothamnus purpurea	Purple calothamnus	6	60
Calothamnus quadrifida	Four-parted calothamnus	10	5 00
Calothamnus sanguinea	Blood-red calothamnus	8	4 00
Capparis ovata	Caper	2	1 00
Capsicum	Pepper	118	11 80
Carpenteria Californica		1	1 00
Cassia corymbosa	Senna	500	50 00
Cassia floribunda	Flowering senna	1	50
Cassia lævigata		100	10 00
Cassia tomentosa	Woolly senna	186	18 60
Casuarina quadrivalvis		52	26 00
Casuarina suberosa	Cork-bark casuarina	27	2 70
Casuarina stricta	Erect casuarina	1	50
Casuarina tenuissima	Narrow-leaved casuarina	84	21 00
Casuarina torulosa	Twisted casuarina	146	146 00
Ceanothus Africanus	African ceanothus	3,072	763 00
Ceanothus Verrucosus	California lilac	1,225	122 50
Cedrus Atlantica	Mount Atlas cedar	35	35 00
Cedrus argentea	Mt. Atlas silver-leaved cedar	18	18 00
Cedrus Libani	Cedar of Lebanon	18	18 00
Cedrus deodara	Deodar	6	6 00
Cerasus ilicifolia	Evergreen cherry	10	10 00
Ceratonia siliqua	Carob tree	125	62 50
Cercocarpus betulifolius		1	1 00
Cestrum aurantiacum	Golden cestrum	36	9 00
Chorozema ilexifolia	Holly-leaved chorozema	10	5 00
Cistus albidus	White rock rose	117	58 50
Cistus floribunda	Free-flowering rock rose	15	3 75
Cistus ladaniferus maculata	Sweet-scented rock rose	1,640	810 00
Cistus parviflora	Sparse-flowered rock rose	18	9 00
Cistus salviafolia	Salvia-leaved rock rose	4	2 00
Citrus aurantiacum	Orange	39	19 50
Clematis crispa		30	30 00
Clianthus puniceus	Parrot's-bill flower	200	50 00
Cobea scadens	Climbing cobea	25	12 50
Coccoloba platyclada	Seaside grape	11	2 75
Coletia ferox	Thorny coletia	3	75
Coprosma Baueriana	Bauer's coprosma	2	1 00
Coprosma Baueriana, var.	Bauer's var. coprosma	4	4 00
Coriaria myrtifolia	Myrtle-leaved coriaria	3	1 50
Coriaria ruscifolia	Ruscus-leaved coriaria	2	2 00
Coronilla emerus		2	2 00
Coronilla glauca	Glaucus coronilla	56	14 00
Coronilla juncea	Rush-leaved coronilla	16	4 00
Coronilla Valentina	Valentine's coronilla	100	33 00
Corynocarpus lavigatus	Smooth corynocarpus	9	9 00
Cotoneaster rotundifolia	Round-leaved cotoneaster	9	4 50
Cratægus pyracantha	Running bush	50	12 50
Cryptomeria elegans	Elegant Japanese cedar	225	122 50
Cupressus Africanus	African cypress	2	2 00

TREES AND SHRUBS—Continued.

Botanic Name.	Common Name.	Number.	Value.
Cuphea platycentra	Cigar plant	340	$34 00
Cupressus Chinensis	Chinese cypress	1	1 00
Cupressus excelsa	Noble cypress	1	1 00
Cupressus elegans	Elegant cypress	7	7 00
Cupressus funebris	Funeral cypress	1	1 00
Cupressus Goveniana		587	58 70
Cupressus Guadalupensis		320	32 00
Cupressus Lawsoniana	Lawson's cypress	1,290	322 50
Cupressus macrocarpa	Monterey cypress	7,080	708 00
Cupressus McNabiana	McNab's cypress	8	2 00
Cupressus pyramidalis	Pyramidal cypress	21	10 50
Cupressus sempervirens		59	5 90
Cytisus albidus	White cytisus	3	75
Cytisus albidus proliferus	White free-flowering cytisus	5	1 25
Cytisus Alpinus	Scotch laburnum	10	2 00
Cytisus hirsutus	Hairy laburnum	1,040	520 00
Cytisus laburnum	Golden chain	90	22 50
Cytisus proliferus	Free-flowering laburnum	8	4 00
Cytisus quercifolia	Oak-leaved laburnum	16	8 00
Cytisus spinosus	Spiny laburnum	2	1 00
Daphne mezereum		5	5 00
Deeringia celosioides		82	20 50
Deeringia celosioides var.		54	13 50
Diosma alba	Breath of heaven	104	20 80
Diosma purpurea	Purple breath of heaven	320	80 00
Dolichos	Australian pea	36	3 60
Dracocephalum Canarensis	Balm of Gilead	10	1 00
Drinujs arillaris		4	4 00
Echium structum		25	12 50
Edwardsia microphylla	Small-leaved Edwardsia	6	6 00
Edwardsia myriophylla	Many-leaved Edwardsia	10	10 00
Eleagnus Japonica	Oleaster	444	222 00
Eleagnus angustifolia, var. Hortensia		88	44 00
Entelea arborescens	New Zealand cork	10	2 50
Erica capitata	Heath	2	1 00
Erica Mediterranea	Mediterranean heath	306	30 60
Eriobotrya Japonica loquat		25	25 00
Escallonia floribunda		30	7 50
Escallonia Montevidensis		30	15 00
Escallonia rosea		210	52 50
Escallonia rubra		27	6 75
Eucalyptus amygdalina	Almond-leaved gum	38	3 80
Eucalyptus citriodora		10	1 00
Eucalyptus globulus	Blue gum	10,000	500 00
Eucalyptus goniocalyx	Angled gum	22	2 20
Eucalyptus leucoxylon	White gum	52	5 20
Eucalyptus macrocarpa		52	5 20
Eucalyptus occidentalis		64	6 40
Eucalyptus rostrata	Spurred gum	100	10 00
Eucalyptus varacmanioides		33	3 30
Eugenia myrtifolia	Myrtle-leaved eugenia	146	36 50
Euonymus Japonica	Japanese spindle tree	460	46 00
Eupatorium ageratoides	Snakeroot	120	12 00
Eupatorium triste	Snakeroot	74	12 33
Euphorbia heterophylla		5	5 00
Eurybia		50	12 50
Eugtryphus latifolius		3	3 00
Fabiana imbricata		200	50 00
Frenella rhomboides		3	1 50
Frenella robusta		6	3 00
Genista alba	White broom	3,200	320 00
Genista Canariense		12	1 20
Genista candecans	White broom	244	24 40
Genista capensis	Cape broom	12	1 20
Genista linifolia	Flax-leaved broom	184	18 40
Genista proliferus	Free-flowering broom	12	1 20
Genista tinctoria	Scotch broom	4,000	400 00
Goodia latifolia	Broad-leaved goodia	15	1 50
Grevillea robusta	Silk oak	19	19 00
Grevillea hirta		1	1 00

Trees and Shrubs—Continued.

Botanic Name.	Common Name.	Number.	Value.
Habrothamnus coccineus		358	$89 50
Habrothamnus elegans		1,080	270 00
Hamamelis Virginica		4	4 00
Helianthemum roseum	Sun rose	22	11 00
Hoheria populnea		100	50 00
Hydrangea Hortensia var.		9	2 25
Hydrangea paniculata		74	7 40
Hypericum patulum	St. John's wort	6	60
Hymenosporum flavum		6	6 00
Indigofera Australis	Indigo	12	3 00
Indigofera dosua	Indigo	241	50 00
Indigofera tinctoria	Indigo	8	2 00
Inga dulcis	Flower fence	10	10 00
Isochroma tubulosa		272	68 00
Ilex aquifolia	Holly	3	3 00
Itea Virginica		44	4 40
Jacaranda minosæfolia		1	1 00
Jasminum capensis		6	3 00
Jasminum puticosum	Yellow jasmine	160	16 00
Jasminum officinalis	White jasmine	192	19 20
Juniperus Bermudianus	Bermuda juniper	120	30 00
Juniperus Chinensis alba	Chinese juniper	164	41 00
Juniperus compacta	Compact juniper	43	10 75
Juniperus communis	Common juniper	104	26 00
Juniperus Lycia		30	7 50
Juniperus squamata	Squamate juniper	48	24 00
Juniperus sabina	Sabin juniper	400	100 00
Juniperus prostrata	Prostrate juniper	1,590	159 00
Juniperus Virginiana		362	90 00
Kerria Japonica		24	12 00
Kunzia pomifera		2	2 00
Lagerstræmia Indica	Crape myrtle	205	20 50
Lantana superba		176	17 60
Laurus camphora	Camphor tree	100	25 00
Laurus glandulosa		2	2 00
Laurus Indica	Indian laurel	6	12 00
Laurus Lusitanicus	Portugal laurel	300	75 00
Laurus nobilis	Sweet bay	10	10 00
Lavatera arborea var.	Tree mallow	100	50 00
Lavandula staecha	Lavender	3	38
Lavendula vera	True lavender	12	6 00
Leonotis Leonurus	Lion's-tail flower	150	150 00
Leptospermum ericoides		400	100 00
Leptospermun lævigatum	New Zealand tea	30,000	3,000 00
Leptospermun scoparium		10,000	1,000 00
Libocedrus decurrens	Port Orford cedar	23	23 00
Libonia floribunda		75	18 75
Ligustrum Japonicum alba		585	146 25
Litrea caustica		6	6 00
Lonicera brachypoda		117	25 00
Lonicera chamæ cerasus	Cherry honeysuckle	136	34 00
Lonicera chamæ rosea	Cherry honeysuckle	150	37 50
Lonicera pulcherrima	Cherry honeysuckle	98	24 50
Lonicera pulcherrima alba	Cherry honeysuckle	120	30 00
Lonicera grandiflora	Large flowered honeysuckle	160	40 00
Lonicera Japonica	Japanese honeysuckle	180	21 50
Lonicera Japonica var.	Variegated honeysuckle	860	86 00
Lonicera	English honeysuckle	284	71 00
Lonicera tatarica splendens		136	34 00
Lophospermum scandens		288	144 00
Lycium parviflorum		2,580	258 00
Mahernia odorata		126	12 60
Mahonia aquifolia		9	4 50
Maurandia Barclayana		6	1 74
Maitenus Chilensis		12	3 00
Melaleuca hypercifolia		24	2 40
Melia Azedarach	Pride of India	100	50 00
Melia	Texas umbrella tree	150	75 00
Mispilus Japonica	Medlar	7	3 50
Myoporum lactum		200	50 00
Moleria Palmerii		10	10 00

Trees and Shrubs—Continued.

Botanic Name.	Common Name.	Number.	Value.
Myrica Californica	Wax berry	10	$5 00
Myrtus communis	Myrtle	2,120	212 00
Myrtus mucronata	Sharp-pointed myrtle	2,240	224 00
Neirembergia gracilis		360	36 00
Nussa aquatica		2	1 00
Olea sativa	Olive	24	12 00
Passiflora	Passion flower	150	37 50
Perophyllum ramosissima		6	6 00
Phillyrea angustifolia		10	5 00
Phillyrea latifolia		12	6 00
Phillyrea media		18	9 00
Photinia arbutifolia	California red berry	2	50
Photinia serrulata		2	1 00
Picea amabilis	Lovely silver fir	1	50
Picea excelsa		27	27 00
Picea Litchensis		15	15 00
Picea magnifica	Magnificent fir	23	11 50
Picea nobilis	Noble fir	1,000	500 00
Picea pectinata		42	42 00
Picea pinsapo		49	49 00
Pimelia rosea		104	52 00
Pinus Austriaca	Austrian pine	96	48 00
Pinus cembra	Swiss stone pine	6	3 00
Pinus Coulterii	Coulter's pine	15	7 50
Pinus densiflora	Large flowering pine	2	2 00
Pinus excelsa	Lofty pine	70	140 00
Pinus Halapensis	Aleppo pine	567	141 75
Pinus Hamiltonii	Hamilton's pine	336	336 00
Pinus insignis	Monterey pine	3,660	366 00
Pinus Jeffreyana	Jeffrey's pine	111	55 50
Pinus Lambertiana	Sugar pine	15	7 50
Pinus Laricio Calabrica	Calabrian pine	300	150 00
Pinus Laricio	Larician pine	54	27 00
Pinus longifolia	Long-leaved pine	17	17 00
Pinus maritima	Sea pine	480	48 00
Pinus Massoniana	Masson's pine	30	30 00
Pinus metis	Yellow pine	14	14 00
Pinus monticola	Mountain pine	22	22 00
Pinus muricata	Bishop's pine	274	264 00
Pinus mugho	Mugho pine	20	20 00
Pinus nigra	Black pine	10	10 00
Pinus parviflora	Few-flowered pine	3	3 00
Pinus pinaster	Sea pine	100	25 00
Pinus pinea	Italian stone pine	161	161 00
Pinus ponderosa	Ponderous pine	74	74 00
Pinus rubra	Red pine	432	432 00
Pinus Sabiniana	Digger pine	2	2 00
Pinus Strobus	Weymouth pine	66	66 00
Pinus Sylvestris	Scotch pine	548	274 00
Pinus Taeda	Loblolly pine	1	1 00
Pinus tomentosa	Woolly pine	5	5 00
Pinus Torreyana	Torrey's pine	10	10 00
Pinus tuberculata		16	8 00
Pittosporum Buchanic		10	10 00
Pittosporum eugeneoides	Turpentine tree	16	4 00
Pittosporum crassifolium	Turpentine tree	4,520	1,130 00
Pittosporum nigrum		1,652	413 00
Pittosporum tobira variegata		10	10 00
Pittosporum rhombifolium		12	12 00
Pittosporum undulatum		28	14 00
Plagianthus Lyallii		50	25 00
Plumbago capensis	Lead wort	350	175 00
Poinciana Gilliesii	Flower fence	26	13 00
Polygala Dalmasiana	Milkwort	180	18 00
Polygala grandiflora	Milkwort	4	2 00
Polygala speciosa	Milkwort	4	2 00
Prosthanthera læcanthos		12	6 00
Prosthanthera minea		3	1 50
Prosthanthera suberosa		22	11 00
Psoralea pinnata		360	100 00
Pyrus Japonica	Japanese quince	18	9 00

Trees and Shrubs—Continued.

Botanic Name.	Common Name.	Number.	Value.
Quercus robur	English oak	2	$2 00
Quercus suber	Cork oak	2	2 00
Retinospora obtusa	Japanese cypress	9	4 50
Raphiolepses indica		98	24 50
Rhamnus alpinus		34	17 00
Rhamnus Californica	California coffee	1,900	190 00
Rhamnus Catharticus		70	17 50
Rhamnus frangula		235	50 00
Rhododendron Catawbiense		282	141 00
Rhododendron hyb.		61	18 30
Rhododendron ponticum		140	15 40
Rosemarinus officinalis	Rosemary	12	3 00
Rubus rosæfolius		6	3 00
Ruscus aculeatus		60	30 00
Salvia fulgens	Fulgent sage	100	10 00
Schinus molle	Pepper tree	308	77 00
Schinus terebinthefolia		1	50
Schotia tamarindifolia		1	1 00
Scedioptys verticillata	Umbrella pine	1	3 00
Sequoia gigantea	Big tree	65	32 50
Sequoia sempervirens	Redwood	66	8 35
Sida pulchella		120	12 00
Solanum capsicastrum	Jerusalem cherry	189	9 45
Solanum jasminoides		180	18 00
Solanum jasminoides var.		164	16 40
Solanum laconiatum	Laciniate solanum	60	6 00
Solanum lanceolatum	Lanceolate solanum	100	8 25
Solanum robustum	Robust solanum	200	20 00
Sollya heterophylla		25	6 25
Spartium junceum	Spanish broom	100	25 00
Spirea Billardii	Billiard's spiræa	12	1 50
Spirea Reevesii	Bridal wreath	118	29 50
Staphyllea pinnata		6	3 00
Stevia serrata	Blood root	40	4 00
Swainsonia galegifolia		10	5 00
Syncarpia laurifolia		800	200 00
Tacsonia		500	125 00
Tamarindus indica	Tamarind	10	10 00
Taxus baccata	English yew	2	2 00
Taxus fastigiata	Irish yew	12	12 00
Taxus cuspidata	New Zealand yew	3	3 00
Tecoma bignonoides		6	3 00
Tecoma capensis		18	45 00
Tamarix elegans		100	10 00
Tecoma jasminoides		50	25 00
Tecoma gracilis		2	1 00
Tecoma radicans		15	7 50
Teucrium Canadense	Germander	100	50 00
Thuja gigantea		33	16 50
Thuja Nepalensis	Nepal arbor vitæ	300	30 00
Thuja Orientalis	Eastern arbor vitæ	255	25 50
Thuja pendula	Pendulis arbor vitæ	15	7 50
Thuja Tatarica	Siberian arbor vitæ	480	120 00
Thuyiopsis dolabrata	Hatchet-leaved arbor vitæ	334	167 00
Tristania conferta		352	176 00
Ulex Europea	Furze	315	31 50
Umbellularia Californica	California laurel	40	20 00
Veronica Andersonii	Speedwell	684	171 00
Veronica decussata	Speedwell	960	96 00
Veronica longifolia	Speedwell	37	3 70
Veronica paniculata	Speedwell	112	11 20
Veronica parviflora	Speedwell	1,350	135 00
Viburnun lucidum		48	24 00
Viburnun opulus	Snowball	120	60 00
Viburnun tinus	Laurestinus	148	14 80
Weigelia rosea		12	1 20
Widdringtonia cupressoides		48	22 00
Totals		205,361	$31,274 25

DECIDUOUS PLANTS NOT INCLUDED IN OTHER LIST.

We also have, not included in the preceding list, nine thousand and fifty-one deciduous plants, valued at $891 02, a list of which is as follows:

Botanic Name.	Common Name.	Number.	Value.
Acer dasycarpum	Silver maple	10	$1 00
Acer macrophyllum	Broad-leaved maple	10	1 00
Acer platanoides	Norway maple	21	2 10
Acer rubrum	Red maple	4	40
Æsculus flava		4	1 00
Æsculus hippocastanum	Horse-chestnut	3	75
Æsculus pavia rubra	Red buckeye	4	12
Ailanthus glandulosa	Tree of heaven	11	55
Albizzia lophantha	Red acacia	56	2 80
Almus serrulata	Sun-leaved alder	4	2 00
Aloysia citriodora	Lemon verbena	254	12 70
Amorpha crocea-lanata	False indigo	460	23 00
Amorpha fragrans nana	False indigo, dwarf	460	23 00
Amorpha fruticosa	False indigo, shrubby	300	15 00
Amorpha glabra	False indigo, rough	466	23 00
Amorpha Lewisii	False indigo, Lewis	460	23 00
Ampelopsis Veitchii	Veitch's Virginia creeper	54	10 80
Ampelopsis Royalii	Royal's Virginia creeper	37	7 40
Amygdalus communis	Sweet almond	16	80
Amygdalus amarus	Bitter almond	10	50
Anona cherimolia	Custard apple	1	50
Anona triloba		10	10 00
Berberis vulgaris	Common barberry	130	13 00
Berberis stenophylla	Narrow-leaved barberry	3	30
Berberis heterophylla		1	10
Berberis dulcis	Sweet barberry	15	1 50
Berberis Darwinii	Darwin's barberry	12	1 20
Betula laciniata	Cut-leaved birch	3	30
Betula lenta	Cherry birch	8	80
Betula lutea	Yellow birch	12	1 20
Betula populifolia	Poplar-leaved birch	6	60
Calicarpa Americana		11	5 50
Caragana altagana	Siberian pea tree	1	1 00
Catalpa bignonoides	Indian bean	10	1 00
Catalpa speciosa	Indian bean	46	4 60
Carya alba	Hickory	15	7 50
Carya amara		18	9 00
Carya olivæformis	Pecan nut	2	2 00
Carya porcina		15	7 50
Castanea Americana	American chestnut	16	4 00
Celtis australis	Southern nettle tree	190	19 00
Celtis cordata	Heart-leaved nettle tree	100	10 00
Cercis Canadensis	Judas tree	2	20
Cercis siliquastrum		124	12 40
Chronanthus Virginicus	Fungi tree	2	20
Clematis coccinea	Virginia bower	1	25
Clematis flammula	Virginia bower	200	40 00
Citrus trifoliata	Three-leaved citrus	10	5 00
Colutea cruenta	Bladder senna	25	2 50
Colutea glauca	Bladder senna	36	3 60
Deutzia crenata		285	57 00
Deutzia gracilis		6	1 50
Deutzia scabra		12	3 60
Ficus carica	Fig tree	4	40
Fraxinus alba Americana	American white ash	54	5 40
Fraxinus excelsior	English ash	5	50
Fraxinus Oregonia	Oregon ash	24	2 40
Fraxinus platycarpa		8	4 00
Gleditschia triacantha	Honey locust	12	1 20
Gymnocladus Canadensis	Kentucky coffee tree	2	20
Hibiscus; various		300	30 00
Juglans nigra	Black walnut	12	1 20
Juglans regia	English walnut	3	30
Juglans Sieboldii		6	3 00

DECIDUOUS PLANTS—Continued.

Botanic Name.	Common Name.	Number.	Value.
Kolreuteria paniculata		630	$31 50
Larix Europea	Larch fir	170	17 00
Liriodendron tulipifera	Tulip tree	175	17 50
Morus alba	White mulberry	140	7 00
Morus Russian	Russian mulberry	2	1 00
Negundo aceroides		7	70
Paulownia imperialis	Paulownia	12	1 20
Phaseolus caracalla	Snail flower	1	50
Philadelphus coronarius	Mock orange	224	22 40
Pistacia vera		5	5 00
Planera cuspidata	Planer tree	2	2 00
Populus dilatata	Poplar	6	60
Platanus occidentalis	Sycamore	4	1 00
Ptelea trifoliata	Hop tree	63	6 30
Quercus coccinea		4	4 00
Quercus Palustris		79	79 00
Quercus robur	English oak	2	2 00
Quercus rubra		23	23 00
Rhus capallina	Dwarf sumac	2	1 00
Rhus coriaria	Sicilian sumac	2	2 00
Ribes grossularia	Wild gooseberry	6	30
Ribes sanguinea	Wild currant	18	1 80
Robinia pseud-acacia	Locust	25	2 50
Roses		2,000	100 00
Salisburia adiantifolia	Maiden-hair tree	6	3 00
Salix; various	Willow	263	13 15
Sophora Japonica pendula	Japanese sophora	169	42 50
Styrax Africana		14	7 00
Styrax officinalis		3	3 00
Syringa vulgaris	Lilac	300	15 00
Tamarix gallica	Tamarack	100	1 00
Taxodium distichum		80	20 00
Tilia Americana	American linden	2	50
Tilia Europea	European linden	2	50
Ulmus Americana	American elm	6	60
Ulmus suberosa	Cork elm	12	12 00
Virgillea lutea	Yellow wood	70	7 00
Virgillea capensis	Cape wood	11	1 10
Vitex agnus-castus	Chaste tree	9	9 00
Totals		9,051	$891 02

ALOES, PALMS, AND GRASSES.

We have now in the nursery three thousand nine hundred and twenty-one different aloes, palms, and grasses, valued at $412 23. We append a complete list of these, with their separate valuations:

Botanic Name.	Common Name.	Number.	Value.
Agave Americana	Century plant	130	$13 00
Agave Americana var.	Variegated century plant	96	19 20
Agave Angustifolia	Flowery century plant	4	4 00
Agave dealbata	Flowery century plant	10	5 00
Agave Cœrubescens	Blue-leaved century plant	6	6 00
Agave densiflora	Dense-flowered century plant	30	15 00
Agave ferox	Ferocious century plant	20	10 00
Agave lophantha	Crested century plant	30	15 00
Agave Salmiana	Salm's century plant	22	11 00
Agave stenophylla	Narrow-leaved century plant	36	18 00
Agave Vivipara	(Vuipi) Viviparous century plant	2	2 00
Arundo donax	Striped reed	10	2 00
Avena elatior	Tall oat grass	300	3 00
Bambusa; various	Bamboo	30	15 00
Brahea edulis	Edible fruited palm	6	6 00

DEER AND ELK GLEN.

Aloes, Palms, and Grasses—Continued.

Botanic Name.	Common Name.	Number.	Value.
Brahea filamentosa	Thready palm	100	$10 00
Chamærops excelsa	Tall palm	110	11 00
Chamærops Martiniana	Martin's palm	6	6 00
Doryanthes Palmerii		503	5 05
Dracæna Australis	Southern dragon tree	120	24 00
Dracæna nutans	New Zealand dragon tree	46	9 20
Elymus condensatus	Lyme grass	12	12 00
Eulalia Japonica	Japanese grass	200	50 00
Eulalia Japonica zebrina	Japanese zebra grass	12	3 00
Gynerium argentum	Pampas grass	200	40 00
Iris (in variety)		100	10 00
Musa ensete	Abyssinian banana	2	5 00
Phalaris canariensis	Common canary grass	200	1 50
Phalaris arundinacea	Reed-like canary grass	54	5 40
Opuntia; various	Contongued cactus	150	15 00
Phormium tenax	New Zealand flax	1,034	51 70
Phœnix canariensis	Canary Is. date palm	2	2 00
Phœnix dactylifera	Common date palm	3	3 00
Phœnix Leonensis		3	2 00
Phœnix Sylvestris	Wood date palm	1	1 00
Phœnix tenices		1	1 00
Pritchardia filifera	California fan palm	18	18 00
Stipa pennata	Common feather grass	4	08
Stipa tenacissima	Tough feather grass	6	48
Yucca; various		300	3 00
Jubæa spectabilis	Showy Jubæa	2	50
Totals		3,921	$412 23

CATALOGUE OF TREES AND SHRUBS IN THE GOLDEN GATE PARK.

Botanic Name.	Common Name.
Abies Douglasii	Douglas spruce.
Abies excelsa	Norway spruce.
Abies Mertensiana	Mertens spruce.
Abies Menziesii	Menzies spruce.
Abies nigra	Black spruce.
Abies Hookeriana	
Abutilon Thomsonii	China bellflower.
Abutilon Boule de Neige	White China bellflower.
Abutilon vexilaria	
Abutilon striatum	Striated bellflower.
Abutilon aurea	Golden bellflower.
Abutilon Thomsonii variegata	
Acacia armata	Thorny acacia.
Acacia decurrens	Silver wattle acacia.
Acacia dealbata	
Acacia cuttriformis	Cutter-leaved acacia.
Acacia fragrans	Sweet acacia.
Acacia floribunda	Free blooming acacia.
Acacia implexa	
Acacia latifolia	Broad-leaved acacia.
Acacia lophantha	Crested acacia.
Acacia linearis	Flax-leaved acacia.
Acacia melanoxylon	Blackwood acacia.
Acacia mollissima	Sweetest acacia.
Acacia pycnantha	Black wattle acacia.
Acacia Salixiana	Willow-leaved acacia.
Acacia Farnesiana	
Acacia homotophylla	
Acacia verticillata	
Acer campestris	English maple.
Acer dasycarpium	Silver maple.
Acer macrophyllum	Large-leaved maple.
Acer platanoides	Norway maple.

TREES AND SHRUBS—Continued.

Botanic Name.	Common Name.
Acer rubrum	Red-leaved swamp maple.
Acer saccharinum	Sugar maple.
Acer polymorphum	Japanese maple.
Ackania malvaviscus	Turk's cap.
Æsculus Californica	California buckeye.
Æsculus hippocastanum	European horse-chestnut.
Æsculus pavia rubra	Red-flowered buckeye.
Albizzia lophantha	Silver-tassel acacia.
Alnus serrulata	Saw-leaved alder.
Aloysia citriodora	Sweet-scented verbena.
Ailanthus glandulosa	Tree of heaven.
Amorpha crocea lanata	Glabra.
Amorpha Lewisii	
Amorpha fragrans nana	
Amorpha fruticosa	False indigo.
Ampelopsis quinquefolia	Virginia creeper.
Ampelopsis Veitchii	
Amygdalus communis	Almond.
Amygdalus purpurea	Purple-leaved peach.
Anona cherimolia	
Appelandra aurantiaca	
Aralia papyrifera	Chinese paper plant.
Aralia Seiboldii	Seibold's aralia.
Aralia spinosa	Hercules' club.
Auracaria Bidwellii	Morton Bay pine.
Auracaria Cookii	Cook Island pine.
Auracaria imbricata	Chili pine.
Auracaria excelsa	Norfolk Island pine.
Arbutus Unedo	Strawberry tree.
Arbutus Menziesii	Madrona tree.
Aristoclochia sipho	Dutchman's pipe.
Armeria Formosa	Portuguese armeria.
Artemesia glauca	Glaceous southern wood.
Aucuba Japonica	Japan laurel.
Baccharis Douglasii	Sea groundsel.
Bambusa falcata	Nepaul bamboo.
Bambusa fortunii	Fortune bamboo.
Bambusa arundinacea	
Bambusa Metaki	
Banksia Cunninghamii	
Berberis vulgaris	Common barberry.
Berberis Darwinii	Darwin's barberry.
Berberis dulcis	Sweet barberry.
Berberis stenophylla	Narrow-leaved barberry.
Berberis nervosa	Nerved barberry.
Betula lenta	Cherry birch.
Betula lutea	Yellow birch.
Betula laciniata	
Betula papyrifera	
Betula populifolia	Poplar-leaved birch.
Betula pendula	Weeping birch.
Bignonia radicans	Trumpet vine.
Bignonia jasminoides	
Bocconia Japonica	
Bouvardea fragrans	
Boldoa fragrans	
Brahea filamentosa	California fan palm.
Brahea Mannii	Arizona fan palm.
Brugmansia suaveolens	Trumpet flower.
Buddlea Lindleyana	
Buddlea globosa	
Buxus sempervirens	Tree box.
Buxus argentea	Silver tree box.
Callistris cuppressiformis conifer	New South Wales callistris.
Callistemon saligna	
Callistemon lanceolata	Bottle brush.
Callistemon rugulosiss	
Callistemon linearis	
Callistemon brachyandrus	
Calycanthus Floridus	

TREES AND SHRUBS—Continued.

Botanic Name.	Common Name.
Calothamnus purpurea	
Calothamnus quadripedus	
Calystachys lanceolata	
Camellia Japonica	Camellia tree.
Carya olivæformis	Pecan nut.
Cassia coryambosa	Buenos Ayres cassia.
Cassia floribunda	Tall cassia.
Caragana altagana	
Casuarinus stricta	
Casuarina suberosa	Cork-bark horsetail pine.
Casuarina glauca	Glaceous horsetail pine.
Casuarina equisetæfolia	
Catalpa bignonoides	Catalpa tree.
Catalpa Kaemfera	Japan catalpa.
Ceanothus Africana	African ceanothus,
Ceanothus Californica	California lilac.
Ceanothus Azureus	Large-flowered California lilac.
Cedrus Lebanii	Cedar of Lebanon.
Cedrus Deodara	East Indian tree of God.
Cedrus Atlantica	Mount Atlas cedar.
Celtus Australis	European nettle tree.
Celtus occidentalis	Sugar nettle tree.
Celtus cordata	
Cerasus mollis	Bird cherry.
Cerasus laurus	English laurel.
Ceratonia Siligna	St. John's bread.
Cercis Canadensis	
Cestrum aurantiacum	Yellow cestrum.
Chamærops excelsa	Australian palm.
Chamærops humilis	European fan palm.
Chronanthus Virginicus	Fringe tree.
Chorozema ilexifolia	
Cistus ladaniferus	Rock rose.
Cistus ladaniferus maculata	Spotted cistus.
Cistus rosea	Rose-colored cistus.
Citrus aurantacea	Orange tree.
Citrus Chinensis	Chinese orange.
Citrus trifoliata	Three-leaved orange.
Clematis aristata	Virgin's bower.
Clematis coccinea	Virgin's bower.
Clematis Jackamii (in variety)	Japanese clematis.
Clerodendron speciosum	Shrubby clerodendron.
Clianthus Damperii	Spotted clianthus.
Clianthus puniceus	Parrot's-bill flower.
Cobea scandens	Mexican cobea.
Coccoloba platyclada	
Colletia ferox	
Coprosma Baueriana	Green-leaved coprosma.
Coprosma variegata	Green-leaved coprosma.
Colutea cruenta	
Cordylin indivisa	New Zealand cabbage palm.
Cordylin Australis	Australian cabbage palm.
Coriaria myrtifolia	Myrtle-leaved coriaria.
Coriaria ruscifolia	Ruscus-leaved coriaria.
Comus pubescens	Dogwood.
Comus sanguinea	Blood-color dogwood.
Coronilla glauca	Glaucus coronilla.
Corylus Americana	Hazelnut.
Corypha Australis	Prickly-stemmed fan palm.
Corynocarpus lavigatus	
Cotoneaster buxifolia	
Cotoneaster thymifolia	
Cratægus oxyacantha	Hawthorn.
Cratægus pyracantha	Burning bush.
Cryptomeria elegans	Elegant cryptomeria.
Cryptomeria Japonica	Japan redwood.
Cuppressus macrocarpa	Monterey cypress.
Cuppressus Lawsoniana	Lawson's cypress.
Cuppressus McNabiana	McNab's cypress.
Cuppressus pyramidalis	Pyramid cypress.

TREES AND SHRUBS—Continued.

Botanic Name.	Common Name.
Cuppressus funebris	Mournful cypress.
Cuppressus pendula glauca	Weeping cypress.
Cuppressus torulosa	
Cuppressus Chinensis	Chinese cypress.
Cydmia Japonica	Japan quince.
Cytissus alpena	Laburnum Scotch.
Cytissus leoparius	Scotch broom.
Cytissus laburnum	Golden chain.
Cytissus hirsutus	Hairy-stemmed broom.
Daphne laurifolia	Spurge laurel.
Daphne odorata	Sweet-scented daphne.
Datura arborea	Tree datura.
Deutzia crenata flora plena	Double flowering deutzia.
Deutzia gracilis	Dwarf deutzia.
Dictamnus fraxinella	
Deeringea celosioides	
Deeringea celosioides variegata	
Diosphorus Virginiana	Persimmon.
Diervillea speciosa	Bush honeysuckle.
Diosma ericifolia	Breath of heaven.
Dipsacus pulonum	
Dolichus lablab	Australian pea vine.
Eleagnus aurea	Golden variegated eleagnus.
Eccremocarpus scabra	Climber.
Echium Lindleyana	
Echium strictum	
Echium candicans	
Edwardsia microphylla	
Erica arborea	Heath.
Erica Mediterranea	Heath.
Erica hymalis	
Erythrinus crita galli	
Escalonia floribunda	
Escalonia macrantha	Granada escalonia.
Escalonia rubra	Red-flowering escalonia.
Escalonia Montevidensis	White escalonia.
Eucalyptus amygdalina	Peach-leaved gum.
Eucalyptus citriodora	
Eucalyptus corymbosa	
Eucalyptus globulus	Blue gum.
Eucalyptus gonicalix	
Eucalyptus peperita	
Eucalyptus pauciflora	
Eucalyptus polyanthemos	
Eucalyptus Pressii	
Eucalyptus rostrata	
Eucalyptus Ribbonii	
Eucalyptus obliqua	Oblique gum.
Eucalyptus paniculatus	
Eucalyptus stricta	
Eucalyptus vitatta	
Eucalyptus viminalis	Stringy bark gum.
Eucalyptus saligna	Willow-leaved gum.
Eugenia latifolia	Leather-leaved myrtle.
Euonymus Japonica	Japan spindle tree.
Euonymus Japan aurea	Golden variegated spindle tree.
Euonymus radicans variegata	White-leaved spindle tree.
Euonymus argentia	Gray spindle tree.
Euphorbia variegata	Variegated euphorbia.
Eupatorium ageratoides	Snakeroot.
Fabiana imbricata	
Fagus sylvatica	Common beech.
Fagus purpurea	Blood beech.
Ficus macrophylla	
Ficus elastica	India-rubber tree.
Ficus carica	Fig tree.
Forsythia viridissima	Green-stemmed forsythia.
Fraxinus excelsa	European ash.
Fraxinus Oregonia	Oregon ash.
Fraxinus pendula	Weeping ash.

TREES AND SHRUBS—Continued.

Botanic Name.	Common Name.
Fraxinus pendula aurea	Golden-bark weeping ash.
Frenilla Australis	New Holland pine.
Frenilla rhomboides	Rhomboid pine.
Galium aparine	
Genista linifolium	Yellow genista.
Genista tinctoria	
Genista scoparia	
Geitonoplesium cymosum	American honey locust.
Gleditschia triacantha	
Goodia latifolia	
Goodia medicaginea	
Grevillea robusta	
Gymnocladus Canadensis	
Habrothamnus elegans	
Habrothamnus coccinea	
Hakea salicina	
Hakea acicularis	
Hakea ulicina	
Hakea leucoptera	
Hakea modosa	
Hakea verrucosa	
Hardenbergia monophylla	
Hedera felix	
Hedera variegata	
Helianthemum roseum	
Hibiscus pungens	
Hibiscus syriacus	
Hydrangea paniculata	
Hymenosporum flavum	
Hypericum canariensis	
Hypericum calycinum	
Hypericum patulum	
Indigofera Australis	
Indigofera tinctoria	
Iacoma speciosa	
Inga dulcis	
Isochroma tubulosa	
Isochroma coccinea	
Ilex aquifolia	English holly.
Jacaranda minosæfolia	
Jasminum aurea	Yellow jasmine.
Jasminum alba	White jasmine.
Juglans regia	English walnut.
Juglans nigra	Eastern black walnut.
Juglans Californica	California walnut.
Juniperus Bermudiana	Bermuda juniper.
Juniperus Phœnicia	
Juniperus Japonica alba	
Juniperus prostrata	
Juniperus communis	
Juniperus squamatosa	
Juniperus Sabina	
Juniperus compacta	
Juniperus Lycea	
Juniperus Hibernica	
Juniperus densa	
Juniperus Japonica	
Juniperus Japonica variegata	
Juniperus Virginiana	
Justicia carnea	
Kennedya macrophylla	
Kerria Japonica	
Kolreuteria paniculata	
Lantana superba	
Laria Europea	
Lagerstræmia Indica	
Laurus camphora	Camphor tree.
Laurus glandulosa	
Laurus Indica	
Laurus nobilis	Sweet bay.

Trees and Shrubs—Continued.

Botanic Name.	Common Name.
Laurus lusitameo	Portugal laurel.
Lavaterea arborea	Tree mallow.
Lavaterea arborea variegata	
Lavendula spica	Lavender.
Lavendula stæchas	
Leonotis leonaria	
Leptospermum ericifolia	New Zealand tea tree.
Leptospermum lævigatum	
Leptospermum scoparia	
Libocedrus decurrens	Port Orford cedar.
Libonia floribunda	
Leucodendron argenteum	
Ligustrum Californicum	California privet.
Ligustrum Japonicum	
Ligustrum vulgaris	
Lerioidendron tulipifera	Tulip tree.
Lonicera brachypoda	
Lonicera chamæcerasus alba	
Lonicera cornicularis	
Lonicera Californica	
Lonicera grandifloris	
Lonicera Japonica	
Lonicera pulcherrima	
Lonicera rubra	
Lonicera Tartarica splendens	
Lotus corniculatum	Horned lotus.
Lotus tetragonolubus	Bird's-foot clover.
Maelura aurantiaca	Osage orange.
Magnolia grandiflora	
Magnolia soulangeana gracilis	
Stelata purpurea	
Mahonia aquifolium	
Mahernia odorata	
Mandevillea suaveolens	Sweet-scented mandevillea.
Maytemes Chilensis	
Melaleuca armellaris	
Melaleuca ericifolia	
Melaleuca hypericifolia	
Melaleuca parviflora	
Melaleuca incana	
Melaleuca genistifolia	
Melianthus major	
Mespilis Japonica	Japanese medlar.
Metrosideros tomentosa	
Morus alba	White mulberry.
Morus Japonica	Japanese mulberry.
Morus nigra	Black mulberry.
Myoporum maculata	
Myrica Californica	Wax berry.
Myrsiphylla asparagoides	
Myrtus communis	
Myrtus latifolia	
Nandina domestica	
Negundo malinifolia	
Negundo aceroides	
Nerium splendens	
Nerium alba	
Neirembergia gracilis	
Netera depressa	
Olea sativa	
Passiflora cercula	
Paulownia imperialis	
Philadelphus coronaria	
Phillyrea latifolia	
Phœnix dactylifera	
Photinia serrulata	
Picea amabilis	California silver fir.
Picea magnifica	
Picea Nordmaniana	Nordman's silver spruce.
Pimelia Australis	

Trees and Shrubs—Continued.

Botanic Name.	Common Name.
Pinus cembra	Siberian pine.
Pinus Coulterii	Coulter's pine.
Pinus densiflora	
Pinus excelsa	Lofty Indian pine.
Pinus Hamiltonii	Hamilton's pine.
Pinus Halapensis	Aleppo pine.
Pinus Jeffreyana	Jeffrey's pine.
Pinus Larico	Corsican pine.
Pinus Larico calabrica	
Pinus insignis	Monterey pine.
Pinus longifolia	Long-leaved pine.
Pinus maritima	French pine.
Pinus Massoniana	Masson's pine.
Pinus mitis	Yellow pine.
Pinus monticola	Mountain pine.
Pinus muricata	Bishop's pine.
Pinus mugho	Mugho pine.
Pinus Montezuma	Mexican pine.
Pinus pinea	Italian stone pine.
Pinus ponderosa	Heavy-wooded pine.
Pinus rubra	
Pinus Strobus	Weymouth pine.
Pinus Sabiniana	Sabin's pine.
Pinus Tadea	
Pinus inops	Jersey scrub pine.
Pinus radiata	
Pinus tomentosa	
Pinus parviflora	
Pinus Torreyana	Torrey's pine.
Pinus Lambertiana	Sugar pine.
Pinus Austriaca	Austrian pine.
Pinus Sylvestris	Scotch pine.
Pistacia vera	Cashaw nut.
Pittosporum eugeneoides	Turpentine tree.
Pittosporum crassifolium	Crassula foliaged pittosporum.
Pittosporum rhombifolium	
Pittosporum eriocarpum	
Pittosporum tobira	Japanese pittosporum.
Pittosporum nigrum	Black turpentine.
Pianera cuspidata	Planer tree.
Platanus occidentalis	Buttonwood.
Platanus orientalis	Oriental plane.
Plumbago capensis	Lead plant.
Plumbago larpenta	
Poinciana pulcherrima	
Poinciana Gillesii	
Polygala grandiflora	
Polygala Dalmasiana	Milkwort.
Polygala speciosa	
Populus balsamina	Balsam poplar.
Populus nigra	Black poplar.
Populus argentea	Silver poplar.
Populus fastigiata	Italian poplar.
Pomaderris lanifera	
Pomaderris aspera	
Pritchardia filifera	California fan palm.
Psoralea glandulosa	
Prostranthera læcanthus	
Prostranthera minea	
Prostranthera Liebercii	
Ptelea trifoliata	Hop tree.
Punica gradatum	
Pyrus Japonica	Japan quince.
Pyrus malus	Apple tree.
Prunus cerrasus	Double flowering plum.
Prunus myrobalan	Myrobalan plum.
Prunus triloba	
Quercus robur	English oak.
Quercus suberosa	Cork oak.
Quercus densiflora	California live oak.

TREES AND SHRUBS—Continued.

Botanic Name.	Common Name.
Retinospora obtusa	Japan cypress.
Retinospora ericifolia	Heath-like retinospora.
Rhamnus Californica	California coffea.
Rhaphiolepsis ovata	
Rhaphiolepsis Indica	
Rhafis flabelliformis	
Rhododendron ponticum	
Rhododendron Catawbiense	Catawba rhododendron.
Rhododendron hybridum	Hybrid.
Rhododendron maximum	Great laurel rhododendron.
Rhododendron Dalhousianum	Dalhousi rhododendron.
Rhododendron nobleanum	
Rhododendron glaucum	Rose bay.
Rhododendron Hodgsonii	
Rhus copallina	Dwarf sumac.
Rhus cotinus	Smoke tree.
Rhus toxicodendron	Poison oak.
Rhus coriaria	Sicilian sumac.
Ribes grossularia	Wild gooseberry.
Ribes sanguinea	Wild currant.
Robinia pseud-acacia	Locust.
Rochea falcata	
Rosemarinus officinalis	Rosemary.
Rubus rosæfolius	Christmas.
Salisburia adiantifolia	Maiden-hair tree.
Salix alba	White willow.
Salix carpia	Black willow.
Salix Babylonica	Weeping willow.
Sambucus niger	Black elder.
Sambucus niger fol argenteis (variegated)	
Sambucus racemosa purpurea	
Scidioptys verticillata	Umbrella pine.
Schinus molle	False pepper.
Schinus terebinthefolia	
Schotia latifolia	Broad-leaved schotia.
Schotia tamarindifolia	
Sequoia gigantea	Big tree of California.
Sequoia sempervirens	California redwood.
Sida pulchella	
Solanum capsicastrum	Capsicum-like solanum.
Solanum robustum	
Solanum laciniatum	Cut-leaved solanum.
Sollya heterophylla	Gem of Swan River.
Sophora Japonica	
Sophora Japonica pendula	
Spartium junceum	
Sphæralcea Caroliniana	Globe marshmallow.
Spiræa aerifolia	Spirea.
Spiræa Billiardii	
Spiræa Japonica	
Spiræa Nobleii	
Spiræa opulifolia	Native meadow sweet.
Spiræa plumosa	
Spiræa prunifolia	
Spiræa Reevesii	
Spiræa Thunbergii	
Sterculia diversifolia	Australian flame tree.
Sterculia platanifolia	
Stewartia pentagyna	
Swainsonia alba	
Swainsonia galegifolia	
Syringa vulgaris	Common lilac.
Syringa Persica	Persian lilac.
Tamarix gallica	European tamarix.
Taxodium distychium	Deciduous cypress.
Taxus baccata	English yew.
Taxus cuspidata	Japan yew.
Taxus fastigiata	Pyramidal yew.
Tecoma capensis	
Thusa gigantea	Gigantic cedar.

TREES AND SHRUBS—Continued.

Botanic Name.	Common Name.
Thusa occidentalis	Western cedar.
Thusa orientalis	Chinese arbor vitæ.
Thea viridis	Tea plant.
Thujopsis dolobrata	Hatchet-leaved thujopsis.
Thujopsis dolobrata variegata	
Tilia Americana	American linden.
Tilia Europea	European linden.
Tristania conferta	
Ulex Europea	English hurty-furty.
Ulmus Americana	American elm.
Ulmus campestris	English elm.
Ulmus fulva	Slippery elm.
Ulmus pendula	Weeping elm.
Ulmus suberosa	Cork-bark elm.
Ulmus	Wheatley's elm.
Veronica Andersonii	Blue veronica (speedwell).
Veronica salicifolia	Willow-leaved veronica.
Veronica paniculata	Paniculate-flowered veronica.
Veronica parviflora	Veronica.
Veronica decussata	Veronica.
Viburnum opulus	Snowball.
Viburnum tinus	
Viburnum laurustinus	
Viburnum tinus grandiflora	
Virgillea lutea	
Virgillea capensis	
Vitex agnus-castus	
Weigelia rosea	
Weigelia rosea variegata	
Wistaria linensis	
Wistaria linensis alba	
Widdringtonia cupressoides	
Wigandia macrophylla	

CATALOGUE OF HERBACEOUS AND FLOWERING PLANTS IN THE GOLDEN GATE PARK.

Botanic Name.	Common Name.
Abronio arenaria	Sand verbena.
Acharanthus (in variety)	Chaff flower.
Aconitum album	White monk's-hood.
Adonis vernalis	Spring flowering adonis.
Agapanthus umbellatus	African lily.
Agathea cœlestis	Blue marguerite.
Agave Americana	Century plant.
Agrostemma coronarium	Rose campion.
Ageratum Mexicanum	Kiss me's.
Allium unifolium	Onion lily.
Acanthus mollis	
Acroclinum roseum	Everlasting.
Agrostemma	Jove's flower.
Alonsoa Warszewiczi	Mask flower.
Altemanthera (in variety)	
Allysium variegatum	Sweet allysium.
Amaranthus (in variety)	Love lies bleeding.
Amaryllis (in variety)	Belladonna, etc.
Anagalis Brewerii	
Anemone Japonica	Wind flower.
Anthemis coronaria	Chamomile.
Antirrhinum major	Snapdragon.
Aquilegia (in variety)	Columbine.
Arabis alpina	Rock cress.
Argemone Mexicanum	Prickly poppy.

HERBACEOUS AND FLOWERING PLANTS—Continued.

Botanic Name.	Common Name.
Artemesia absinthium	Wormwood.
Astragalis molissima	Rattle-weed.
Balsamina Hortensia	Balsam.
Bambusa falcata	Spear bamboo.
Bambusa fortunii	Fortune's bamboo.
Bambusa arundinaceæ	Reed bamboo.
Bambusa Metaki	Japanese bamboo.
Baptisia alba	False indigo.
Berberis vulgaris	Wintercress.
Bellis perennis	Daisy.
Beta Chilensis	Chili beet.
Bignonia radicans	Trumpet creeper.
Brodiæa Californica	Brodie's lily.
Browalia elata	Blue scroph.
Cacalia tesselata	Tassel flower.
Caladium esculentum	Edible arum.
Calceolaria shrubby	Ladies' satchel.
Calendula officinalis	Pot marigold.
Caliprora lutea	Lily of beauty.
Calochortus elegantissimus	Mariposa lily.
Campanula media	Canterbury bell.
Canna Indica	Indian shot.
Canna Ehemannii	Eheman's canna.
Celosia cristata	Cock's-comb.
Celosia plumosa	Plumed celosia.
Centaurea candidissima	Dusty miller.
Centaurea cyanus	Corn flower.
Centaurea gymnocarpa	Centaury.
Centhranthus rubra	Red valerian.
Cerastrum tomentosum	Mouse-ear chickweed.
Chamœpuce diacantha	Fishbone thistle.
Cheiranthus cheire	Wallflower.
Chrysanthemum sinensis	Chinese chrysanthemum.
Chrysanthemum Japonicum	Japanese chrysanthemum.
Chrysanthemum frutescens	Marguerite.
Chicorium entybus	Chicory.
Cineraria hyb. (in variety)	
Cineraria maritima	Foliage cineraria.
Clarkia pulchella	Chippy flower.
Clematis aristata	Virgin's bower.
Clematis Jackmanii	Jackman's clematis.
Clerodendron Balfourii	Chance plant.
Cobea scadens	Mexican climber.
Coleus Vershafeldtii	German nettle.
Collinsia bicolor	Bear balm.
Commelyna cœlestis	Spiderwort.
Convalaria majalis	Lily of the valley.
Convolvulus minor	Morning glory.
Convolvulus altheaoides	Birdweed.
Coreopsis coronata	Tickseed sunflower.
Coronilla glauca	Bladder senna.
Cosmos bipinnata	Star flower.
Crassula floribunda	Tree-flowering crassula.
Crepis rubra	Red hawkweed.
Cyclobothra speciosa	Droop lily.
Cynoglossum grande	Hound's tongue.
Cyperus papyrus	Egyptian paper reed.
Cuphea platycentra	Cigar flower.
Dahlia hybrida	Dahlia.
Dasylirion Wheelerii	Wheeler's dasylirion.
Delphinum (in variety)	Larkspur.
Dianthus barbatus	Sweet William.
Dianthus caryophyllus	Carnation.
Dianthus sinensis	China pink.
Dictamnus fraxinella	Ash-leaved dictamnus.
Dielytra spectabilis	Bleeding heart.
Digitalis purpurea	Foxglove.
Dipsacus fullonum	Teasle.
Eccremocarpus scabra	Spray flower.
Echeveria secunda glauca	Hen and chickens.

HERBACEOUS AND FLOWERING PLANTS—Continued.

Botanic Name.	Common Name.
Echinocactus vulgare	Melon cactus.
Entelia arborescens	New Zealand cork tree.
Epiphyllum grandiflorum	Cactus.
Eupatorium ageratoides	White snakeroot.
Eupatorium triste	
Fourcroya Australis	Southern fourcroya.
Fuchsia (in variety)	Fuchsia.
Funkia (in variety)	Daly lily.
Funkia Japonica	Japanese lily.
Gailardia picta	Gailardia.
Galium aparium	Cleavers.
Gazania splendens	
Geitonoplesium cymosum	Scrambling lily.
Geranium (in variety)	
Gillia Californica	Dell flower.
Gladiolus hybrida	Sword-leaved iris.
Geum atro-sanguineum	Avens.
Glaucium corniculatum	Horned poppy.
Gnaphalium lanatum	Woolly eidleweis.
Godetia rosea	California rosy godetia.
Gomphrena globosa	Globe amaranth.
Gypsophylla elegans	Snowflakes.
Helianthemum roseum	Sun rose.
Heliantheus Californica	Sunflower.
Helichrysum hybrida	Everlasting flower.
Heliothopium Peruvianum	Heliotrope.
Hedychium Gardnerianum	Gardner's ginger.
Heleborous niger	Christmas rose.
Hemerocallis flava	Yellow day lily.
Hyacinthus candicans	Hyacinth.
Hibiscus (in variety)	
Humea elegans	Elegant humea.
Iberis coronaria	Candytuft.
Iberis perennis	Perennial candytuft.
Iris Kiampflerii	Fleur de Luce.
Ixia coccinea	Scarlet ixia.
Lathyrus latifolia	Everlasting pea.
Lathyrus odorata	Sweet pea.
Lophospermum scandens	Crested pea.
Lillium (in variety)	Lilies.
Linum speciosmum (in variety)	Flax.
Linaria cymbalaria	Toad flax.
Lobelia cardinalis	Scarlet lobelia.
Lobelia erinus (in variety)	
Lupinus (in variety)	Common lupin.
Lychnis Chalcedonica	Scarlet lychnis.
Malva rosea	Flowering mallow.
Mammillaria speciosa	Cactus.
Martynia fragrans	Ram's-horn pickle.
Mirabilis jalapa	Four o'clock.
Matthiola hybrida	Stock.
Matricaria exenia	Wild chamomile.
Maurandria Barclayana	Barclay's climber.
Mimulus hybrida	Monkey flower.
Mimulus moschatus	Musk.
Myosotes palustris	Forget-me-not.
Mesembryanthemum (in variety)	Fig marigold.
Mesembryanthemum crystallinum	Ice plant.
Myrsiphyllum asparagoides	Smilax.
Narcissus latifolia (in variety)	Daffodil.
Nasturtium (in variety)	Indian cress.
Nelumbium luteum	Carolina lotus.
Nelumbium speciosum	Egyptian lotus.
Nemophylla insignis	Baby eyes.
Nepeta glechoma	Catnip.
Nigelia Hispanica	Love in mist.
Nolana atriplicifolia	Bellflower of Peru.
Nicotiana Virginicum	Tobacco plant.
Œnothera grandiflora	Evening primrose.
Opuntia Indica	Prickly pear cactus.

HERBACEOUS AND FLOWERING PLANTS—Continued.

Botanic Name.	Common Name.
Oxalis rosea	Flowering oxalis.
Phaceolus multiflora	Scarlet runner.
Phaceolus caracala	Snail flower.
Papaver somniferum	Opium poppy.
Papaver Orientalis	Oriental poppy.
Papaver bracteatum	Crimson poppy.
Pelargonium (in variety)	Lady Washington.
Phlox decussata	Ground phlox.
Phlox Drummondii	Annual phlox.
Petunia hybrida (in variety)	Petunia.
Penstemon centranthifolia	Penstemon.
Perilla Nankinensis	
Polyanthus tuberosa	Tuberose.
Primula polyantha	Cowslip.
Portulaca grandiflora	Purslane.
Potentilla coccinea	Cinquefoil.
Pyrethrum aurea	Golden feverfew.
Pyrethrum rosea	
Peonia officinalis	Peony rose.
Ranunculus Persicum	Persian crawfoot.
Resida odorata	Mignonette.
Richardia Ethiopica	Calla lily.
Ricinus communis	Castor bean.
Rivinia humilis	
Salpiglossis (in variety)	
Salvia Africana	Black sage.
Salvia coccinea	Crimson sage.
Salvia elegans	
Salvia globosa	
Salvia patens	
Salvia rutilans	
Salvia splendens	
Sanvitalia procumbens	
Saponaria calabrioa	Bouncing Bet.
Saxifragea sarmentosa	Strawberry geranium.
Scabiosa atro-purpurea	Mourning bride.
Sedum (in variety)	Stone crop.
Sempervivum Californicum	California house leek.
Silene pendula	Catchfly.
Smilax auriculata	Cat's-brier.
Solanum (in variety)	Jerusalem cherry.
Spergula pilifera	Flowering moss.
Specularia speculum	Venus looking-glass.
Statice lemonium	Sea lavender.
Stellaria aurea	Golden chickweed.
Steria serrata	Winter white.
Tagetes (in variety)	Marigold.
Thymus elegantissimum	Thyme.
Tigridea grandiflora	
Trachelium cœraleum	Throat wort.
Tradescantia elegans	Wandering Jew.
Tutelia lava	Spring lily.
Tutonia uvaria	Red-hot poker.
Tutonia flafum	Weather-cock iris.
Tropæolum canariensis	Canary creeper.
Verbena hybrida	Verbena.
Vinca major	Periwinkle.
Viola tricolor	Pansy.
Viola odorata	Violet.
Viscaria oculata	Rock lychnis.
Watsonia oreubens	Watson's iris.
Whittavia grandiflora	
Xeranthemum annuum	
Yucca gloriosa	Adam's needle.
Yucca aloëfolia	
Yucca filamentosa	
Yucca Whippleii	
Zinnia elegans	

HERBACEOUS AND FLOWERING PLANTS—Continued.

Botanic Name.	Common Name.
GRASSES.	
Agrostis nebulosa	
Agrostis plumosa	
Arundo conspicua	
Arundo donax	
Arundo donax variegata	
Briza major	Large quaking grass.
Briza minor	Small quaking grass.
Dactylus glomerata var.	
Eulalia Japonica	Japan ribbon grass.
Eulalia zebrina	
Erianthus ravenue	
Festuca glauca	
Gynerium argenteum	Pampas grass.
Gymnotrix latifolium	
Isolepis gracilis	Basket rush.
Panicum plicatum	
Phormium tenax	New Zealand flax.
Stipa pinnata	Feather grass.

LIST OF PLANTS IN CONSERVATORY.

Abutilon Fire King	2
Abutilon Selborvianum Marmoratum	6
Abutilon Thomsonii	2
Abutilon Boule de Neige	
Abutilon Darwinii	2
Aspidistra surida variegata	10
Azaleas (50 varieties)	200
Asparagus plumosus nana	6
Asparagus plumosus	
Asparagus tenuissimus	2
Begonia rex (varieties)	250
Begonia metallica	50
Begonia niegra	50
Begonia odorata	75
Begonia semperflorens alba	200
Begonia semperflorens rubra	100
Begonia glaucophylla scadens	50
Bromelia Binotii	8
Caladiums (75 varieties)	200
Campsidium filicifolium	2
Cissus discolor	100
Coffea Arabica	2
Croton Disraeli	2
Croton lancifolium	2
Croton majesticum	5
Croton pictum	2
Croton mutabilis	2
Croton Youngii	
Croton undulatum	
Croton spirale	2
Croton nevilla	
Croton elegans	
Croton interruptum	2
Croton irregular	4
Croton variegatum	14
Croton aucubifolium	6
Croton Weismanii	7
Cyanophyllum magnificum	
Cyperus allernifolius	2
Cyperus variegatus	2
Dreffenbachia Bauseii	20
Dreffenbachia languinea picta	15
Dreffenbachia Marmorata	2
Dracæna Baptistii	2

Dracæna Bauseii	2
Dracæna Cooperii	25
Dracænea Goldieana	4
Dracænea Lindenii	3
Dracænea Guilfoylei	10
Dracænea nigro rubra	2
Dracænea terminalis	15
Echites nutans	
Echites nutans picta	
Ficus ripens	5
Ficus elastica	
Ficus Parcellii	
Fittonia argyroneura	150
Fittonia Pierceii	25
Fittonia Verschaffetii	100
Francisea Americana	6
Gardenia fortunii	6
Hibiscus Cooperii	10
Hibiscus rosa sinensis	5
Hoya Paxtonii	
Hoya carnosa picta	10
Isolepis miracilis	13
Maranta Mazellii	10
Maranta nutens	6
Maranta striata	8
Maranta regalis	2
Maranta zebrina	20
Maranta picta	2
Maranta Vanden Hickii	5
Monstera deliciosa	2
Musa Cavendishii	20
Musa vittata	2
Musa languinea	2
Musa zebrina	4
Musa ensete	2
Pandanus graminifolius	2
Pandanus Javanicus variegatus	10
Pandanus utilis	7
Pandanus Veitchii	10
Pandanus reflexus	1
Panicum variegatum	150
Peperomia argentea	20
Peperomia arifolia	1
Philodendron pertusum	2
Philodendron radiatum	1
Philodendron Lindenii	1
Philodendron crinipes	4
Passiflora quadrangularis	1
Passiflora quadrangularis variegatus	1
Sanchezia nobelis variegata	20
Tillandsia argentea	2
Tillandsia sanguinolenta	6
Tillandsia zebrina	1
Tradescantia discolor	2
Tradescantia ripens	10
Tradescantia tricolor	25

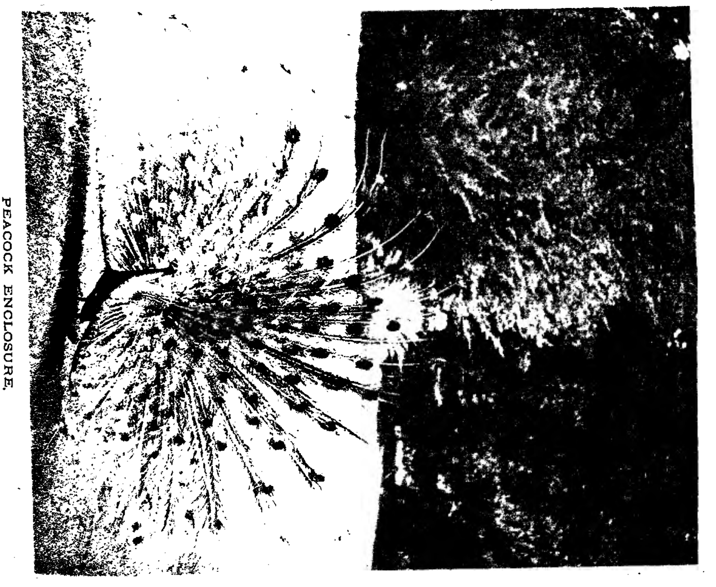
General Collection.

Acalypha macrophylla	2
Acalypha musaica	3
Acalypha Wilkesiana	2
Alocacia gigantea	10
Alocacia Jenningsii	2
Alocacia macrorhiza variegata	6
Alocacia metallica	5
Alocacia Veitchii	2
Alocacia Sedenii	1
Alpina nutans	1
Anthurium crystallinum	7
Anthurium magnificum	10
Anthurium regale	2
Anthurium Veitchii	2
Anthurium Andreanum	1

Anthurium cordifolium	1
Anthurium Williamsii	1
Anthurium Schirzerianum	10
Aralia Veitchii	1
Aralia papyrifera	2
Aralia Sieboldii	2
Ardisia crenulata	1
Artocarpus incisa (bread-fruit tree)	1
Bertalonia guttata	50
Bilbergia vittata	2
Bilbergia guttata	2
Bilbergia farinosa	2
Bilbergia nutans	2
Bilbergia pallescens	1
Begonias—Fuchsioides, Rubra, Weltoniensis, Schmidtii, Alba picta, Gilsonii, Lemoinei, Elaine, Diadem, Pearl, Tuberous, Chelsea Giant, Cleopatra, Flambeau, Imperialis, Magnet, Piercii, Queen Victoria, Seraph, Starlights, Trojan, Philip De Ore, Pearieafolia, Vinesta, Cærulea	
Bonapartea juncea	3
Bougainvillea glabra	7
Bougainvillea spectabilis	4
Bouvardia carnea	2
Bouvardia Alfred Neuner	1
Bouvardia alba odorata	2
Bouvardia Humboldtii	4
Bouvardia rosea oculata	1
Brugmandsea sanguinea	2
Caladiums—Adolph Adam, Alfred Bleu, Annibal, Argyrites, Agropini Dimiter, Baron Jas. De Rothschilds, Baroness De Rothschilds, Beethoven, Bicolor, Bicolor Splendens, Chantenii Splendens, Chantenii, Duc De Nassau, Dr. Lindley, Endlichemum, Esculentum, E. G. Henderson, Gerard Dow, Jules Duplessis, Leicenier, Louis Pinnier, Madame Alfred Bleu, Mons. A. Hardy, Newmanii, Onslow, Prince Albert Edward, Prince William, Refulgens Rubra, Splendens, Triumph de le Exposition, Perle De la Brazil, De Condol, Whiteni, Sedanii, Langii, Virginalis, Edward Andre, Lomertinii, Louis Pioner, Maribale, Hookerii, Horace, Reine Victoria, Napoleon III	
Calceolaria herbaceous	1
Calycanthus Floridas	1
Camellias—Alba Pleno, Double White, C. M. Hovey, Fimbriata, Lady Hume, Duchess of Orkney, Imbricata, Candidissima, Elegans Candilier, Maculata Alba, Augusta, Jubilee, L'Averier, Princess Clotilda, Striata, Remelia Campini, Augustina Superba, Countess of Orkney, Duchess of Berri, Jeffersonii, Lowi, Laura Frost, Nipha De Zebrina, Mrs. Abbey Wilder, Montroni Vera, Me. Louis Van Houtii, Me. Verschaffeltii, Valtevareda, Marchioness of Exeter	
Canna Ehemanii	1
Canna iridifolia	1
Chorozena cordala splendens	1
Chorozena lilicifolium	1
Cineraria hybrida (in variety)	
Chrysanthemums	250
Clerodendron Balfourii	1
Clerodendron Fallar	1
Clerodendron kæmpferi	1
Clerodendron speciosa	1
Coccoloba platyclada	1
Coleus—Alarm, Asa Gray, Bayard, Butterfly, Carnival, Chamelion, Chancellor, Chelsea Beauty, Dolly Varden, Glory of Autumn, Glow Worm, Golden Fleece, Lord Beaconsfield, Multicolor Splendens, John McLaren, Progress, Sultanii, The Shah, Yellow Jacket	
Crinum amabile	1
Crinum Augustine	1
Cyclamen Persicum	1
Cyclamen rubra	1
Cyclamen giganticum	1
Cyclamen alba	1
Darlingtonia Californica	1
Dionea mucipula	1
Eranthemum peticulatum	1
Eranthemum sanguineum	1
Eranthemum versicolor	1
Daphnea odorata	1
Daphnea odorata variegata	1
Euphorbia jacquinifolia	

Euphorbia scandens	1
Eucharis Amazonica	1
Eucharis candida	1
Eucharis Japonica	1
Eurycles Australasica	1
Funkea odorata	1
Fuchsia, Storm King	1
Gloxinia grassifolia (in variety)	
Gloxinia pendula (in variety)	
Hedychium Gardnerianum	1
Heliotrope, Purple and Gold	1
Heliotrope, Snow Wreath	1
Hibiscus Collerii	1
Hibiscus fulgidus	1
Hibiscus Kermisinus	1
Hibiscus Lambertii	1
Hibiscus pleno-rubra	1
Imatophyllum miniatum	1
Impatience Sultanii	1
Impatience Hawkerii	1
Impatience Martii	1
Ixia (in variety)	
Ixora aurora	1
Ixora, Prince of Orange	1
Ixora Javanica	1
Jasminum, Duchess de Orleans	1
Jasminum flora pleno	1
Jasminum, Cape Jasmine (Gardenii, Fortunii)	1
Justicia Carnea	1
Justicia splendens	1
Lasiandra macrantha	1
Lapageria alba	1
Lapageria rosea	1
Linaria cymbarnaria (Kenilworth ivy)	1
Linaria variegatus	1
Libonia floribunda	1
Lophospermum scandens	1
Mackaya bella	1
Mandevillea suaveolens	1
Meyenia erecta	1
Mimulus moschata	1
Narcissus (in variety)	
Oleander nerium (in variety)	
Pancratium maritium	1
Passiflora cœrulea	1
Passiflora, Constance Elliot	1
Passiflora fulgens	1
Passiflora macrocarpa	1
Passiflora princeps	1
Pilea artilleryensis	1
Persea grattissima (alligator pear)	1
Petunia Bonnie Dundee (and varieties)	
Physcanthus auricomus	1
Peisteria elata (Holy Ghost plant)	1
Pimelia decussata	1
Plumbago capensis	1
Plumbago coccinea	1
Curculigo recurvata variegata	1
Primula sinensis fimbriata	1
Primula sinensis alba	1
Primula sinensis Kennisiana splendens	1
Primula Japonica	1
Primula obconica	1
Primula Chinensis cærulea	1
Ravena humilis	1
Rogiera gratissima	1
Roses—La France, Bon Selene, Camoens, Madame Cecile Bruner, Duchesse de Brabant, Maréchal Neil, Sunset, Grace Darling, American Beauty, President, Papa Gontier, Perle de Jardines, Reine Marie Henriette, Andre Schwartz, Laurette, Mignonette, Jacquimot, Maria Van Houtte, William Allen Richardson	
Ruellia macrantha	1
Russellia juncea	1
Sanseviera Zeylanica	1
Statice Halfordii	1
Stephanotis floribunda	1

THE ELK.



PEACOCK ENCLOSURE.

Stigmaphyllum cileare	1
Strelitzia Augustæ	1
Strelitzia Regiuæ	1
Streptocarpus polyantifolia	1
Streptocarpus Rexii	1
Tabernæmonta coronaria (fl. pl.)	1
Tacsonia Buchananii	1
Tacsonia exomensis	1
Tacsonia Van Vloxemi	1
Tecoma jasminoides	1
Thunbergia coccinea	1
Thunbergia Harrisii	1
Thunbergia laurifolia	1
Thunbergia odorata	1
Thyrsacanthus rutilans	1
Torenia Asiatica	1
Torenia Fourneri	1
Toxicophlæa spectabilis	1
Vallota purpurea	1
Vincia alba	1
Vincia rosea	1
Viola sauris	1
Viola Marie Louise	1
Yucca quadricolor	1
Yucca filamentosa	1
Pteris grandicops	2
Pteris hastata	4
Pteris enternata	2
Pteris serrulata cristata	10
Pteris serrulata variegata	50
Pteris tremula	10
Pteris tricolor	1
Platycerium alcicorne	4
Platycerium biforme	2

Tree Ferns.

Alsophilla Australis	8
Cibotium regale	1
Cyathea dealbata	1
Cyathea Smithii	2
Dicksonia aular	2

Lycopods.

Salaginella aurea	1,000
Salaginella caesii arborea	100
Salaginella cuspidata	10
Salaginella denticulata	2
Salaginella grandis	2
Salaginella envolvius	2
Salaginella Mertensii	3

Palms.

Acanthonhiza aculeata	1
Areca alba	2
Areca rubra	13
Areca monostachya	1
Areca sapida	1
Caryota urens	7
Coccus insignis	3
Coccus plumosa	4
Coccus Weddeliana	2
Chamærops excelsa	1
Chamærops gracilis	2
Chamærops humilis	2
Cinchona (in variety), Peruvian bark	304
Corypha Australis	3
Corypha decora	1
Cycus revoluta	12
Diclyosperma aureum	2
Drymophlœus Singaporensis	1
Kentia Australis	2
Kentia Belmoreana	1

Kentia Fosteriana	1
Latania borbonica	7
Livistona altissima	2
Macrozamia spiralis	1
Oreodoxa regia	2
Phœnix dactylifera	14
Phœnix reclinata	20
Phœnix rupicola	20
Pritchardia Gaudichaurdi	1
Pritchardia grandis	1
Pritchardia Pacifica	3
Rhapalostylus Baueri	1
Raphis flabelliformis	1
Sabal Adamsonii	2
Seaforthia elegans	6
Seaforthia robusta	2
Thrinax argentea	2
Zalacea nitida	1
Zamia integrifolia	1

Aquatics.

Nelumbium speciosum	1
Nymphea alba	3
Nymphea Mearliacca chromoletto	5
Nymphea cœrulea	1
Nymphea dentata	6
Nymphea rubra	2
Nymphea Zanzibariensis	1
Nymphea Devoniensis	4
Nymphea flava	2
Ouvirandra feriestralis (lace plant)	2
Piontaderia craceps major	6
Victoria regia	2

Nepenthes.

Nepenthes Chelsonii	2
Nepenthes gracilis major	3
Nepenthes Hookerianum	2
Nepenthes insignis	1
Nepenthes Rafflesiana	2
Nepenthes Sendi	1

Orchids.

Acineta Barkerii	2
Acineta Humboldtii	4
Aerides crassifolium	1
Aerides Japonicum	2
Aerides Leanii	2
Aerides odoratum coronatum	2
Aerides Quinquevulnerium	20
Aerides vividis	3
Angræcum falcatum	3
Angræcum pertusum	2
Angræcum sesquipedale	1
Angræcum virens	3
Barkeria Skinnerii	1
Barkeria spectabilis	2
Bletia hyacinthiana	7
Bletia Tankenella (Phajus grandifolius)	7
Brassavola glauca	4
Brassavola oculata	4
Brassia candata	2
Brassa verrucosa	1
Burlingtonia imperialis	20
Burlingtonia venusta	2
Calanthe discolor	1
Calanthe oculata	3
Calanthe pleochroma	2
Catasetum media	1
Catasetum maculatum	1
Cattleya amethystina	2
Cattleya citrina	1

Cattleya aurea	1
Cattleya chocœnsis	1
Cattleya Wameri	1
Cattleya El Dorado	3
Cattleya Mendellii	1
Cattleya gigas	2
Cattleya insignis	1
Cattleya Percivallianum	1
Cattleya intermedia	2
Cattleya speciosissima	1
Cattleya labiata	1
Cattleya mossiæ	2
Cattleya Skinnerii	10
Cattleya splendens	1
Cattleya Tianæ	6
Chysis aurea	2
Cælogne cristata	4
Cælogne ocellata	2
Cymbidium incifolium album	2
Cymbidium incifolium rubrum	1
Cypripedium barbatum	20
Cypripedium argus	1
Cypripedium insignis	58
Cypripedium villosum	1
Cypripedium Pearcei	15
Cypripedium Boxallii	1
Cypripedium Sedenci	50
Cypripedium Dominianum	1
Cypripedium Spicerianum	3
Dendrobium anguilaria	1
Dendrobium cacaltatum	1
Dendrobium Dalhousianum	2
Dendrobium Dearei	2
Dendrobium Hillii	6
Dendrobium Farmerii	2
Dendrobium Japonicum	58
Dendrobium Kingianum	2
Dendrobium nobile	10
Dendrobium Pierardi	5
Dendrobium thyrsiflorum	3
Dendrobium pulchellum	3
Deudrobium superbum	2
Disa grandiflora	4
Epidendrum brassavolæ	2
Epidendrum cinnabaronum	7
Epidendrum cochleatum	20
Epidendrum cuspidatum	10
Epidendrum paniculatum	3
Epidendrum vitelmum	20
Gongora portentosa	5
Gongora punctata	3
Lælia acuminata	2
Lælia acuminata rosea	1
Lælia anceps	2
Lælia anceps alba	3
Lælia autumnalis	6
Lælia crispa	4
Lælia Hillii	2
Lælia superba	3
Leptotes bicolor	1
Lycaste aromatica	20
Lycaste Deppei	30
Lycaste lanipes	2
Lycaste Skinnerii	18
Lycaste Skinnerii alba	2
Masdevallia Dayana	2
Masdevallia elegans	1
Masdevallia citrina	1
Maxillaria grandiflora	4
Maxillaria tenuifolia	1
Mesopinidium sanguineum	2
Odontoglossum Barkerii	1
Odontoglossum cirrhosum	1
Odontoglossum citrosmum	1

Odontoglossum citrosmum album	1
Odontoglossum citrosmum roseum	1
Odontoglossum citrosmum Alexandrea	1
Odontoglossum crispum	2
Odontoglossum grande	20
Odontoglossum Hallii	1
Odontoglossum Insleayi	2
Odontoglossum pescatorei	10
Odontoglossum maculatum	1
Odontoglossum vexillarium	2
Oncidium ampliatum	1
Oncidium Barkerii	1
Oncidium Cavendishianum	2
Oncidium concullatum	4
Oncidium leucochilum	20
Oncidium ornithorhyncum	1
Oncidium papilio	2
Oncidium Warnerii	2
Peristeria elata (Holy Ghost flower)	12
Phanis alba	3
Phanis maculata	2
Phanis Blumeri	1
Phalænopsis amabilis (butterfly orchid)	10
Phalænopsis grandiflora	1
Phalænopsis Schilleriana	17
Renanthera coccinea	2
Saccolabium guttatum	6
Saccolabium pulcharum	2
Saccolabium retusum	1
Sobralia macrantha	2
Sophronites grandiflora	2
Sophronites violacea	1
Spathoglottis furtuni	2
Stanhopea aurea	6
Stanhopea grandiflora	4
Stanhopea insignis	4
Stanhopea martiana	3
Stanhopea maculata	7
Stanhopea oculata	3
Stanhopea trigina	4
Stanhopea Wardii	6
Thunia tricolor	4
Thunia Bensonii	2
Tucopelia tortilis	10
Vanda concolor	1
Vanda densiflora	2
Vanda guttata	2
Vanda nebulosa	1
Vanilla aromatica	20
Zygopetalum McKayi	1
Zygopetalum majus	1

Ferns.

Botanical Name.	Common Name.	Number.
Adiantum amabile	Maiden-hair fern	40
Adiantum assimile cristatum	Crested maiden-hair fern	2
Adiantum capillus	True maiden-hair fern	20
Adiantum Bauerii	Bauer's maiden-hair fern	1
Adiantum cuneatum	Cuneate maiden-hair fern	150
Adiantum concinum	Circinate maiden-hair fern	10
Adiantum decorum		2
Adiantum Farleyense	Brazilian maiden-hair fern	25
Adiantum formosum	Grand maiden-hair fern	10
Adiantum gracillinum	Most graceful maiden-hair fern	20
Adiantum Hendersonii	Henderson's maiden-hair fern	1
Adiantum Sudemannii	Sudemann's maiden-hair fern	2
Adiantum macrophyllum	Large-leaved maiden-hair fern	4
Adiantum multifidum	Much divided maiden-hair fern	3
Adiantum monochlamis	Single arranged maiden-hair fern	1
Adiantum pedatum	Canadian maiden-hair fern	5
Adiantum pentophyllum	Five-leaved maiden-hair fern	2
Adiantum patens	Blue maiden-hair fern	1

Ferns—Continued.

Botanical Name.	Common Name.	Number.
Adiantum Peruvianum	Peruvian maiden-hair fern	6
Adiantum Princeps		10
Adiantum Santa Catherine	St. Catherine's maiden-hair fern	7
Adiantum trapeziforme	Rhomb-leaved maiden-hair fern	3
Adiantum Williamsii	Williams' maiden-hair fern	9
Adiantum Banksii	Banks' maiden-hair fern	1
Aspidium	Shield fern	4
Aspidium trifoliatum	Three-leaved shield fern	2
Asplenium alatum	Winged spleen wort	12
Asplenium Belangerii	Belanger's spleen wort	2
Asplenium bulbiferum	Bulbous spleen wort	12
Asplenium fulcatum	Falchion-leaved spleen wort	7
Asplenium viviparum		2
Blechnum Boreale		1
Cheilanthes vestita		1
Davallia cristata	Crested davallia	12
Davallia bullata		6
Davallia Japonica	Japanese davallia	20
Davallia Moreana	More's davallia	7
Davallia tenuifolia	Narrow-leaved davallia	5
Gymnogramma chrysophylla	Yellow-leaved gymnogramma	1
Gymnogramma decomposita		4
Gymnogramma sulphureum	Sulphury gymnogramma	8
Hymenodium crinitum		1
Hymenophyllum	Filmy-leaved fern	1
Lastrea aristata	Male fern	2
Lomaria Gibba		2
Lomaria heterophylla		2
Lomaria lanceolata		1
Lygodium scandens	Climbing snake's-tongue	40
Microlepia hirta cristata	Crested fern	20
Microlepia Emersonii cristata	Emerson's crested fern	4
Nephrodium molle		8
Nephrodium truncatum		3
Nephrolepsis Banksii	Banks' nephrolepsis	6
Nephrolepsis davalloides aristata		10
Nephrolepsis Duffii		25
Nephrolepsis encifolia		10
Nothochlæna lanuginosa	Woolly fern	1
Pteris argyrea	Silver bracten	40
Pteris grandicops		2
Pteris hastata		4
Pteris enternata		2
Pteris serrulata cristata		10
Pteris variegata		50
Pteris tremula		10
Pteris tricolor		1
Pilatycerium alcicorne		4
Pilatycerium biforme		2
Polypodium aureum		1
Polypodium vulgare		1
Scolopendrium crispum	Curled-leaved	1
Todea Africana		1
Woodsia illvensis		1
Woodwardia radicans		1

SEMI-ANNUAL REPORT

OF THE

BOARD OF PARK COMMISSIONERS.

JULY 1, 1890, TO DECEMBER 31, 1890.

SACRAMENTO:
STATE OFFICE, : : : : : A. J. JOHNSTON, SUPT. STATE PRINTING.
1891.

Office of the Commissioners of Golden Gate Park,
Buena Vista Park, Mountain Lake Park,
San Francisco, Cal., January 1, 1891.

To His Excellency H. H. Markham, *Governor, Sacramento, Cal.:*

Sir: The Park Commissioners herewith submit their semi-annual detailed statement of the receipts and disbursements for the six months ending December 31, 1891.

W. W. STOW,
JOSEPH AUSTIN,
R. P. HAMMOND, Jr.,
Park Commissioners.

RECEIPTS AND DISBURSEMENTS

From July 1, 1890, to December 31, 1890.

RECEIPTS.

From taxes	$54,565 03
From pound fees	33 00
From proceeds of Children's Quarters	3,025 74
For rent of P. & O. R. R. Depot	100 00
Balance from last year	3,571 19
	$61,294 96

DISBURSEMENTS.

Construction and improvement	$32,513 77
Maintenance	26,164 30
Stock	1,870 60
Miscellaneous items	698 65
Salaries (Superintendent and Secretary)	1,650 00
	$62,897 32

CONSTRUCTION ACCOUNT.

Structures.—Building stable for goats and jacks, concrete wall at stable, corral and manure pit, bridge, grading, lumber, bricks, lime, cement, etc., putting gas in Lodge, plumbing, etc., labor and material	$5,095 06
Waterworks.—Extension of distribution pipe system, including pipe, meter, and labor, and final payment to W. B. Bradbury on contract	4,760 22
Drainage.—Grounds, construction of cesspool and sewer, lumber, etc., labor, and material	225 06
Ways.—Construction of new roads, walks, etc., including all labor of grading, quarry work, and macadamizing, powder, fuse, and other materials	10,853 58
Grounds.—To labor of grading, forming, dressing, trimming, soiling, fertilizing grounds newly brought to a finished condition in this respect	1,867 40
Plantations and Forests and Reclamation.—Planting trees south side of the Park, labor	61 00
Conservatory.—Purchase of new plants especially for the Conservatory, improvements in structure	445 72
Small Works.—Hauling loam, labor, and team hire	5,896 25
Nursery.—The entire nursery expense, including labor, material, and new stock	3,309 48

MAINTENANCE ACCOUNT.

Structures.—Labor, lumber, paints and oils, glass, etc., devoted to and used in repairs and general maintenance of buildings, painting Lodge and outhouses and all fences and gates	$2,405 34
Waterworks.—Labor, pipe fittings, etc., expended in repairs	101 51
Drainage.—Labor, etc., maintenance of sewers	85 00
Ways.—Labor and material, repairing, cleaning, dressing, sprinkling, etc., roads, walks, concourses, etc.	4,857 48
Grounds and Gardening.—Labor and material, maintenance of garden and flower plots, lawns, and grounds generally	11,007 95
Forests and Plantations.—Labor, trimming, cleaning, and dressing out plantations	451 25
Conservatory.—The current cost of the Conservatory, including labor, water, and fuel	3,077 40
Policing.—The services of the regular park police and extra men	4,059 37
Children's Quarters.—Labor, repairs, plumbing, and drainage, etc.	119 00

APPORTIONED ACCOUNT.

Nursery.—The entire nursery expense, including labor, material, and new stock	$3,309 48
Stables.—Including hay and grain, horseshoeing, attendance, etc., and medicinal services rendered	4,791 47
Water.—All water supplied the park according to monthly bills	1,521 31

STOCK AND MISCELLANEOUS ACCOUNT.

Stock.—New live and rolling stock, etc., tools, implements, watering and other apparatus	$1,870 60
Miscellaneous.—A number of items of current expense not chargeable under either of the foregoing heads, printing reports, demands, advertising ordinances, office expenditures, telephone, general expenditures, and freight	698 65

All of which is respectfully submitted.

V. V. BLOCH,
Secretary.

ANNUAL REPORT

OF THE

STATE BOARD OF HORTICULTURE

OF THE

STATE OF CALIFORNIA,

FOR 1890.

SACRAMENTO:
STATE OFFICE, : : : : : : : J. D. YOUNG, SUPT. STATE PRINTING.
1890.

STATE BOARD OF HORTICULTURE.

OFFICERS AND MEMBERS.

ELLWOOD COOPER, President .... Santa Barbara,
Commissioner for the Los Angeles District.

L. W. BUCK, Vice-President .... Vacaville,
Commissioner for the Napa District.

S. RUNYON, Treasurer .... Courtland,
Commissioner for the Sacramento District.

J. L. MOSHER, Auditor .... San Francisco,
Commissioner for the State at Large.

FRANK A. KIMBALL .... National City,
Commissioner for the State at Large.

A. F. WHITE .... Santa Rosa,
Commissioner for the Sonoma District.

FRED. C. MILES .... Penryn,
Commissioner for the El Dorado District.

I. H. THOMAS .... Visalia,
Commissioner for the San Joaquin District.

A. BLOCK .... Santa Clara,
Commissioner for the San Francisco District.

EXECUTIVE COMMITTEE.

J. L. MOSHER, Chairman.

ELLWOOD COOPER. FRANK A. KIMBALL.

B. M. LELONG, Secretary .... Ex officio Horticultural Officer.
ALEXANDER CRAW* .... Clerk of the Publishing and Quarantine Bureau.
Miss ELLA F. HALLAHAN .... Clerk.
HARRY STANLEY .... Messenger.

Office of the Board:

No. 220 Sutter Street, San Francisco.

* Appointed; vice, Geo. Rice, resigned July 1, 1890.

CONTENTS.

PREFATORY.

We desire to make fullest acknowledgment to all writers and officials of whose reports and standard works we have availed ourselves, and freely consulted, in the preparation of the Annual Report for 1889, and in the present volume. Among them we desire especially to mention the following:

"California Botany" (Geological Survey), by State Geologist J. D. Whitney, Vols. I and II.
"Polypetalæ," by W. H. Brewer and Sereno Watson.
"Gamopetalæ," by Asa Gray—a book of special value to botanists.
"Downing's Fruit and Fruit Trees of America," by A. J. Downing.
"Fruit Trees" (from the French), by M. Du Baeuil.
"Barry's Fruit Garden," by P. Barry.
"California Fruits and How to Grow Them," by E. J. Wickson.
"Guide to the Study of Insects," by A. S. Packard, Jr., M.D.—a book which all fruit growers should have.
"The Insect World," by Louis Figuirer.
"Insects Injurious to Vegetation," by Thaddeus William Harris, M.D.
"Manual of Injurious Insects," by Miss Eleanor A. Ormerod.
"An Account of New Zealand Insects," by W. M. Maskell.
"Injurious Insects of the Orchard," by Matthew Cooke.
"Insects Injurious to Fruit," by William Saunders.
"An Introduction to Entomology," by J. Henry Comstock.
Report of J. A. Litner, State Entomologist, N. Y.
Report of C. M. Weed, State Entomologist, Ohio.
Report of Department of Agriculture, "Insect Life" (periodical bulletin), issued by the Division of Entomology, Washington, D. C.
"Foods: Their Composition and Analysis," by Alexander Wynter Blyth.
"The Techno-Chemical Receipt Book," by William T. Brannt.
"Agricultural Chemical Analysis," by Percy Faraday Frankland.
"Commercial Organic Analysis," by Alfred H. Allen.
"Agriculture in Some of Its Relations with Chemistry," by F. H. Storer.
"Experimental Chemistry," founded on the work of Dr. Julius Adolph Stockhardt.
And others.

We would be glad to be informed of any error or omission that unintentionally we may have made.

REPORT.

Office State Board of Horticulture,
San Francisco, December 30, 1890.

To his Excellency R. W. Waterman, *Governor, and to the Senate and Assembly of the State of California:*

In accordance with the amended law (Statutes 1889, Section 9, page 91), we most respectfully submit for your kind consideration this our annual report for the year 1890.

We desire to extend to your Excellency, and to all the various State Departments at Sacramento, our sincere thanks for your, and their, very kind assistance and counsel.

Respectfully submitted.

ELLWOOD COOPER,
President.

B. M. Lelong,
Secretary.

LAWS RELATING TO HORTICULTURE.

AN ACT

To create and establish a State Board of Horticulture.

[Approved March 13, 1883; amended by an Act approved March 8, 1889.]

The People of the State of California, represented in Senate and Assembly, do enact as follows:

SECTION 1. There shall be a State Board of Horticulture, consisting of nine members, who shall be appointed by the Governor; two from the State at large, and one from each of the seven horticultural districts, which are hereby constituted as follows:

First—The Sonoma District, which shall include the Counties of Sonoma, Marin, Lake, Mendocino, Humboldt, Del Norte, Trinity, and Siskiyou.

Second—The Napa District, which shall include the Counties of Napa, Solano, and Contra Costa.

Third—The San Francisco District, which shall include the City and County of San Francisco, and the Counties of San Mateo, Alameda, Santa Clara, Santa Cruz, San Benito, and Monterey.

Fourth—The Los Angeles District, which shall include the Counties of Los Angeles, Ventura, Santa Barbara, San Luis Obispo, San Bernardino, and San Diego.

Fifth—The Sacramento District, which shall include the Counties of Sacramento, Yolo, Sutter, Colusa, Butte, Tehama, and Shasta.

Sixth—The San Joaquin District, which shall include the Counties of San Joaquin, Stanislaus, Merced, Fresno, Tulare, and Kern.

Seventh—The El Dorado District, which shall include the Counties of El Dorado, Amador, Calaveras, Tuolumne, Mariposa, Placer, Nevada, Yuba, Sierra, Plumas, Lassen, Modoc, Alpine, Mono, and Inyo.

SEC. 2. The members appointed from each district shall be residents of the district from which they are appointed, and shall be specially qualified by practical experience and study in connection with the industries dependent upon horticulture. They shall each hold office for the term of four years, except that of the nine first appointed, four, to be determined by lot, shall retire at the end of two years, when their successors shall be appointed by the Governor.

SEC. 3. [The Board shall biennially elect a President, a Vice-President, a Chairman of the Finance Committee, and appoint from without their own number a Secretary, who shall be ex officio Horticultural Officer, and elect of their own number a Treasurer, who shall give a bond to the State, with securities approved by the Board, in the sum of ten thousand dollars, for the faithful discharge of his duties.]

SEC. 4. The Board may receive, manage, use, and hold donations and bequests for promoting the objects of its formation. It shall meet semi-annually, and as much oftener and at such places as it may deem expedient, to consult and adopt such measures as may best promote the horticultural industries of the State. It may, but without expense to the State, select and appoint competent and qualified persons to lecture in each of the horticultural districts named in section one of this Act, for the purpose of illustrating practical horticultural topics, and imparting instruction in the methods of culture, pruning, fertilizing, and also in the best methods of treating the diseases of fruit and fruit trees, cleansing orchards, and exterminating insect pests. The office of the Board shall be kept open to the public, subject to the rules of the Board, every day, excepting legal holidays, and shall be in charge of the Secretary during the absence of the Board.

SEC. 5. For the purpose of preventing the spread of contagious disease among fruit and fruit trees, and for the prevention, treatment, cure, and extirpation of fruit pests and the diseases of fruit and fruit trees, and for the disinfection of grafts, scions, orchard debris, empty fruit boxes and packages, and other suspected material or transportable articles dangerous to orchards, fruit, and fruit trees, said Board shall make regulations for the inspection and disinfection thereof, which said regulations shall be circulated in printed form by the Board among the fruit growers and fruit dealers of the State, shall be published at least twenty days in two daily newspapers of general circulation in the State not of the same city or county, and shall be posted in three conspicuous places in each county in the State, one of which shall be at the County Court House thereof. Such regulations when so posted shall be held to impart notice of their contents to all persons within this State, and shall be binding upon all persons.

SEC. 6. [Said Board shall appoint without their number a competent person, especially qualified for the duties of his office, who shall be known as Clerk of the Publishing and Quarantine Bureau of the State Board of Horticulture (to hold office at the pleasure of the Board), who shall be qualified, by experience and education as a compiler, to cor-

NOTE.—The amendments to the various sections of the original Acts appear inclosed in brackets.

rect reports and essays; to present in a logical order all the information to be published, and shall give his whole time in such work, and such other duties as may be required of him by the Board and by reason of his official position, and shall have power to enforce all rules and regulations regarding the spread of insect pests, quarantining districts or nurseries found to be infected. He shall be paid for his services as Clerk of the Publishing and Quarantine Bureau of the State Board of Horticulture, one hundred and seventy-five dollars per month, to be paid as other State officers.]

SEC. 7. [The said Board, and in case of necessity during the recess of the Board, the said Clerk of the Publishing and Quarantine Bureau, may appoint such Quarantine Guardians as may be needed to carry out the provisions of this Act, whose duties it shall be to see that the regulations of the Board, and the instructions of the Clerk of the Publishing and Quarantine Bureau, are enforced and carried out; said Clerk may appoint, in case of emergency, a deputy, who shall have the same power as his own, whose salary shall not exceed three dollars per day for each day's services performed, said services to be paid by the State Board of Horticulture. The said Quarantine Guardians shall report to the said Clerk, or to the State Board, all infractions or violations of said directions, regulations, and of the law in regard to quarantine, disinfection, and destruction of insect and other pests injurious to fruit, fruit trees, or vines, and precautions against the spreading of all the aforesaid named pests and diseases. The salary of Quarantine Guardian shall not exceed three dollars per day, and shall be paid by the owners of orchards and other places and localities under quarantine regulations; and they may maintain an action therefor before any Justice of the Peace in any township in which any quarantined locality is wholly or in part situated, but in no case shall they have any claim upon the State for such services.]

SEC. 8. [It shall be the duty of the Secretary to attend all meetings of the Board and of the Executive Committee, and to preserve records of its proceedings and correspondence; to collect books, pamphlets, and periodicals, and other documents containing information relating to horticulture, and to preserve the same; to collect statistics and other information showing the actual condition and progress of horticulture in this State and elsewhere; to correspond with agricultural and horticultural societies, colleges, and schools of agriculture and horticulture, and other persons and bodies, as he may be directed by the Board; and prepare, as required by the Board, reports for publication. He shall appoint, subject to the approval of the Board, a competent person as clerk, and he shall be held responsible for the acts of said clerk. He shall be paid for his services as such Secretary and ex officio Horticultural Officer a salary of one hundred and seventy-five dollars per month. His clerk shall be paid a salary (as such clerk) of fifty dollars per month, each to be paid as other State officers.]

SEC. 9. [Repealed.]

SEC. 10. The Board shall, biennially, in the month of January, report to the Legislature a statement of its doings, with a copy of the Treasurer's accounts for the two years preceding the session thereof, and abstracts of the reports of the Inspector of Fruit Pests and Secretary.

SEC. 11. The Treasurer shall receive all moneys belonging to the Board, and pay out the same only for bills approved by it, and shall annually render a detailed account to the Board.

SEC. 12. There is hereby appropriated, for the use of the State Board of Horticulture, as set forth in this Act, out of any moneys in the State Treasury not otherwise appropriated, the sum of ten thousand dollars for the year commencing April first, one thousand eight hundred and eighty-five, and ten thousand dollars for the year commencing April first, one thousand eight hundred and eighty-six, and the State Controller will draw his warrants upon the State Treasurer in favor of the Treasurer of said Board for the said sums, or any part thereof, when they become available, upon proper demand being made for the same by the said Board. [There is hereby appropriated for the use of the State Board of Horticulture, as set forth in this Act, out of any moneys in the State Treasury not otherwise appropriated, for the fiscal year ending June thirtieth, eighteen hundred and eighty-nine, the sum of one thousand dollars, and the State Controller shall draw his warrants upon the State Treasurer in favor of the Treasurer of said Board for the same, upon proper demand.]

SEC. 13. This Act shall take effect and be in force from and after its passage, and all Acts or parts of Acts inconsistent or in conflict with the provisions of this Act are hereby repealed.

SEC. 14. [The President (and in his absence, the Vice-President) and the two Commissioners for the State at large, shall constitute the Executive Committee; said committee shall have charge of the management of the affairs of the Board while the Board is not in session. The members of said committee shall receive their actual traveling expenses in attending quarterly meetings of the Executive Committee. The other members of the Board shall receive their actual traveling expenses (only) in attending semi-annual meetings of the Board.]

SEC. 15. [Vacancies occurring in any office shall be filled by appointment made by the President of the Board, with the consent of the Executive Committee, until the next meeting of the Board.]

SEC. 16. [The Board shall make and publish their reports annually.]

SEC. 17. [It shall be the duty of the County Boards of Horticulture to make quarterly reports in writing to the State Board of the condition of fruit interests in their several districts, what is being done to eradicate insect pests, also as to disinfecting, and as to quarantine against new insects, and as to carrying out of all laws relative to the greatest

good of the fruit interest. Said Board shall publish said reports in bulletin form, or may incorporate so much of the same in their annual reports as may be of general interest.]

SEC. 18. [The expenditures necessary to be made in experiments in the different districts shall be determined by the Board. On application of one or more of the fruit growers in such districts, the said Board shall select such person or persons to make such experiments, and pay the expenses thereof. The sum of not exceeding one thousand dollars for traveling expenses shall be allowed when the Board or the Executive Committee shall deem it necessary to send either the Clerk of Bureau or Secretary to direct and supervise such experiments; *provided*, that not more than one thousand dollars shall be expended in any one year for such traveling expenses.]

AN ACT

To protect and promote the horticultural interests of the State.

[Approved March 14, 1881; amended by an Act approved March 19, 1889.]

The People of the State of California, represented in Senate and Assembly, do enact as follows:

SECTION 1. Section one of said Act is hereby amended so as to read as follows:

Section 1. [Whenever a petition is presented to the Board of Supervisors of any county, and signed by twenty-five or more persons who are resident freeholders and possessors of an orchard, or both, stating that certain or all orchards or nurseries, or trees of any variety, are infested with scale insects of any kind, injurious to fruit, fruit trees, and vines, codlin moth, or other insects that are destructive to trees, and praying that a Commission be appointed by them, whose duty it shall be to supervise their destruction as herein provided, the Board of Supervisors shall, within twenty days thereafter, select three Commissioners for the county, to be known as a County Board of Horticultural Commissioners. The Board of Supervisors may fill any vacancy that may occur in said Commission by death, resignation, or otherwise, and appoint one Commissioner each year, one month, or thereabouts, previous to the expiration of the term of office of any member of said Commission. The said Commissioners shall serve for a period of three years from the date of their appointment, except the Commissioners first appointed, one of whom shall serve for one year, and one of whom shall serve for two years, and one of whom shall serve for three years, from the date of appointment. The Commissioners first appointed shall themselves decide, by lot or otherwise, who shall serve for one year, who shall serve two years, and who shall serve three years, and shall notify the Board of Supervisors of the result of their choice.]

SEC. 2. Section two of said Act is hereby amended so as to read as follows:

Section 2. [It shall be the duty of the County Board of Horticultural Commissioners in each county, whenever it shall deem it necessary, to cause an inspection to be made of any orchard, or nursery, or trees, or any fruit-packing house, store-room, sales-room, or any other place in their jurisdiction, and if found infested with scale bug, codlin moth, or other insect pests injurious to fruit, trees, and vines, they shall notify the owner or owners, or person or persons in charge or possession of said trees or place, as aforesaid, that the same are infected with said insects, or any of them, or their eggs or larva, and they shall require such person or persons to disinfect or destroy the same within a certain time, to be specified. If within such specified time such disinfection or destruction has not been accomplished, the said person or persons shall be required to make application of such treatment for the purpose of destroying them as said Commissioners may prescribe. Said notices may be served upon the person or persons owning or having charge or possession of such infested trees, or places, or articles, as aforesaid, by any Commissioner, or by any person deputed by the said Commissioners for that purpose, or they may be served in the same manner as a summons in a civil action. If the owner or owners, or the person or persons in charge or possession of any orchard, or nursery, or trees, or places, or articles, infested with said insects or any of them, or their larva or eggs, after having been notified as above to destroy the same, or make application of treatment as directed, shall fail, neglect, or refuse so to do, he or they shall be deemed guilty of maintaining a public nuisance, and any such orchards, nurseries, trees, or places, or articles thus infested, shall be adjudged and the same is hereby declared a public nuisance, and may be proceeded against as such. If found guilty, the Court shall direct the aforesaid County Board of Horticultural Commissioners to abate the nuisance. The expenses thus incurred may be a lien upon the real property of the defendant.]

SEC. 3. Section three of said Act is amended so as to read as follows:

Section 3. [Said County Boards of Horticultural Commissioners shall have power to divide the county into districts, and to appoint a local Inspector for each of said districts. The State Board of Horticulture, or the Quarantine Officer of said Board, shall issue commissions as Quarantine Guardians to the members of said County Boards of Horticultural Commissioners, and to the local Inspectors thereof. The said Quarantine Guardians, local Inspectors, or members of said County Boards of Horticultural Commissioners, shall have full authority to enter into any orchard, nursery, or place or places where trees or plants are kept and offered for sale, or otherwise, or any house, store-room, sales-room, depot, or any other such place in their jurisdiction, to inspect the same, or any part thereof.]

SEC. 4. Section four of said Act is hereby amended so as to read as follows:

Section 4. [It shall be the duty of said County Board of Horticultural Commissioners to keep a record of their official doings, and to make a report to the State Board of Horticulture, on or before the first day of October of each year, of the condition of the fruit interests in their several districts, what is being done to eradicate insect pests, also as to disinfecting, and as to quarantine against insect pests and diseases, and as to carrying out all laws relative to the greatest good of the fruit interest. Said Board shall publish said reports in bulletin form, or may incorporate so much of the same in their annual reports as may be of general interest.]

SEC. 5. Section five of said Act is hereby amended so as to read as follows:

Section 5. [Each member of the County Board of Horticultural Commissioners, and each local Inspector, shall be paid for each day actually engaged in the performance of his duties under this Act, payable out of the County Treasury of his county, such compensation as shall be determined by resolution of the Board of Supervisors of the county, before entering into the discharge of his or their duties.]

SEC. 6. Section six of said Act is hereby amended so as to read as follows:

Section 6. [Said County Boards of Horticultural Commissioners shall have power to remove any local Inspector who shall fail to perform the duties of his office.]

SEC. 7. [Repealed.]

SEC. 8. Section eight of said Act is hereby amended so as to read as follows, and to be known as section seven of said Act, viz.:

Section 7. [If any member of the County Board of Horticultural Commissioners shall fail to perform the duties of his office, as required by this Act, he may be removed from office by the Board of Supervisors, and the vacancy thus formed shall be filled by appointment by the Board of Supervisors.]

SEC. 9. Section nine of said Act is hereby amended so as to read as follows, and to be known as section eight of said Act, viz.:

Section 8. [It shall be the duty of the County Board of Horticultural Commissioners to keep a record of their official doings, and to make a monthly report to the Board of Supervisors, and the Board of Supervisors may withhold warrant for salary of said members and Inspectors thereof until such time as said report is made.]

SEC. 10. A new section is hereby added to said Act, to be known as section nine, and to read as follows, viz.:

Section 9. All Acts or parts of Acts in conflict with the provisions of this Act are hereby repealed.

SEC. 11. This Act shall take effect and be in force from and after its passage.

CONSTITUTIONALITY OF ACTS.

OPINION OF THE ATTORNEY-GENERAL.

OFFICE OF THE ATTORNEY-GENERAL OF THE STATE OF CALIFORNIA,
SACRAMENTO, June 10, 1889.

B. M. LELONG, *Esq.*, *Secretary State Board of Horticulture, San Francisco:*

DEAR SIR: Replying to your inquiry of eighth instant, I have to say that I regard the Act "to amend an Act entitled 'An Act to protect and promote the horticultural interests of the State,'" approved March 14, 1881, Statutes of 1889, page 413, constitutional. It is a later Act than the other Act to which you call my attention, approved March 7, 1889, Statutes of 1889, page 89, and if there is any conflict between the two Acts, the later Act must prevail, but I do not wish to be understood as saying that there is any conflict.

I think the Board of Supervisors of Sonoma County, on the presentation of a proper petition, as required by the Act of March 19, 1889, should, within the time limited, select a County Board of Horticultural Commissioners. Nor is it necessary for me at this time to give an opinion whether everything in the Act of March 19, 1889, is constitutional.

Very truly yours,

G. A. JOHNSON,
Attorney-General.

SUPERIOR COURT DECISION.

APPOINTMENT OF COUNTY BOARDS OF HORTICULTURAL COMMISSIONERS MANDATORY.

Hon. Jno. G. Pressley, Judge of the Superior Court of Sonoma County, on the nineteenth of June, 1889, rendered the following decision, in which the validity of the Act, directing the Boards of Supervisors to establish County Boards of Horticultural Commissioners, is sustained:

E. A. Rogers vs. the Board of Supervisors of Sonoma County.

John Goss, Esq., attorney for plaintiff.

On the nineteenth of March an Act of the Legislature was approved entitled "An Act to amend an Act entitled 'An Act to protect and promote horticultural interests of the State,' approved March 14, 1881."

This Act (of March, 1889) provides that, "Whenever a petition is presented to the Board of Supervisors of any county, and signed by twenty-five or more persons who are resident freeholders and possessors of an orchard, or both, stating that certain or all orchards, or nurseries, or trees of any variety, are infested with scale insects that are destructive to trees, and praying that a Commission be appointed by them, whose duty it shall be to supervise their destruction as herein provided, the Board of Supervisors shall, within twenty days thereafter, select three Commissioners for the county, to be known as a County Board of Horticultural Commissioners."

The duties of the Board so appointed are declared by the Act. It appears from the complaint that in accordance with this Act, a petition was presented to and filed with the Board of Supervisors, signed by this plaintiff and twenty-six other persons possessing the qualifications prescribed by the Act, praying for the appointment of a County Board of Horticultural Commissioners for Sonoma County, and a demand was made on the Supervisors that they carry into effect the provisions of the Act and appoint the Commissioners.

The Board refused to appoint Commissioners.

Twenty days have expired since the filing of the petition and the demand for action upon it, and still the Board of Supervisors refuse and neglect to make any selections or appointment of Commissioners.

This action is brought for a writ of mandate compelling the Board of Supervisors to make the selection and appointment as required of them by the Act.

A demurrer has been interposed to the complaint, and in support thereof, it is contended:

First—That the Act of fourteenth of March, 1881, of which the Act of nineteenth of March is amendatory, was repealed by an Act approved thirteenth of March, 1883, which provides for the appointment by the Governor of a State Board of Horticulture, and that in consequence of the Act of 1889 being amendatory of a repealed statute it is nugatory.

The Act of 1883 does not, in express terms, repeal the Act of 1881, nor is that Act elsewhere expressly repealed. It is a well settled legal principle that repeals by implication are not favored. A subsequent Act does not, by implication, repeal a prior statute unless the subsequent one entirely covers the provisions of the first, and so completely that every portion of the first is provided for by the second. There must appear an intent to entirely substitute one for the other.

Says Bishop in his work on Statutory Crimes, Section 154: "We have seen that every legislative Act in affirmative words is to be regarded, *prima facie*, as an addition to the mass of the law; for such on its face it purports to be. Yet, when it is inconsistent with the former law, it must, as the last expression of the legislative will, prevail. But repeals by implication, thus explained, are not favored. And a legislative intent to repeal an existing statute is not presumed. If two Acts, seeming to be repugnant, can be reconciled by any fair construction, they must be, when no repeal will be held to take place."

The same principle is laid down by Judge Field in the case of *Pierrepont* vs. *Crouch*, 10 Cal. 316.

There are numerous other authorities to the same effect.

Is there any apparent intent to substitute one of these Acts for the other, or such repugnance as would destroy the first? Let us see. The first provides for a County Board of Horticulture. The second for a State Board. The first prescribes duties to be performed by County Boards of Supervisors. The second prescribes duties to be discharged by the Governor. The first provides for a Board of three Commissioners with local jurisdiction. The second for a Board of nine Commissioners with a jurisdiction coextensive with the State. The first authorizes Boards created by its authority to divide counties into districts. The second creates districts composed of several counties. The first requires duties to be performed by County Boards which are not required by the second of the State Board. For instance: The first provides for proceedings against persons who, after notice, fail or refuse to treat infested trees as directed by the Board, and a destruction of trees by such Board when directed by a Court. No such proceedings and destruction are provided for by the second. There are other differences between the two Acts which might be pointed out, but these are sufficient to show that there is no such similarity in the powers of the Boards created by them as would necessarily cause a conflict between these Boards, or would justify a Court in holding that one Act repeals the other. I must, therefore, hold that the Act of 1881 was not repealed by the Act of 1883, and was in full force when the amendatory Act of 1889 was passed. The Act of 1883 is an addition to the then existing legislation, and not a substitute for the Act of 1881.

Second—It was contended that Acts of the Legislature which provided that a duty imposed shall be performed within a certain time are directory and not mandatory. I cannot assent to that proposition. Where a Court or Board is directed by law to perform an act in a given time, the law, unless it declares the act may not be done after the expiration of the time, is so far directory as that the act is valid, though done after the time fixed, but is not directory in the sense that the duty or act directed may be entirely disregarded or omitted. The time is given that the Board may have ample opportunity to act intelligently and with good judgment, but not to enable the Board or officer of whom the duty is required to disregard it entirely. I have no doubt but that the Board of Supervisors is required by the law in question to appoint a County Board of Horticultural Commissioners, and that it may be lawfully done after the expiration of the twenty days given them in the Act for deliberation.

Counsel referred to some authorities from other States in support of his contention. I do not think these authorities go to the extent claimed by him, and if they did, there being not such decision by our own Supreme Court, I would hold the law in this State to be different. The purpose of the Legislature was to give the Supervisors time to make judicious selections, and not to justify or authorize an annulment of the legislative will expressed by the statute.

REGULATIONS

TO PREVENT THE SPREAD OF CONTAGIOUS DISEASES AMONG FRUIT AND FRUIT TREES; AND FOR THE PREVENTION, TREATMENT, CURE, AND EXTIRPATION OF FRUIT PESTS AND DISEASES OF FRUIT AND FRUIT TREES; AND FOR THE DISINFECTION OF GRAFTS, SCIONS, ORCHARD DEBRIS, EMPTY FRUIT BOXES, ETC.

[Adopted by the State Board of Horticulture at the meeting of June 29, 1889.]

All purchasers who have received fruit in any box, sack, or other package of any description, shall immediately upon receiving the same disinfect each box, sack, or other package, by subjecting it to boiling water or steam under pressure for a sufficient length of time to destroy all insects or germs attached to or contained in such box, sack, or other package; and all such boxes, sacks, and other packages shall be kept secure from infection so long as they remain in the place where disinfected.

Disinfection of Fruit Trees, Scions, etc.

For the purpose of disinfecting fruit trees, scions, cuttings, grafts, etc., the following is recommended:

Whale-oil soap (80 per cent strength)	5 pounds.
Water	4 gallons.

Directions.—Dissolve thoroughly soap in water, and immerse the tree, scion, cutting, or plant for at least two minutes, while the solution is still hot, or for such length of time as will destroy all insects or germs.

Pernicious (Aspidiotus Perniciosus) Scale.

Summer Remedy for Peaches.

Potash	14 pounds.
Caustic soda (98 per cent)	8 pounds.
Lime, unslacked	5 pounds.
Fish oil, polar or seal	10 gallons.

Directions.—First—Dissolve the soda and potash by placing them together in about ten or twelve gallons of water.

Second—Slack the lime in the barrel in two gallons of water; then add the fish oil to the lime and stir well until the lime and the oil have turned to a thick batter; then add the soda and potash, water, boiling hot, and stir well with a dasher for five minutes or more. Then leave standing for about four or six hours; then fill up with cold water; do not pour in all the water at once, but about two buckets at a time. Stir well as the first two buckets of water go in, to prevent lumps. Use the following day. Apply cold, one pound to the gallon of water. In dissolving it do not boil, but weigh the amount to be used, place in a barrel, and on top of it pour hot water, about one bucket to every one hundred pounds of material.

After pouring in the hot water, stir lively with a dasher until it is entirely dissolved; then reduce with cold water until thin enough to pass through the strainer; then place in the tank and fill up with water; stir well and it is ready for use; apply cold.

Summer Remedy for Pears and Apples.

Caustic soda (98 per cent)	10 pounds.
Potash	10 pounds.
Tallow	40 pounds.
Resin	40 pounds.

Directions.—First—Dissolve the potash and soda in ten gallons of water. When dissolved, place the whole amount in the barrel (fifty-gallon measure).

Second—Dissolve the tallow and resin together. When dissolved, add the same to the potash and soda in the barrel, and stir well for five minutes or so. Leave standing for about two hours; then fill up with water, stirring well as every bucket of water goes in. Use the following day, one pound to the gallon of water; apply warm.

Winter Remedy.

Lime	25 pounds.
Sulphur	20 pounds.
Salt	15 pounds.

Directions.—Take ten pounds of lime, twenty pounds of sulphur, and twenty gallons of water; boil until the sulphur is thoroughly dissolved. Take the remaining fifteen pounds of lime and fifteen pounds of salt, and when thoroughly slacked, mix together and add enough water to make in all sixty gallons of solution; strain, and apply warm.

Brown Apricot Scale.

Summer Remedy.

Caustic soda (98 per cent)	1 pound.
Resin	5 pounds.
Water	40 gallons.

Directions.—Boil caustic soda in one and one half gallons of water. When dissolved, take out and lay aside one half of the solution; then add resin to the remainder in the kettle. After resin is dissolved, add slowly balance of soda solution. When thoroughly cooked, add water to make in all forty gallons of solution; apply warm.

Winter Remedy.

Sulphur	20 pounds.
Lime	25 pounds.
Salt	15 pounds.

Directions.—Take ten pounds of the lime, twenty pounds of the sulphur, and twenty gallons of water. Boil until the sulphur is thoroughly dissolved. Take the remainder—fifteen pounds of lime and fifteen pounds of salt—slack, and add water to make the whole mixture sixty gallons. Mix the whole together, strain, and spray on the trees milk warm or warmer. This can only be applied when the foliage is off the tree, and has in this condition no injurious effect on the fruit buds or tree whatever.

For Cottony Cushion (Icerya Purchasi) Scale.

Caustic soda (98 per cent)	2 pounds.
Resin	10 pounds.

Directions.—Boil caustic soda in one and one half gallons of water. When dissolved, take out and lay aside one half of the solution; then add resin to the remainder in the kettle. After resin is dissolved, add slowly balance of soda solution. When thoroughly cooked, add water enough to make in all forty gallons of solution; apply warm.

For Black Scale (Lecanium Olea) on Olive Trees.

Five gallons best kerosene oil, 150 degrees test; one and one fourth pounds good common soap, or one bar and a half of soap usually sold as pound packages; two and a half gallons of water. This makes the emulsion. When using, dilute six and one half gallons of water for each gallon of oil, and to this mixture add two and a half pounds of good home-made soap dissolved in boiling water. All this mixing should be done with hot water, and applied at a temperature of 140 degrees Fahrenheit.

Red Scale (Aspidiotus Aurantii) on Citrus Trees.

Caustic soda (98 per cent)	8 pounds.
Resin	15 pounds.
Whale oil or fish oil	2 quarts.

Directions.—Boil oil, caustic soda, and resin together in about ten gallons of water for about three or four hours; then add water enough to make in all one hundred gallons of solution. Apply warm. Must be cooked well as per directions, to secure best results.

For Codlin (Carpocapsa Pomonella) Moth.

For Early Ripening Apples and Pears.

Spray once with one pound of Paris green to one hundred and eighty gallons of water, when just out of bloom.

For Fall and Winter Apples and Pears.

Spray twice. First application as above; second application with one pound of Paris green to two hundred gallons of water. Use the Paris green without any additions, simply stirring the liquid continually and straining it before using.

For Woolly (Schizoneura Lanigera) Aphis.

Root Form.—Dress liberally with ashes, especially in moist localities, or use gas lime, about one and one half shovelfuls around each tree in such a manner that it will not come in direct contact with the bark of the tree.

Branch Form.—Brush with kerosene emulsion, or resin solution, or spray.

For Flowering Shrubs or Garden Plants.

Sulphur	1 pound.
Lime	1 pound.
Water	2 gallons.

Directions.—Boil ingredients together one hour. Dilute one gallon of the mixture with three gallons of water; use more or less water according to the strength of the plant.

Borers.

Guard trees from infection by placing a shake or board on the south and west sides of the tree, which protects it from sunburn; or give a coating of whitewash, containing some soap and sulphur. In removing a borer, smear the wound over with grafting wax.

Peach Root (Sannania Pacifica) Borer.

Remove the earth at the base of the tree and wrap up the trunk with stout paraffine paper, and pile up against the paper air-slacked lime or ashes.

Note.—Wherever beneficial insects or parasites are decreasing the spread of injurious insect pests, no spray or wash should be used, and the parasites should be colonized and taken care of.

EXTRACTS FROM MEETINGS OF THE BOARD.

March 10, 1890.

The Board met in Los Angeles pursuant to a resolution adopted at the meeting held in Fresno November 8, 1890. The following Commissioners were present: Messrs. Block, Buck, Kimball, Miles, Mosher, Runyon, Thomas, and President Cooper. Absent, Commissioner White.

The minutes of November 4–8, 1889, were read and duly approved.

The President announced that Rev. N. R. Peck had resigned as Commissioner, and that the Governor had appointed Mr. Fred. C. Miles, of Penryn, and welcomed Mr. Miles into the Board.

Nominations for the position of Vice-President, made vacant by the resignation of Commissioner Peck, were then declared in order.

Commissioner Block nominated Commissioner Buck for the position of Vice-President.

On motion, nominations were closed, and the Secretary was directed to cast the vote of the Commissioners present for Mr. Buck.

The Secretary cast the vote of the Commissioners present for Commissioner L. W. Buck, for the position of Vice-President, and he was declared unanimously elected by President Cooper.

Vice-President Buck made a few remarks, in which he returned warm thanks for the honor conferred, and promised to perform the duties of the office to the best of his ability.

SECRETARY'S REPORT.

The report of the Secretary was read, covering the period since the last meeting of the Board, as follows:

To the honorable the State Board of Horticulture:

Gentlemen: I herewith submit to your kind consideration this, my report as your Secretary, since your last meeting held at Fresno, November 4, 1889.

PUBLICATIONS.

In accordance with a resolution adopted at your last meeting there were twenty thousand bulletins, No. 53, reprinted. The annual report for 1889 has just been issued. It is a volume of nearly six hundred pages, contains nearly three hundred illustrations, and four lithographic plates.

MEMORIALS.

In accordance with the wishes expressed at the last meeting, and at the last Convention, I have forwarded to Congress all such memorials as have been adopted at these meetings. Replies have been received from our representatives that they would receive their due consideration.

QUARANTINE GUARDIANS.

Since my last report the following have been commissioned Quarantine Guardians: John M. Balhache, E. A. Rogers, Mark L. McDonald, J. R. Totman, Frank W. Willis, F. M. Johnson, W. J. Clarke, Thomas Knoch, C. F. Ayer, J. B. Wilkie, F. F. Clyma, F. Edw. Gray, W. O. Welch, Thomas Weiss, W. G. Jasper, Hiram Hamilton, G. W. Preble, F. H. Keith, J. H. Thomas, R. P. Patterson, E. W. Meglone, L. D. Coffee, A. C. Koch, F. W. Rohlfing, Ed. Harkness, C. J. Berry, G. M. Gray.

EXECUTIVE COMMITTEE.

The Executive Committee met at the office on February 24 and 25, 1890, in pursuance of instructions from you, to take an inventory of all State property in our charge; they, no doubt, will present a report.

VICE-PRESIDENT.

By reason of a vacancy in the office of Vice-President of the Board, caused by the resignation of Rev. N. R. Peck, as Commissioner, having moved out of his district, the President, who is authorized by law to fill all vacancies, with the advice and consent of the Executive Committee, appointed Commissioner L. W. Buck to that office.

DEATHS.

It becomes my painful duty to officially announce the demise of Gen. M. G. Vallejo, your former Treasurer and Commissioner for the Sonoma District. He died at his residence in Sonoma, on the eighteenth day of last January, after a painful and lingering illness.

The late General was too well known for me to offer at this time words in eulogy to his memory, but believe that President Cooper voiced the sentiments of the Board in saying: "He was one of Nature's noblemen—a generous heart, a soul beaming with kindness, simple as a child, and true in every instinct. A great man has gone."

I most respectfully recommend that when this Board does adjourn, it do so out of respect to the late General M. G. Vallejo.

Respectfully submitted.

B. M. LELONG,
Secretary.

SAN FRANCISCO, CAL., March 1, 1890.

The report was received and placed on file, on motion of Commissioner Block.

The appointments of Quarantine Guardians made since the last meeting of the Board were, on motion of Commissioner Block, confirmed.

TREASURER'S REPORT.

The Treasurer then presented his report as follows:

To the honorable the State Board of Horticulture:

GENTLEMEN: I herewith submit to your consideration this, my report as your Treasurer, up to March 1, 1890.

The following are the amounts paid in warrants to cover claims, as follows, viz.:

October 10, 1889—Call Co., "Call," one year	$7 80	
Dutton & Patridge, supplies	5 95	
A. W. Rose, rent	135 00	
G. G. Wickson & Co., supplies	22 50	
Samuel Carson & Co., books	6 70	
N. W. Motheral, salary and traveling expenses (Special Agent)	212 45	
L. A. Bertling & Co., supplies	15 50	
J. R. Dobbins, salary (Special Agent)	75 00	
W. B. Dunlap, books	9 50	
J. Caire, chemicals, etc.	12 00	
B. M. Lelong, traveling expenses	135 75	
Archul & Co., fruit jars (stone, one dozen)	7 20	
G. G. Wickson & Co., typewriter paper	5 50	
Wells, Fargo & Co., expressage	12 55	
M. Denicke, fruit for experimental purposes	15 00	
J. W. DeLamater, fruit for experimental purposes	7 50	
W. J. Bryan, Postmaster, stamps	154 00	
Cartage	27 90	
Freight	16 25	
Janitor	10 50	
Office boy	9 00	
Telegrams	3 70	
Subscriptions to papers, "Garden and Florist," "Journal of Horticulture," "The Garden"	11 85	
Supplies	16 10	
		$935 20
November 2, 1889—Dutton & Partridge, supplies	$10 85	
H. S. Crocker & Co.	30 00	
Justinian Caire, chemicals	4 75	
Chris. Jorgensen, water color sketching	50 00	
A. W. Rose, rent	135 00	

J. R. Dobbins, salary (Special Agent)	$39 00	
W. L. Bovyer, carpenter work	43 00	
John T. Gray, plumbing	3 00	
T. W. Jackson & Co., caustics	4 00	
P. W. Butler, olives for experimental purposes	9 00	
A. H. Ste Marie, translating	66 75	
A. Scherchy, translating	20 00	
Alschul & Co., fruit jars, (two dozen)	14 40	
Wempe Bros., paper boxes	3 00	
A. D. Oakley & Co., stencils, etc.	6 00	
Cartage	16 05	
Wells, Fargo & Co., expressage	7 90	
Freight	16 97	
Telegram	40	
Gas	1 60	
Office boy	12 00	
Janitor	4 00	
Supplies	5 75	
		$503 42
November 27, 1889—Dutton & Partridge, supplies	$2 00	
Dewey & Co., books	5 25	
Chris. Jorgensen, sketching	55 15	
N. W. Motheral, salary and traveling expenses	203 90	
Geo. Rice, traveling expenses	11 20	
I. H. Thomas, traveling expenses	20 35	
N. R. Peck, traveling expenses	29 35	
J. L. Mosher, traveling expenses	45 70	
Ellwood Cooper, traveling expenses	50 80	
A. Block, traveling expenses	30 25	
A. W. Rose, rent	135 00	
A. K. Whitton, reporting	250 00	
B. M. Lelong, traveling expenses	27 90	
M. S. Flynn, one week's work	15 00	
J. R. Dobbins, three days' service, with team	15 00	
J. R. Winterburn & Co., cuts	75	
Miss M. E. Wilson, woodcuts	34 00	
Freight	5 48	
Cartage	4 65	
Expressage	14 50	
Office boy, three weeks	9 00	
Gas	3 00	
Supplies	90	
		$969 13
December 14, 1889—"Overland Monthly," one year	$4 00	
Dutton & Partridge, supplies	5 50	
The J. Dewing Co.	5 00	
Chris. Jorgensen, sketching	5 00	
A. W. Rose, rent	135 00	
L. W. Buck, traveling expenses	46 60	
Sol. Runyon, traveling expenses	42 40	
Samuel Carson & Co., books	56 00	
Miss M. E. Wilson, wood engravings	50 00	
J. R. Winterburn & Co., electro cuts	19 00	
E. C. French, wood engravings	26 00	
Alschul & Co., fruit jars	3 50	
Cartage	1 00	
Wells, Fargo & Co., expressage	7 75	
Janitor, two months	21 35	
Office boy, three weeks	9 00	
Supplies	1 30	
		$438 40
January 6, 1890—Dutton & Partridge, supplies	$1 25	
A. M. Ebbetts, coal	5 75	
Samuel C. Partridge, supplies	16 85	
A. W. Rose, rent	135 00	
Photo-Engraving Co., photo-electric cuts	34 00	
Miss Bertha Henicke, wood engravings	39 00	
J. R. Winterburn & Co., electro cuts	14 00	
Wells, Fargo & Co., expressage	20 45	
Telegrams	1 50	
Cartage	3 45	
Office boy, three weeks	9 00	
Janitor	10 50	
		$290 75
January 25, 1890—Dutton & Partridge, supplies	$26 60	
California Furniture Co., supplies	30 00	

P. J. Healey, books	$5 50	
C. C. Reidy, wood cuts	10 00	
Dewing & Co., paper, one year	3 00	
Geo. Rice, traveling expenses	17 50	
B. M. Lelong, traveling expenses	35 00	
W. J. Bryan, Postmaster, stamps	85 00	
J. R. Winterburn & Co., electro cuts	2 00	
Wells, Fargo & Co., expressage	31 05	
Cartage	3 25	
Telegrams	3 45	
Supplies	1 20	
Office boy, three weeks	9 00	
Janitor	10 50	
		$273 05
Chris. Jorgensen, sketching	$2 00	
Jas. Duffy & Co., supplies	1 50	
Swan, Stein & Co., supplies	4 00	
Union Box Factory, supplies	45 72	
P. J. Healy, books	7 50	
G. G. Wickson & Co., supplies	2 50	
California Furniture Co., supplies	26 00	
Dutton & Partridge, supplies	33 00	
A. W. Rose, rent	135 00	
J. R. Winterburn & Co., electro cuts	6 10	
Wells, Fargo & Co., expressage	8 75	
Swasey & Co., printing fruit plates	5 50	
Gas	9 60	
Office boy, two weeks	6 00	
Supplies	11 80	
		$304 97
Total		$3,714 92
Amount expended up to last meeting		6,569 61
Appropriation		$12,500 00
Balance in Treasury		$2,215 47

Salary Fund.

Salary Secretary, eight months	$1,400 00
Salary Clerk of P. & Q. B., eight months	1,400 00
Salary Secretary's Clerk, eight months	400 00
Total	$3,200 00
Appropriation	4,800 00
Balance	$1,600 00

Very respectfully submitted.

SOL. RUNYON,
Treasurer.

SAN FRANCISCO, CAL., March 1, 1890.

The report of the Treasurer was read, and on motion of Commissioner Block was adopted and placed on file.

REPORT OF THE EXECUTIVE COMMITTEE.

The Executive Committee then presented their report, as follows:

SAN FRANCISCO, CAL., March 1, 1890.

To the honorable State Board of Horticulture of California:

GENTLEMEN: Your Executive Committee beg leave to present for your consideration the following report, which is the result of their examination of the books, accounts, and vouchers in the office of the Secretary of the Board, as well as of all the property under the control of the Board, including office furniture, fixtures, library, etc., made at the office of the Board, February 24 and 25, 1890:

First—The book of original entry, covering the period from July 1, 1888, to February 8, 1890, every entry being examined in detail, clearly showed the amount paid and for what it was paid.

Second—We examined as a whole all the bills paid by the Board from date of removal

to present offices, about July 14, 1887, to February 8, 1890, and compared each bill with the receipt showing its full payment.

Third—We examined and appraised all the furniture, in most instances relying upon the bills for value, and where no bills were found the value was estimated.

Fourth—The library we found to contain the following number of books: Twenty-one volumes turned over by the former to present Secretary; two hundred and two volumes secured through exchange; six hundred and eighteen volumes bought, and two hundred and eighty-seven volumes bought in paper covers or without covers, and which have been bound or are in process of binding. One thousand one hundred and twenty-eight volumes in all, and valued as follows:

Twenty-one volumes, $210, estimated. The values of the following were ascertained from the bills: Nine hundred and five volumes, $1,235 90; two hundred and sixty-two volumes, $100. One thousand one hundred and twenty-eight volumes, $1,545, total value of library.

Fifth—Electrotypes and woodcuts, forming an exceedingly valuable collection, covering about eighteen superficial feet, cannot have cost less than $1,000, although we did not separate the bills of items, so as to determine the exact cost. These cuts and electrotypes number three hundred and sixty pieces, some of them as many as five separate subjects.

Sixth—We found an itemized account of old furniture, waste paper, rubbish, and truck sold, amounting to $79 50, said amount having been turned into the State Treasury.

Seventh—We found by the Secretary's report a balance of $2,214 27 remaining to the credit of the Board to carry on all its operations till the close of the present fiscal year, June thirtieth. The average monthly expenses for the nineteen months from July 1, 1888, to February 1, 1890, have been about $520. Applying this average to the remaining months of the present fiscal year, we find that $2,600 will be required. However, from this amount there should be deducted one month's rent, $135, not embraced in the above statement, and also the sum of $223 64, in value of postage stamps now on hand, thus leaving the amount at the disposal of the Board about equal to the probable expenses to be incurred before the close of the present fiscal year.

Eighth—A careful examination of the various rooms and offices of the Board disclosed the fact that the total value of the furniture, fixtures, carpets, etc., amounted to $2,700, which amount does not include the expense of putting up the various partitions, painting, etc.

Ninth—The actual running expenses of the Board, based on the amount disbursed in the nineteen months, July 1, 1888, to February 1, 1890 (not including salaries, which are provided for by law, nor the purchase of any permanent property), to be as follows:

Expenses of members of Board attending two Conventions	$640 00
Expenses of members of Executive Committee attending two meetings	340 00
Expenses, incidental, two Conventions	150 00
Expenses of stenographer, two Conventions	500 00
Traveling expenses of two clerks, two Conventions	160 00
Expense one year's rent, twelve months, at $135 per month	1,650 00
Incidental office expenses, twelve months	1,284 00
Postage stamps, $105 per month, twelve months	1,260 00
	$6,154 00

This estimate is based entirely on the average expenses of the Board during the period reviewed, but cannot fairly represent our future requirements, especially when we consider the constantly increasing demands made on the Board for many purposes, among which we may mention the increasing demand of fruit growers for experimental work in suppressing our numerous fruit pests, and the study of diseases of trees and plants; the largely increased expense of the annual report, consequent upon its increased size. The present report being larger than any previously published, a greater sum will be required in its distribution, not only in postage, but in express and freight charges, in drayage, in paper for wrapping, in boxes for transportation in quantity to Conventions and districts. In fact, we may say that the work of the Board is increasing so fast in importance that its expenses, with the most rigid and exacting economy, cannot be estimated at less than $6,250 for the coming fiscal year.

Tenth—A careful examination of the books of the Secretary develops the fact that during the period from April 17 to July 1, 1887, there was no money in the State Treasury with which to pay the absolutely indispensable expenses of the Board, and that the Secretary paid such bills to the amount of $414, and that no portion of such indebtedness has been refunded to Mr. Lelong. We also found that Mr. Lelong had also paid out $166 78 in discounts on State warrants, a part of such discounts having actually been paid to officers of the Board. We also found bills to the amount of $80 18, which were paid by the Secretary, and no part thereof has been returned to him.

We further found that while acting under the instructions of the Board, during the presentation and pendency of the amended horticultural bill before the Legislature, that the Secretary incurred expenses for traveling and other incidentals to the amount of $362 30, itemized statements being rendered for every disbursement. We, therefore, find that there is now due to Mr. Lelong the sum of $1,023 71, for moneys actually disbursed by him for account of the State Board of Horticulture, which sum does not embrace any charge for interest, which is properly chargeable for the use of his money.

For the coming fiscal year, June 30, 1890, to June 30, 1891, the appropriation is		$12,500 00
Minimum estimate for expenses	$6,250 00	
Due Secretary	1,023 71	
		7,273 71
Leaving a probable balance of		$5,226 29

The publications of the Board must sustain the enviable character of the horticulturists of our State, and to do it every step must be an advancing one; and in this regard, we may say that we believe the dissemination of exact knowledge deduced from experiments, through the medium of our publications, to be the most important feature in the work of our Board.

To summarize, we beg to say that after a careful examination of the offices of our Secretary, we find that his duties have been performed in an *exceedingly satisfactory* manner. We find the furniture and fixtures of the offices of the Board to be of a useful and not of an extravagant character, when the importance of this department is considered.

The general arrangement, neatness, and good order maintained at all times, is highly commendable to our Secretary, and is worthy of great praise.

Respectfully submitted.

FRANK A. KIMBALL,
J. L. MOSHER,
ELLWOOD COOPER,
Executive Committee.

Commissioner Block made a few complimentary remarks and said he was, indeed, very glad that such report was made, and moved that the report be received, adopted, and spread in full upon the minutes of the Board, as the sentiments of the Board toward the Secretary, for the efficient services performed by him since his accession to the office. Motion carried unanimously.

Commissioner Block moved that the Executive Committee be and are hereby given full power to settle the account due the Secretary in any way they choose. Motion carried.

On motion of Commissioner Block, Commissioners Cooper, Mosher, and Miles were appointed to draft a suitable set of resolutions in memory of the late General M. G. Vallejo, former Treasurer and Commissioner.

The President made a statement with regard to a parasite that is now destroying the red scale in Florida.

Commissioner Block moved that the Executive Committee be authorized to procure said parasite for distribution in this State. Motion carried.

On motion of Commissioner Block, the Secretary was granted a leave of absence of eight weeks, said leave to be taken under the direction of the Executive Committee.

On motion, the Board then took a recess, to meet at the call of the President, out of respect to the memory of the late General M. G. Vallejo.

MARCH 14, 1890.

The Board met pursuant to adjournment. All the Commissioners were present except Commissioner White.

The committee appointed to draft resolutions of respect to the memory of the late General Vallejo, submitted the following:

WHEREAS, It has pleased Almighty God to remove from our midst General M. G. Vallejo, our former Treasurer, and Commissioner for the Sonoma District; therefore, be it

Resolved, That in the death of General Vallejo we have lost a warm friend, and the State a dutiful servant, who for many years occupied the position of Treasurer to this department;

Resolved, That we, the State Board of Horticulture, in session at Los Angeles, this the fourteenth day of March, 1890, extend to the family of the late General Vallejo our sympathy and condolence in this their great bereavement;

Resolved, That these resolutions be spread in full upon the minutes of this Board, and that a copy be engrossed and attested to by the officers of this Board, and transmitted to the family of the late General Vallejo.

ELLWOOD COOPER,
J. L. MOSHER,
FRED. C. MILES,
Committee.

Commissioner Block moved that the resolutions be adopted and spread in full upon the minutes of the Board, and a copy be transmitted to the family of the late General Vallejo. Motion carried unanimously.

Commissioner Block moved that the next State Convention of Fruit Growers be held at Santa Cruz, the date thereof to be fixed by the President. Motion carried.

Commissioner Buck moved that when the Board does adjourn, it do so to meet at Santa Cruz, at the call of the President. Motion carried.

On motion of Commissioner Block, the subject-matter with regard to lithographic plates for the next annual report was referred to the Executive Committee, with full power to act.

The Board then adjourned.

SECRETARY'S REPORT.

OFFICE OF THE STATE BOARD OF HORTICULTURE,
SAN FRANCISCO, CAL.

The law as to the time to report was amended at the last session of the Legislature, from "biennially" to "annually;" therefore, we now present our reports annually, this report being the second submitted for your consideration since the passage of the Act.

The report for 1889 (the first made under the amended law) is a volume of 536 pages, and contains four colored lithographic plates, and the following is a digest of its contents:

First—Reports of the Treasurer, covering a period from April 15 to November 1, 1889, inclusive. In this report may be seen the total amount expended during that time. The reports of the Treasurer, following that period, are to be found in the present volume, up to the close of the forty-first fiscal year—June 30, 1890.

Second—Reports of the Secretary covering a period of a year, from November, 1888, to November, 1889. In that report may be seen a general outline of the amount of work performed during that year, and the amount of publications issued and distributed, and many other matters of vast importance. Attached to that report is a supplementary report in which fruit culture is treated at length. Among other things the following occupy the most prominent part of the volume: (*a*) The olive—botanical study, in which every point bearing upon the "oleaceæ and the olive" are brought out. (*b*) Chemical study of the olive; this being the most complete ever published, and is divided as follows: (1) Complete analysis of the soil; (2) mechanical analysis; (3) physico-chemical analysis; (4) chemical analysis; (5) analysis of the ashes of the wood, the leaves, and the fruits of the olive; (6) composition of the ashes of the wood, the leaves, and the fruit of the olive; (7) measurement of the tannin in the olive and bark; (8) immediate analysis of olives; (9) pulp analysis; (10) analysis of the endocarp; (11) analysis of the kernel; (12) relations between soil and plant; (13) what an olive can produce in wood, leaves, and fruit, yearly; (14) analysis of the oil cakes; (15) studies compared with the researches of other authors, and conclusions; (16) climate and abode of the olive; (17) vegetation and life of the olive tree; (18) temperature; (19) propagation; (20) varieties of the olive tree; (21) grafting and budding; (22) olive oil—analysis and methods of detecting adulterants.

Third—The culture of the fig is treated at some length, in which the latest processes of preparation are given, and also the same with regard to propagation, formation of the tree, production of fruit, etc.

Fourth—Grafting and budding the walnut is another subject treated at some length, the latest and most successful experiments being given. Many other subjects bearing on fruit growing are also fully illustrated.

Fifth—The strawberry tree, packing oranges, the lemon in Sicily, and tree planting, arrangement of the orchard, etc., receive much attention.

Sixth—Injurious insects are fully treated as follows: (*a*) Scale insects and remedies therefor; character of the Coccidæ, and their metamorphoses; division of the Coccidæ into sub-families, and their classification. (*b*) The Aphidæ, features of and reproduction, together with the most approved remedies. (*c*) Pear slugs and caterpillars. (*d*) Codlin moth, and remedies, time of application, etc. (*e*) The Eastern Plum Curculio, and other curculios, fully illustrated for comparison in identifying. (*f*) Tree borers. (*g*) Tree spiders or mites.

Seventh—The art of soap making in the field is one of great importance to every orchardist, as in this method no machinery or fire is required.

Eighth—The fungoid diseases are also fully illustrated, and the best means employed for their check are treated at length. The experiments made against the "pear cracking" and "leaf blight" have been very successful. The fungi treated are as follows: Pear blight (*Entomosphorium maculatum*); cherry, peach, and plum rust (*Puccinia pruni-spinosæ*); cherry powdery mildew (*Podosphæra oxycantha*); rose rust (*Phragmidium mucronatum*); rose leaf black spot (*Actinonema rosæ*); and strawberry leaf blight (*Sphærella fragariæ*).

Ninth—Beneficial insects also occupy a most prominent part, nearly all the species found on this coast being illustrated; "they should be reared and protected, as by their natural fecundity, which is very great, they assist most materially in the work of destroying injurious insects, and were it not for their aid they could not otherwise be destroyed effectually."

The *Vedalia cardinalis* (Australian ladybird) may be cited as an instance. A colored lithographic plate of this insect in its various stages appears, and the insect is again illustrated in Plate IV of this volume. Other beneficial insects of no less importance are also treated at some length.

It is our purpose to introduce all parasites and predaceous insects that may be discovered in other States and foreign countries. Already various lots have been imported and are now being propagated, with the object in view of distributing them among the orchardists of our State.

Tenth—The report contains, among other matters of vast importance to the fruit growers, the proceedings of the *Tenth, Eleventh, and Twelfth* State Fruit Growers' Conventions. The tenth was held at the City of Chico, Butte County, in November, 1888, the eleventh, at National City, San Diego County, in April, 1889, and the twelfth, at the City of Fresno, in November, 1889. These Conventions are held semi-annually in different parts of the State, it being understood that the spring Convention shall be held in the southern part of the State and the fall Convention in the northern or central part, as this time best suits the convenience of the fruit growers. By this arrangement the Conventions are held in the sections that are most interested in the subjects discussed at that time of year.

Our President, in his addresses at the various Conventions, has called special attention to all subjects to be discussed, and has taken particular care and pains in reviewing the fruit industry, together with sundry recommendations which the fruit growers have not been slow in advancing. In his address before the Tenth State Convention, held at Chico, November, 1888, he said: "Our fruit industry is rapidly increasing from year to year; our fruits are sought by the people in almost every part of the country; we have a growing demand, with an increased interest in our products." Since then the methods of preparation and the improvements of varieties have received the greatest energies at the hands of the growers, by which they have been immensely remunerated. During 1890 the markets of the United States have been supplied almost with California fruits exclusively. The proceedings of the Tenth State Convention contains, besides the President's address, an address of welcome, by E. Graham, of Chico, and the following essays: "Insect Pests," by H. P. Stabler, of Yuba City; "Peach Culture," by P. W. Butler, of Penryn; "Cherry Culture," by James E. Gedney, of Mesa Grande, San Diego County; "Wheat vs. Fruit," by General N. P. Chipman, of Red Bluff, Tehama County; "Shall We Can or Dry our Fruits?" by R. C. Kells, of Yuba City, Sutter County; "Citrus Culture," by Jesse Wood, of Chico, Butte County; "Floral Culture," by Emory E. Smith, of San Francisco. Discussions followed the reading of all papers, which may be seen printed in full in the report.

Eleventh—The proceedings of the Eleventh State Convention contains an address by President Cooper, in which the fruit industry is reviewed at some length, together with many recommendations, which were acted upon, and an address of welcome, by Mrs. Flora M. Kimball, of National City, followed by the reading of the following essays: "Injurious Insects and Remedies," by Professor D. W. Coquillett, of Los Angeles; "Pruning and Cultivation," by Hon. Ellwood Cooper, of Santa Barbara, who afterwards read an essay on "Olive Culture;" "Irrigation and Protection of Water Sources," by L. M. Holt, of San Bernardino; "Fruit Packing," by Hon. L. W. Buck, of Vacaville; "The English (Madeira) Walnut," by Hon. Russell Heath, of Carpenteria, Santa Barbara County; "Japanese Nut and Camphor Trees," by H. H. Berger, of San Francisco; "Effect of Rain on Blossoms," by Gilbert Tompkins, of San Leandro, Alameda County; "Horticultural Machinery," by H. A. Brainard, of San José; "Orange Culture," by Fred. C. Miles, of Penryn, Placer County; "Lemon Culture," by Dr. O. H. Conger, of Pasadena, Los Angeles County; "Scale of Points for Judgment of Citrus Fruits," by J. E. Cutter, of Riverside, San Bernardino County; "Palms for Ornamental Purposes," by Professor Henry Chapman Ford, of Santa Barbara; "The Horticultural Resources of California—Southern California," by T. S. Van Dyke, of San Diego; and a full report of the products exhibited, together with various other matters affecting the fruit industry.

Twelfth—The proceedings of the Twelfth State Convention contains, as the former Conventions, an address by President Cooper, and an address of welcome by E. J. Griffith, of Fresno, and the following essays: "Fruit Pests and Their Extermination," by Louis W. Burr, of Bakersfield; "Nature's Methods of Subduing Insect Pests," by Prof. D. W. Coquillett, of Los Angeles; "Fig Culture and Seedling Smyrna Figs," by Hon. E. W. Maslin, of Loomis, Placer County; "Fruit Drying," by J. L. Mosher, of San José; "Resin Spray and Its Effects on Citrus Trees," by J. H. Kellom, of Tustin City, Orange County; "Floral Culture," by Mrs. Ellwood Cooper,* of Santa Barbara; "The Raisin Grape," by T. C. White, of Fresno; "The Mysterious Vine Disease," by Tim. Carroll, of Anaheim; "Fruit Culture in Fresno County," by Geo. E. Freeman, of Fresno; "Coöperation of Fruit Growers," by B. N. Rowley, of San Francisco, together with many other reports, etc., followed by discussions.

*Mrs. Cooper contemplates embodying her extensive researches into a treatise, which, if carried out, will be of great value to amateur and professional florists.

Thirteenth—Extracts from the minutes of the Board of the various meetings from November 21, 1888, to November 4, 1889, synopses of the reports of the Special Agent, reports of the various County Boards of Horticultural Commissioners throughout the State, a roster of officers of National and State and County Horticultural Societies and Commissions, Glossary on Entomology and Botany, conclude the volume. Besides the four colored lithographic plates, the report contains one hundred and thirty-seven wood engravings of fruits, fungoids, injurious and beneficial insects, etc.

PUBLICATIONS.

There has been considerable demand on the part of fruit growers and newcomers into our State for the publications of this Board, as they contain the information required by beginners, as well as supplying information to the masses interested in the fruit industry.

The demand for our last annual (1889) report was so great that it has been impossible to supply the applications for copies made upon us. The various schools throughout the State made urgent requests to be supplied with enough copies for each school district. I regret very much that their wants could not be satisfied, as at least one hundred and twenty-five thousand copies would have been required, as there are at least twenty-five or more school districts in each of the fifty-three counties of our State. A single demand made by an educational department would have required fifty-two hundred copies. I have supplied all the school and public libraries with bound copies, but regret to say that the many school districts throughout the State have only been supplied with one copy each, as the issue became exhausted, the demand for them being so large and the amount printed (ten thousand) proving inadequate.

Various bulletins have been published from time to time, which have supplied information required at the various periods of the year. During a leave of absence allotted to me, I visited during the months of April and May, 1890, several of the Eastern and Southern States, in search of information in relation to the fruit industry. I visited all the largest fruit-growing districts in Florida, Maryland, Delaware, and New Jersey; also other States of less importance in horticulture. The results attained were published and distributed in bulletin form.

The lithographic plates in the present volume were designed by me and sketched in water colors by our artist, Mr. Chris. Jorgensen, to whom special credit is due for the able manner in which the work was executed. The lithographing was executed by H. S. Crocker & Co., of San Francisco, and speaks for itself, and also establishes the fact that there is no further need of sending such work abroad when satisfactory results can be obtained at home. The biennial reports for the years 1885, 1886, 1887, 1888, and 1889, are about exhausted.

CORRESPONDENCE.

The correspondence for the past year has been very large; numerous letters are received every day from all sections throughout the State; the scope of inquiry being upon topics of interest to those particular sections. In every case they have been given prompt and due attention. The correspondence with Ministers and Consuls in foreign countries is still kept up, and considerable good has been accomplished through it. I am informed that the reports received from the Consulates by the Department of State, United States, are now being printed, and we shall soon receive printed copies for distribution. It is to be hoped that this report will impart the desired information upon kindred subjects, that would aid the horticulturists of this State. With this view I arranged the list of questions, and made them as broad as possible to cover the subjects upon which information is sought. The following is a copy of the instructions forwarded to the Consulates:

DEPARTMENT OF STATE,
WASHINGTON, September 28, 1889.

To the Consular Officers of the United States:

GENTLEMEN: At the request of the California State Board of Horticulture, acting through Mr. B. M. Lelong, its Secretary, the inclosed series of questions relative to the cultivation of oranges, lemons, figs, and olives, is sent to you for reports. You are requested to give such information in response thereto as you can acquire without expense to the Government or to yourselves. But should you find it impracticable to make a satisfactory report without outside aid, you will submit to the Department an estimate of the anticipated cost before you obligate yourself for any specific sum.

I am, gentlemen, your obedient servant,

ALVEY A. ADEE,
Acting Secretary.

MEMORIALS TO CONGRESS.

I have forwarded to the Senators and Representatives from this State, copies of all the resolutions and memorials adopted at the various Conventions held throughout the State. These have been introduced by them in both Houses. I also appeared, while at Washington, before the House Committee on Adulterated Goods, and laid before them all matters intrusted to my care. It is to be hoped that they will be given due consideration.

HORTICULTURAL COMMISSIONERS.

The following are the County Boards of Horticultural Commissioners appointed by the various counties throughout the State since the amendment of the Act, March 19, 1889:

Alameda County Horticultural Commission.

A. D. Pryal, President .... Temescal.
Wm. Barry .... Alameda.
A. P. Crane, Secretary .... San Lorenzo.

Butte County Horticultural Commission.

C. J. Berry, President .... Biggs.
Ed. Harkness .... Oroville.
G. M. Gray, Secretary .... Chico.

Colusa County Horticultural Commission.

J. R. Totman, President .... Colusa.
F. M. Johnson .... Colusa.
Frank W. Willis, Secretary .... Colusa.

El Dorado County Horticultural Commission.

J. H. Thomas, President .... Coloma.
E. W. Meglone .... Granite Hill.
R. P. Patterson, Secretary .... Placerville.

Humboldt County Horticultural Commission.

J. D. Barber, President .... Rohnerville.
Jacob Zehendner .... Rohnerville.
A. P. Campton, Secretary .... Rohnerville.

Kern County Horticultural Commission.

M. Wyatt, President .... Bakersfield.
C. A. Maul .... Bakersfield.
L. W. Burr, Secretary .... Bakersfield.

Los Angeles County Horticultural Commission.

A. F. Kercheval, President .... Los Angeles.
Geo. E. Mitchell .... Pomona.
F. Edward Gray, Secretary .... Alhambra.

Mendocino County Horticultural Commission.

C. R. Thomas, President .... Ukiah.
Mart. Baechtel .... Mendocino.
Carl Purdy, Secretary .... Ukiah.

Nevada County Horticultural Commission.

John Rodda, President .... Grass Valley.
Henry Waters .... Nevada City.
J. R. Vineyard, Secretary .... Anthony House.

Orange County Horticultural Commission.

H. Hamilton, President .... Orange.
F. H. Keith .... Anaheim.
S. W. Preble, Secretary .... Tustin City.

Placer County Horticultural Commission.

M. W. Baker, President .... Colfax.
H. E. Parker .... Penryn.
Geo. W. Applegate, Secretary .... Applegate.

San Benito County Horticultural Commission.

G. Brown, President .... Hollister.
E. W. Bowman .... San Juan.
J. A. Schofield, Secretary .... Hollister.

San Bernardino County Horticultural Commission.

H. B. Muscott, President .... Santa Barbara.
Bradford Morse .... Riverside.
W. E. Collins, Secretary .... Ontario.

San Joaquin County Horticultural Commission.

Joseph Hale, President .... Stockton.
Geo. W. Wise .... Stockton.
W. H. Robinson, Secretary .... Stockton.

San Mateo County Horticultural Commission.

Wm. J. McNulty, President .... Woodside.
Alex. Moore .... Redwood City.
Dr. L. D. Morse, Secretary .... San Mateo.

Santa Barbara County Horticultural Commission.

T. N. Snow, President .... Santa Barbara.
R. Machin .... Lompoc.
O. W. Maulsby, Secretary .... Santa Maria.

Sonoma County Horticultural Commission.

John M. Balhache, President .... Healdsburg.
Mark L. McDonald .... Santa Rosa.
E. A. Rogers, Secretary .... Santa Rosa.

Sutter County Horticultural Commission.

R. C. Kells, President .... Yuba City.
J. C. Gray .... Yuba City.
H. P. Stabler, Secretary .... Yuba City.

Tulare County Horticultural Commission.

J. N. Wright, President .... Visalia.
C. M. Stone .... Hanford.
N. W. Motheral, Secretary .... Hanford.

Ventura County Horticultural Commission.

N. W. Blanchard, President .... Santa Paula.
N. B. Smith .... Ventura.
M. E. Isham, Secretary .... San Buenaventura.

Yuba County Horticultural Commission.

G. W. Harney, President .... Marysville.
Jas. W. Mills .... Marysville.
F. W. Johnson, Secretary .... Marysville.

MEETING OF HORTICULTURAL COMMISSIONERS.

The Horticultural Commissioners, representing the various County Boards throughout the State, assembled for the first time in Convention at Los Angeles, on March 11, 1890. The meeting was called for the purpose of devising some plan by which the Commissioners could communicate with each other upon topics of importance in the discharge of their duties, and also for the purpose of perfecting a permament organization and a general interchange of ideas.

I had the honor of calling the Convention to order, and of addressing the delegates assembled on the importance of the work before the Convention to the fruit interest of the State. A permanent organization was then effected, and W. E. Collins, of Ontario, San Bernardino County, was elected Chairman, and H. P. Stabler, of Yuba City, Sutter County, Secretary.

Mr. Collins, on taking the chair, reviewed the work performed by the various Commissions throughout the State, and also the work performed by his own Commission, and outlined a plan of action for the future.

Nearly all of the twenty-one County Boards of Horticultural Commissioners were represented in the Convention. Various Commissioners addressed the Convention as to the work performed by their respective Boards and Inspectors, who were listened to with much interest.

On motion, M. E. Isham, of Ventura County, and H. P. Stabler, of Sutter County, and E. A. Rogers, of Sonoma County, were appointed a Committee on Order of Business, and, pending a report from said committee, a recess was taken.

On reassembling, the Convention proceeded to roll call of the various counties represented, and reported the rates of compensation allowed by the counties.

The following resolution was adopted;

WHEREAS, Insect pests are rapidly spreading in many parts of the State, and several fruit-growing counties are yet without County Boards of Horticultural Commissioners, which are indispensable in the work of exterminating insect pests; therefore, be it

Resolved, By the County Boards of Horticultural Commissioners in Convention assembled, that we do earnestly recommend the appointment of County Boards of Horticultural Commissioners in all fruit-growing counties, and we ask the Boards of Supervisors to adopt a liberal policy to the Commissions when appointed.

For the purpose of avoiding the spread of noxious insects by nursery stock, a resolution was adopted requesting the various Commissions throughout the State to inform each other at the proper season as to the condition of the various nurseries in regard to pests.

At the various meetings during the week there were full and exhaustive discussions on insect pests, spraying, quarantine regulations, and proposed changes in the laws relative to their suppression.

The meetings proved of much value, and were pronounced a decided success. The Convention, after having received reports from the various committees appointed, and having given them instructions to report at the next meeting, adjourned to meet at the call of the Chairman, at Santa Cruz, in November, at which time and place the Fourteenth State Fruit Growers' Convention will convene.

QUARANTINE GUARDIANS.

The following Quarantine Guardians have been appointed since my last report, viz.: M. H. Baldwin, William Barber, E. B. Flack, John Scote, Harvey E. Smith, Henry Waters, J. R. Vineyard, M. W. Baker, George W. Applegate, H. E. Parker, Edward Polifka, A. M. Pettingill, H. C. Oakley, George Vankirk, W. R. McCully, Fred. Mascott, W. H. Ingelow, H. M. Waldo, David Gregerson, H. H. Ruggles, W. G. Jasper, John Guill, T. B. Huchings, J. W. Benson.

THE LIBRARY.

The following books have been added to the Library (excepting those marked with an asterisk) since our last report. It has been our aim to secure all the standard works on horticulture that have been published in the United States and in foreign countries. We have secured mostly all such publications, and all reports, etc., issued by the horticultural societies, schools and colleges of horticulture and agriculture, of the country. These are of great value, and are indispensable to the student of horticulture and kindred subjects:

AUTHOR.	Name of Book.
Alderton	Orange Culture in New Zealand; 2 vols.
Alfonso	Coltivazione degli Agrumi.
Allemao	Monoc. and Dic. Plants.
Allen	*New American Farm Book.
Allen	Commercial Organic Analysis.
Aloi	Prezzio Lire.
Aloi	The Olive and Olive Oil.
Ashmead	Orange Insects.
Ayer	American Newspaper Annual.
Baccarini	Colori nei Vegetati.
Balfour	Asafœtida Plants.
Barba	Orchidees de Nice.
Bailey	Synopsis of Queensland Flora.
Baker	*Practical and Scientific Fruit Culture.
Ballard	*Insect Lives.
Barry	*Fruit Garden.
Baillon	History of Plants; 9 vols.
Baillon	Botanical Dictionary; 4 vols.
Bentham	Olacineæ.
Bentham	Campan. and Oleac Orders.
Berkeley & Broome	Brisbane Fungi.
Berkeley & Broome	Ceylon Agaricus.
Berkeley	Handbook of British Mosses.
Berkeley	Cryptogamic Botany.
Berkeley	Gleanings of British Algæ.
Berkeley	Cuban Fungi.
Berkeley	Ceylon Fungi.
Berkeley	Fungi.
Bennett	The Orange in New South Wales.
Bennett	Valles spir. Flower Stalk.
Bennett	Hyacinth Flower Stalk.
Bennett	Impatiens Fulva.
Bennett-Murray	Cryptogamic Botany.
Bertrand	Botany.

AUTHOR.	Name of Book.
Bowers & Vines	* Practical Botany.
Berger	* Pomologie Generale; 12 vols.
Barry	* Fruit Culture.
Brannt	Vinegar Acetates, Cider, Fruit Wines, Preservation of Fruits.
Breuil	Fruit Trees.
Brill	Farm Gardening and Seed Growing.
Buckton	*Monograph of the British Aphides; 4 vols.
Bernays	*Horticultural Industries of Queensland.
Black	Cultivation of the Peach, Pear, Quince, and Nut-bearing Trees.
Bleasdale	The Olive Tree.
Brown	*Book on Butterflies.
Brannt	Animal and Vegetable Fats and Oils, Artificial Butter, and Lubricants.
Brannt	Techno-chemical Receipt Book.
Blyth	Foods: Composition and Analysis.
Brebms	*Entomology (in German).
Cameron	*Monograph of the British Phytophagous Hymenoptera; 2 vols.
Cappe	Cultivation of the Olive.
Caruso	The Olive.
Cooper	The Olive.
Comstock	Entomology.
Contance	The Olive.
Cooke	School Entomology.
Cooke	*Injurious Insects of California.
Cooke	Brazilian Fungi.
Cooke	*Microscopic Fungi.
Curtis	*Farm Insects.
Curtis	Trade between United States and Spanish America.
Culver	*Fruit Preservers' Manual.
Crocker	Parliamentary Procedure.
Cushing	Manual.
Copeland	Country Life.
Crozier	Culture and Rearing of Silkworms.
Cox	Mines and Minerals.
Cox	*Hand Book of Coleoptera; 2 vols.
Chapin	Scale Insects.
Coquillett	Methods of Destroying Scale Insects.
Cooke (M. C.)	Grevillea.
Cole	American Fruit Book.
Davis	* Culture of the Orange.
Des Cars	Tree Pruning.
De Mueller	Species Plantanum.
Dreschel	Chemical Reaction.
De Puy	People's Cyclopedia.
Draper	Chemistry of Plants.
Dewey	Picturesque California.
Downing	* Rural Essays.
Downing	* Fruit and Fruit Trees of America.
Downing	* Selected Fruits for Garden and Market.
Douglas & Scott	* British Hemiptera.
Duncan	* Transformation of Insects.
Del Amo	Memoria.
Elliott	* Hand Book for Fruit Growers.
Elliott	* Western Fruit Growers' Guide.
Estabrook	Photography in the Studio and Field.
Enfield	* Indian Corn.
Ellwanger	* The Rose.
Forbes	Poisons for Codlin Moth.
Forbes	Noxious and Beneficial Insects.
Flamant	* Olive Culture.
Flint	* Harris' Insects Injurious to Vegetation.
Flint	* Poultry Breeding.
Figuier	* The Insect World.
Fulton	* Peach Culture.
Fresenius	Manual of Quantitative Chemical Analysis.
Fresenius	System of Instruction in Quantitative Chemical Analysis.
Fuller	Hop Culture.
Fuller	Strawberry Culturist.
Fuller	* Small Fruit Culturist.
Fuller	Propagation of Plants.
Fuller	* Sweet Potato Culture.
Fitz	

AUTHOR.	Name of Book.
Flagg	* Hand Book of Sulphur-Cure.
Frankland	Agricultural Chemical Analysis.
French	* Farm Draining.
Gallesio	* Treatise on the Citrus Family.
Glenny & Ormerod	* Peach and Nectarine Culture.
Garey	* Orange Culture in California.
Grindon	Plant Life.
Gilman	Profit Sharing between Employer and Employé.
Galloway	Treatment of Fungous Diseases on Plants.
Hooker	Plants of Galapagos Archipelago.
Hubbard	Rust on the Orange.
Hance	North China Plants.
Hogg	Apples and Pears; 2 vols.
Hogg	* Fruit Manual.
Henderson	Hand Book of Plants.
Henderson	* Practical Floriculture.
Henderson	Gardening for Profit.
Hall	Irrigation—California.
Hall	Irrigation Development.
Heinrich	Window and Flower Garden.
Haldane	Subtropical Cultivations and Climates.
Hilgard	Alkali Lands.
Hilgard	Methods of Fermentation.
Hart	Plants of Ireland.
Husmann	* American Grape Growing and Wine Making.
Jaeger	* Life of North American Insects.
Joly	Les Orangeries.
Johnson & Hogg	Journal of Horticulture.
Kingsley	* Riverside Natural History; 6 vols.
Kirby & Spencer	* Entomology; 2 vols.
Kern	Practical Landscape Gardening.
King	* Bee Keeping.
Klee	Insects Injurious to Fruit and Fruit Trees of California.
Leconteux	Rural Economy.
Langstroth	*The Honey Bee.
Lindsay	Foot Plant and Poison of New Zealand.
Llaurado	Pamphlets.
Lindley	Horticulture.
Lelong	The Olive.
Lelong	Citrus Culture in California.
Lewis	Los Angeles County.
Lintner	Pests of the Pomologists.
Le Maout	Les Trois Regnes Botanique.
Linnæus	Flora Dalekailica.
Linnæus	Botanical Nomenclature.
Loudon	*Encyclopedia of Plants.
Lubbock	*Monograph of the Collembola and Thysanura.
Langley	San Francisco Directory; 4 vols.
Merrill	Chemical Reaction.
Masters	Passifloraceæ.
Masters	Passiflora of Ecuador and New Granada.
Marvin	The Olive.
Maw	The Genus Crocus.
Mutel	Flore Française.
Maskell	*New Zealand Insects.
Moore	Census of Plants of New South Wales.
Moore	*Handbook of Orange Culture.
Manning	Book of Fruits.
Miers	Oleaceæ Genera.
Murray	Economic Entomology.
Marcourt	*Florida Fruits.
Moule	Vegetation, Creation, and God.
Morris & Henderson	Ringworm Fungus.
McKenney	Pacific Coast Directory, 1887–88.
Newman	Illustrated Natural History of British Moths.
Nilson	Timber Trees of N. S. W.
Norton	Elements of Scientific Agriculture.
Neken	Preparing, Treatment, and Examination of Wine.
Neck	Present and Future Productions of Florida.
Ormerod	Injurious Insects and Common Farm Pests.
Ormerod	* Guide to Methods of Insect Life.

AUTHOR.	Name of Book.
Ormerod	Injurious Insects and Methods of Prevention.
Ormerod	Injurious Insects.
Ott	Soap and Candles.
Orange Judd	* My Vineyard at Lakeview.
Orange Judd	* Flax Culture.
Orange Judd	* Tobacco Culture.
Orange Judd	Farm Conveniences.
Polk	California State Gazetteer, 1888.
Porter	Forestry of Europe.
Potter	Agriculture in Germany.
Perkins	Elementary Quantitative Chemical Analysis.
Paxton	* Botany; 16 vols.
Parlatore	Italian Flora; 8 vols.
Parsons	The Rose.
Pardee	Strawberry Culture.
Phin	* Open Air Grape Culture.
Pierre	Agriculture.
Parparelli	Olive Culture.
Pecori	Culture of the Olive.
Packard	* Half Hours in the Tiny World.
Packard	* Guide to the Study of Insects.
Quinn	* Pear Culture for Profit.
Quincy	* Soiling for Cattle.
Quinby	* New Bee Keeping.
Ridpath	History of the World; 3 vols.
Robinson	Facts for Farmers and the Family Circle.
Roe	* Success with Small Fruits.
Rye	* British Beetles.
Riley	* Locust or Grasshopper Plague.
Rivers	* The Orchard House.
Rivers	* The Fruit Garden.
Rorer	Canning and Preserving.
Riondet	Agriculture in France.
Rixford	* The Wine Press and the Cellar.
Robinson	Letters on Landscape Photography.
Saunders	*Insects Injurious to Fruits.
Stockhardt	*Chemistry of Plants.
Scott	Nurserymen's Universal Directory.
Scott	Passiflora.
Scribner's Sons	*Encyclopedia Britannica; 25 vols.
Smith	Plants with Perfect Seeds.
Smith	British Hymenoptera.
Smith	*Diseases of Field and Garden Crops.
Storer	Agriculture; 2 vols.
Schenck	Gardeners' Text-Book.
Scudder	Butterflies.
Stoddard	Encyclopedia Americana; 3 vols.
Stephens	British Beetles.
Spry	British Coleoptera.
Strong	*Fruit Culture.
Stockhardt & Heaton	*Experimental Chemistry.
Spaulding	*Orange Culture in California.
Triplett	New Law and Form Book for Business Men.
Thorpe	Quantitative Chemical Analysis.
Todd	*Apple Culturist.
Treat	*Injurious Insects of the Farm and Garden.
Turner	*Cyclopedia of Practical Floriculture.
Thomas	*American Fruit Culturist.
Turrill	Products of California.
Turrill	California Exhibits at New Orleans.
Tulasne	Fungi.
Traill	Photographic Amateur.
Von Mueller	Select Extra Tropical Plants.
White	Gardening for the South.
White	Cranberry Culture.
Waring	*Draining for Profit and Health.
Wood	*Rennie's Insect Architecture.
Willet	*Wonders of Insect Life.
West	Petals of Flowers.
Wilson	*Our Farm Crops.
Westwood	*British Moths.

AUTHOR.	Name of Book.
Westwood	*Arcana Entomology; 2 vols.
Westwood	*Insects.*
Westwood	*British Butterflies.
Wickson	California Fruits.
Wickson	California Illustrated.
Woods	*Insects at Home.
Wheeler	Michigan Flora.
Waring	Elements of Agriculture.

Codes.

*Political Code of California, 1885.
*Code of Civil Procedure, 1885.
Deering's Annotated Codes and Statutes of California—Civil Code.
Deering's Annotated Codes and Statutes of California—Penal Code and Statutes in Force.
Law and Practice of Legislative Assemblies.
Journal of the Assembly, Twenty-eighth Session.
Journal of the Senate, Twenty-eighth Session.
Statutes of California, 1880.
Statutes and Amendments to the Codes of California, 1883, 1884–5, 1886–7*, 1889.
United States Statutes at Large; vols. 21–25.
Supplement to the Revised Statutes of the United States.

Reports.

Annali di Agricoltura in Italia, 1876–89.
Notizie sulla Agricoltura in Italia, 1876 and 1885.
Maison Rustique; 5 vols.
Trade Guilds of Europe.
Condition of Agriculture in Italy; 4 vols.
Study of Agriculture (in Italian); 2 vols.
Annals of the Botanical Society (Italian); 12 vols.
Pomologie Generale; 12 vols.
U. S. Geological Exploration of the Fortieth Parallel.
Studi Botanici Sugli Agrami; 2 vols.
Principale Culture Agrarie.
Journal of Practical Agriculture, 1873-80.
Geological Survey of California; 2 vols.
Annals of the National School of Agriculture of Montpellier; 2 vols.
Forestry in Italy (in Italian).
Linne Systema Vegetabilium; 3 vols.
Annals of the National Institution of Agriculture (Italian).
Pomona Italiana (in Italian).
Geological Survey of Canada.
Notize Interno alle Condizione della Agricoltura.
Systema Vegetabilium; 2 vols.
Systeme Sexuel des Vegeteux.
Mantessa ad Linnaci; 2 vols.
Sprengel; 5 vols.
Commercial Relations; 2 vols.
Annales des Science.
California State Library Catalogue.
Register of Purdue University, 1888-90.
Register of the University of California, 1887-88.
Genera Plantarum.
Systema Plantarum Europea; 3 vols.
Industries of N. S. W.
Botanical Gardens of N. S. W.
Sedimentary Formations, N. S. W.
Rain and River Observations, N. S. W.
Soils of N. S. W.
Intoxicating Drink Inquiry, N. S. W.; 2 vols.
Handbook of Statistics of N. S. W.
Statistical Register, N. S. W.
Conservation of Water in N. S. W.; 2 vols.
Department of Mines, N. S. W.
Railways and Tramways, N. S. W.
Fisheries of the Colony, N. S. W.
Board of Technical Education, N. S. W.

United States Forestry, 1877.
Cultivation of the Rose in Italy (in Italian).
Expenditures on Local and National Works, N. S. W.
Customs Handbook, N. S. W.
Fifth Convention of American Florists.
Commissioner of Transportation for California, 1877–8.
California State Board of Silk Culture, 1886–88.
California State Mineralogist, 1885–89; 2 vols. 1885–6, 3 vols. 1889.
Kansas State Horticultural Society, 1883–88; 4 vols. 1887–8.
Colorado State Agricultural Society.
Department of Agriculture of Queensland.
U. S. Commissioner for California at the World's Industrial Exposition at New Orleans.
Borax Deposits of California and Nevada.
Colorado State Horticultural Society, 1882–84.
Ohio Horticultural Society, 1884–85.
California State Viticultural Commissioner, 1881–88.
California State Board of Health, 1871, 1881, 1886, 1888.
Department of Agriculture, U. S. A., 1865–88.
Department of Agriculture, Melbourne.
Missouri State Horticultural Society, 1883–85.
Twenty-fourth Industrial Exposition, Mechanics' Institute, of San Francisco.
Fruit Growers' Association of Ontario, 1888.
New York State Entomologist, 1885.
Entomological Society of Ontario, 1885, 1887–88.
Board of Health for City of Nashville, 1877.
Nineteenth Industrial Exhibition, Mechanics' Institute, of San Francisco.
Railroad Commissioners of California, 1881–84; 2 vols. 1884.
Treasurer of Home for Feeble-Minded—California.
U. S. Patent Office, 1847–61; 2 vols., p. II, 1853.
Royal Agricultural and Horticultural Societies, 1880–88.
Third Biennial Interstate Commerce Commission.
Kansas State Board of Agriculture, 1888.
Department of Agriculture of Illinois, 1888.
European Consulates; 3 vols.
Forestry of Kansas.
Mississippi Valley Horticultural Society, 1883–84.
Montreal Horticultural Society, 1877, 1879–80, 1882–83, 1884–85, 1887–88.
Michigan Horticulture.
United States Consular, 1889–90.
Agriculture of Massachusetts, 1886–88.
New York State Agricultural Society, 1883–84–86.
California State Board of Examiners, 1889.
California State Board of Equalization, 1887–88.
California Agricultural Society, 1878–89.
Reclamation of Arid Lands.
Willard Asylum for the Insane, 1887.
Trip to Australia, by Koebele.
Investigation of Commissioner of Labor Statistics, 1887.
Waters and Water Supply, by Hilgard.
Wattles and Wattle Barks.
On Miami Strawberry.
Board of San Francisco Park Commissioners, 1890.
Agricultural Bureau of South Australia, 1890.
Royal Commission on Vegetable Products.
Fruit Growers' Association of Nova Scotia, 1888–89.
Massachusetts Horticultural Society, 1888.
Universal International Exposition of Paris, 1889.
U. S. Statistical Abstract, 1886–88.
Council of Agricultural Education, 1884–89.
Farmers' Institute of Wisconsin, 1889.
Wisconsin State Agricultural Society, 1889.
Wisconsin Dairymen's Association, 1889.

Bulletins—Agricultural Experiment Stations.

Missouri, 1890.	California, 1886–89.	Vermont, 1887–90.
Oregon, 1889–90.	Mississippi, 1888–90.	Missouri, 1888.
Minnesota, 1888–89.	Texas, 1889.	Nebraska, 1889–90.
South Dakota, 1890.	Wisconsin, 1888–90.	Arkansas, 1889.
New York, 1888–90.	Illinois, 1888–89.	West Virginia, 1887–89.
Virginia, 1889 (3 Nos.), 1890.	Massachusetts, 1888–90.	Iowa, 1888–89–90.
Delaware, 1888–89.	Nevada, 1888–89.	New Jersey, 1887–90.
Maryland, 1889.	Colorado, 1887–90.	Michigan, 1888–90.
Nevada, 1889.	Connecticut, 1888–89.	Alabama, 1888–90.
Tennessee, 1890.	Rhode Island, 1889–90.	Ohio, 1884–85, 1888–89, 1890.
Alabama, 1890.	Kansas, 1887–89.	Pennsylvania, 1887–90.

In the supplement to this report the results of the investigations carried on since the issuance of our last annual report (1889) are given, together with later notes.

Very respectfully,

B. M. LELONG,
Secretary.

CONVENTION OF FRUIT GROWERS.

PROCEEDINGS OF THE THIRTEENTH STATE FRUIT GROWERS' CONVENTION.

OPENING DAY.

LOS ANGELES, CAL., March 11, 1890.

ORDER OF BUSINESS AND SUBJECTS FOR DISCUSSION.

Tuesday, March 11, 1890.—The Convention assembled at 10 o'clock A. M.

1. Calling to order by the President.
2. Election of two Vice-Presidents.
3. President's semi-annual address.
4. Address of welcome.

Afternoon Session, 2 o'clock.—"Insect Pests and their Extermination."

Wednesday, March 12, 9:30 A. M.—"Planting, Cultivating, and Pruning."
Afternoon Session.—Excursion to Pasadena.

Thursday, March 13, 9:30 A. M.—"Selecting, Preparing, Packing, and Marketing Fruits."
Afternoon Session, 2 o'clock.—"Olive Culture and Citrus Fruits."
Evening Session.—"Floral and Forest Culture."

Friday, March 14, 9:30 A. M.—"Fig Culture, Table and Raisin Grapes, and Small Fruits."
Afternoon Session—"Diseases of the Vine;" "Tariff on Fruits;" unfinished business, and arrangement for next Convention.

CALLED TO ORDER.

Hon. Ellwood Cooper, President of the State Board of Horticulture, called the Convention to order promptly on time. Rev. Eli Fay, of Los Angeles, opened with prayer.

ELECTION OF VICE-PRESIDENTS.

The President announced that it would be in order to select three Vice-Presidents. The following persons were elected: J. B. Lankershim, Dr. J. P. Widney, of Los Angeles, and Dr. O. H. Conger, of Pasadena, who took their places on the stage.

At the opening of the Convention, there were on the platform, besides the President and Vice-Presidents, Governor R. W. Waterman, His Honor

Henry T. Hazard, Mayor of Los Angeles; Colonel E. W. Jones, President of the Chamber of Commerce; Rev. Eli Fay, Dr. O. H. Conger, Hon. L. W. Buck, the Vice-President, and various members of the State Board of Horticulture, and Secretary.

OPENING ADDRESS.

By HON. ELLWOOD COOPER, President of the Convention.

(Vice-President L. W. BUCK in the chair.)

PRESIDENT COOPER: Ladies and Gentlemen: This will be the thirteenth State Fruit Growers' Convention, and the ninth held under the auspices of the State Board of Horticulture. It has been my privilege to preside at these Conventions, beginning with that held in Los Angeles, in November, 1885.

At that Convention, and at each subsequent one, I called your attention to the important questions which I thought most concerned us. So many times have I repeated these subjects and enlarged upon any special line of interest as manifested in the discussions, that I do not consider it necessary to present the same views again. In the first instance, a statement somewhat in detail seemed fitting and proper; now, most of you are as familiar with the subjects as myself. Those who are new in the line of seeking horticultural knowledge, I refer to the reports which we have here for gratuitous distribution, and to the programme presented, which outlines the discussions of this Convention.

At this time, and in the future, should I hold my present position, and feel it my duty to make an opening address, I will confine my remarks to some special subject or subjects, the importance of which may have been impressed upon me by the discussions at the preceding Conventions. In this instance it is the vine disease.

At the Fresno Convention, held in November last, there were four distinct theories presented to account for this terrible calamity which has spread over parts of Los Angeles County and adjoining districts; also one suggestion.

The Fresno people maintained that in their county all the vines that had died could be accounted for by bad drainage and alkali; that no disease had appeared there, and that no danger was apprehended. The suggestion offered was, that everything has a period of life, and there was a possibility that the period of life of the grapevine was nearing its end, and would sooner or later disappear from the face of the earth. The first theory advanced gave the cause as poverty of soil, the vines dying from lack of sap or poisonous sap.

The second theory claimed that by the cultivation of trees and plants in Los Angeles County the climate was changed, and becoming more tropical was not adapted to vine growing in the localities where the disease had made such havoc.

The third theory contends that too early pruning was the cause.

The fourth theory held that it was a disease not yet understood, and was spreading with alarming rapidity.

I believe it was generally conceded that the vines died at the top first, that is to say, from the top downward, and not from the root upward, which is usual with plants. The different authors of these theories were persistent in impressing their views, which indicated a conviction on their part. It is characteristic of our American people that when anything out of the usual course occurs, every individual rushes after a theory of his own make up, and those who are not directly interested, after having matured a theory, let the matter rest and assume an indifferent position as to the result. We are all indirectly sufferers and should be united as one mind, free from bias, to ferret out the cause and find a remedy.

At said Convention there were also many severe expressions made criticising experts who were investigating this malady, almost to the extent that they were wrong in all their conclusions. Such a sentiment, if encouraged, will lead us backward instead of forward. I was extremely sorry that any such expressions should have been made. I am conscious that scientists may make mistakes, but all are not on the wrong line of investigation. To the specialist we must look for the solution.

I have made no examination, and have seen but little of the vineyards where the disease was prevalent, but I have listened to the statements of the different parties who have examined the vineyards in different localities, experts as well as owners, neighbors, and sufferers, and have gathered such information as leads me to the following conclusions:

First, as to the suggestion that the vine might be nearing its end, I am not prepared to seriously consider such a condition. It is true that many plants that once flourished do not now exist, but their disappearance is accounted for by great convulsions and climatic changes that made their further growth and life impossible. It is also true that some scientists have suggested that the two species of Platanus, the one known on the Atlantic Coast as the buttonwood, the other on this coast as the sycamore, were approaching their end, since for several years they have been subject to serious blights all over the world. This takes place every spring. From this supposed weakness scientists have concluded that the final end was near, but may it not be a disease that could be successfully treated. The loss to the world of the grapevine is more than I am willing to believe is probable.

The first, second, and third theories—poverty of soil, more tropical climate, or too early pruning—do not satisfy my mind as to the probable cause. Young vines on virgin soil of the best quality have succumbed. Grapes of the finest quality are produced in the tropics, besides there has been no material change in climate. Pruning could not be the cause, as wild vines in the cañons, grown for ages without being disturbed, have died. Neither bad drainage nor alkali will account for it. The fourth theory, that it is a disease, is not so easily disposed of. Experts have asserted that the microscope could not detect any fungi; that the root of the affected vine, compared with one in a healthful condition, was exactly the same; that it was a sort of paralysis or a wilting death without any apparent cause. The impossibility of discovering these poisonous particles, by reason of their minuteness, proved nothing, because if we consult the New American Cyclopædia, page 246, where it describes this character of fungi under the head of "Oidium albicans," vegetable parasites of man, and "Oidium Tuckeri," known as Mildew Tuckery, or vine mildew, which has proved such a destructive pest to

the vineyards of southern Europe and Madeira, we will find this statement: "That neither time nor the powers of chemistry avail aught against them, which are so subtile in their invisibility, and may be wafted from one point of the earth to another by wind and wave." It seems to me, therefore, that it is safer for us to conclude that it is a fungous growth of a poisonous character; that the particles float and are carried through the air, and taking root in the tender leaves, grow and kill the vine, notwithstanding the fact that the particles and the fungous growth may be so minute, so subtile in their character, that they remain as yet undiscovered.

In my experiments with poisonous substances, in a mild form, for spraying trees, I found that wherever the insects were touched they were killed. The second or third day afterwards the tender shoots began wilting. This continued by degrees until all the tree above ground was dead. I practiced the clipping off of the branches, thinking to arrest the poisonous influence, but it was ineffectual. In cutting the wilting branches I found a black streak between the bark and wood. I would keep on cutting until I found the natural appearance; still the poison would work its way downward until the roots were reached. When the effect ceased, new shoots were thrown up and they are now growing. The trees with which I experimented were the olive and lemon, the effects being about the same on both. The poison entered through the pores, united with the sap, and killed the tree above the roots, but why the roots were not killed is more than I can comprehend. I have understood that the vine disease acts to a certain extent in a similar way; that is, the top wilts and dies the first year without necessarily killing the roots. The second year new shoots are thrown out, but wanting in vigor easily succumb to the disease, and the root follows. I sincerely hope that much new light will be given on this subject during the sessions of this Convention.

PARASITES, AND PREDACEOUS INSECTS.

I desire to call your special attention to this branch of our horticultural work. The success in fighting the red scale with the resin wash, the San José scale with lime, salt, and sulphur, and the codlin moth with arsenic washes and the Thistle trap, ought not to divert our attention from searching for parasites to pit against these insects and destroy them in the manner Nature intended. I stated at the Fresno Convention that the law would not permit the State Board to expend money in sending an entomologist to foreign countries to search for parasites. We should not relax our efforts in trying to secure this work from the National Government.

I have read recently a report on insects and fungous pests by Henry Tryon, of Queensland, Australia, published in Brisbane in 1889. I find on examination of this work that they have many noxious insects very destructive in their character, preying upon fruit and fruit trees that have not yet appeared in our State. The greatest precaution should be exercised in the examination of all plants landed on this coast from that country. I have been deeply interested in the numerous parasites that are also found there, as described in said work, and the opinion that I always maintained, viz.: that we must look to Australia for parasitic insects to aid us in combating noxious insects, has been fully confirmed.

On page 16, in speaking of the coccinellidæ beetle, he says: "Wherever aphides exist there, there are ladybirds in the larval or adult condition to feed upon them. It is for destroying our scale insects that the coccinellidæ are here most highly useful. To mention but a single instance, that of a small black beetle reddened at each extremity, belonging to the group "Scymnites" and named cryptolœmus. The larva of this is a small active grub measuring about one fourth inch in length, covered above with six rows of contiguous elongated white mealy secreted appendages. Quite recently the bunya bunyas and other auricaraceous trees growing about Brisbane have been infested by a coccus insect, an apparently undescribed species of dactylopius, which affects especially the spot where the leaves and branches unite, and the insects were at one time so numerous that the death of these valuable trees from their attacks seemed very imminent. However, the cryptolœmus beetle also visited the auricaries, and in some places its larvæ occurred in such profusion that the trunks of these trees and the ground around their bases looked as if flour had been dusted in patches here and there upon them. Both in its adult and larval condition it waged war upon the coccid insects, and as a result these trees are saved from destruction. This friendly insect is none other than the one which is met with on various native trees, especially acacias, and also on the citraceous and other economic plants of our gardens. Here also it visits for the purpose of ridding them, or at least checking the increase of the various scale insects, especially those belonging to the lecanidæ, which infest these trees, and these pests it literally mows down to the surface of the leaf, so great is its voracity."

Again, on page 17, he says: "In 1873 it was brought under the notice of the Secretary for Agriculture, Victoria, that one of these insects, namely, *Bracon capitata*, was a very effectual enemy to the grasshoppers, one informant stating that he had noticed that when the locusts were most numerous this ichneumon fly was to be seen in great force."

Count Castlenau, the celebrated entomologist, in reference to this insect, stated also: "This parasite is most important, as I believe it will be to it alone that we may one day owe the disappearance of the locust." Again, on page 18, he says: "The most remarkable case, however, is that of a moth which, in Australia, rids us in great measure of our scale insects. Public attention was first directed to its existence by Mr. G. Masters, at a meeting of the Linnean Society of New South Wales, held in 1885, at which he exhibited some small moths (afterwards named *Thalpochares coccophagus*) bred from caterpillars found feeding on a coccus which infested the common Zamia. These caterpillars, Mr. Masters remarked, in the course of a few days completely cleared the plant of the scale, devouring the coccus and forming with the scales, or empty skins, complete coverings for themselves, which they carried about on their backs. They fed at night, and during the day fixed themselves securely to the midrib of the frond. Now, this useful insect is exceedingly common both in the Toowoomba and Brisbane districts, and it is probably widely represented in southern Queensland. Every tree in these districts which is infested with black scale (*Lecanium oleæ*) will afford examples of *Thalpochares coccophagus*. Strange to observe, we have never met with one in this colony who has

recognized the role of this insect. Whenever, at Toowoomba, we sought typical examples of the black scale for study, we were directed to examine the angles between the branchlets of the orange tree for 'extra fine examples' of the coccus we were in quest of. Indeed, we found more than once that these alone remained, together with fumagine, to attest the previous occupancy of these trees by the scale insect in question. In these instances the species of mimicry which Nature had evidently wrought (with such perfection as to effect in this caterpillar a resemblance to extra fine examples of black scale) to serve for this caterpillar as a safeguard from destruction at the hands of the ordinary foes of insect life, tend only to insure its being killed, its utility being overlooked." A further description of this insect is to be found on page 126. I will not copy further, but the numerous parasites and predaceous insects described in said work ought to impress upon our minds the importance of an immediate investigation, even if only a semblance of fact should be credited to the report.

I urge, therefore, that we memorialize Congress for an adequate appropriation to defray the necessary expenses of a specialist to go to Australia and adjacent islands, to investigate these reported predaceous insects; and to petition the National Government to send Professor Albert Koebele as such specialist at the earliest possible moment, with instructions to collect such parasitic insects as are found preying upon noxious insects, and send them to Professor D. W. Coquillett for colonizing and distribution in California and other parts of the United States.

I also desire to call your attention to the fact that we are extending our fruit orchards, which will enormously increase the fruit product, and that no united effort is being made to better distribute the fruits. There seems to me to be great danger in rival fruit companies rushing large quantities of fruit into the same market, depressing the prices and causing serious losses to the growers. Merchants who handle or sell goods, having no interest except the commission, as a matter of course make more or less money, according to the bulk of their business.

The fruit growers cannot expect to sell their fruits at their orchards, or at the nearest shipping point. In order to get their just share of the proceeds they must be interested until the fruit almost reaches the door of the consumer. How is this to be brought about? It would be better to make an effort to combine the fruit companies, or divide the territory. One thing, however, is manifest, and that is, if the fruit growers expect to get their just proportion of the proceeds, have their fruits in every possible market, and in proper quantities, they must be united and manage the business themselves.

GOVERNOR R. W. WATERMAN'S REMARKS.

In introducing Governor Waterman, the President stated that this was the first occasion upon which this Convention had been honored by the presence of the Chief Executive of the State in discussing the fruit problem.

The Governor made a few remarks congratulating the Board on its work, and the fruit growers upon the interest they manifested in their chosen occupation.

Our efforts must be to improve upon our methods of cultivation, irrigation, and varieties of fruits, and concentration in marketing and shipping.

REMARKS OF MAYOR H. T. HAZARD.

THE PRESIDENT: I have the further pleasure to introduce to you the Mayor of the City of Los Angeles.

MR. HAZARD: Mr. President, and Ladies and Gentlemen: It is a peculiar pleasure to me to welcome to the City of Los Angeles a body representing, as you do, the fruit-growing interests of our State. It marks a new era in the prosperity and growth of our State. I take pleasure in welcoming you to Los Angeles and Southern California, because we look to you as the representatives that should bring, in connection with the cultivation of the soil, intelligence, learning, wisdom, and experience, and it is with pleasure that I listened to the address of your distinguished President, showing that while we have men who can cultivate our soil, we have knowledge that looks abroad for information and experience. And when we bring to our aid the experience of mankind in different parts of the world, I believe that Southern California will, in a few years, become the garden spot of the world.

Believing, then, that you represent the true interests of our State, I am proud and glad to welcome you to Los Angeles. I hope that your stay will be pleasant, and in years to come, if you see fit (and you will always be welcome) to be again with us, we will be glad to meet you. Hoping that God may speed you in your good work, we say go on. Thanking you, and hoping you will have a pleasant stay, I bid you good day. [Applause.]

ADDRESS OF WELCOME.

THE PRESIDENT: The fruit growers of Los Angeles and surrounding districts have selected one of their fellow citizens to deliver the address of welcome, the usual course that has been adopted at all the preceding Conventions. I take pleasure in introducing to you Dr. O. H. Conger, of Pasadena.

DR. CONGER: Mr. President, Ladies and Gentlemen: It is always a pleasing duty to stand as the representative of, or participant with, a self-devoted people to a great principle or cause, and upon this occasion it is especially gratifying to welcome so large and distinguished a delegation of representative horticulturists from abroad to the hospitalities of all Southern California. To you we extend a hearty greeting and warm welcome.

Again we meet to do honor to this largely augmented industry since the last annual assemblage. We meet also in the direct and indirect interest, not only of the intelligent horticulturist of the land of the orange and the vine, but in the interest of mankind at large.

No bounds can define the limits of thought or the generous offerings from the great storehouse of knowledge accumulated during the decades of struggle, successes, and failures in pursuit of the oft perplexing and

diversified horticultural industries of our coast. The zones of peculiar environment are being more clearly and legibly marked throughout the entire Pacific Slope, and a better understanding also of this vital question is near.

A quarter of a century ago we were famous for our exceptional and boundless mineral resources, and long ago explorers had searched the nooks and corners of our rugged mountain fastnesses in pursuit of Nature's unseen and unknown golden treasures, exciting the cupidity and envy of the monetary centers of the commercial world by the revelations thus obtained.

To-day our ambition has changed, and we convene not under a tent or the broad sheltering arms of the majestic pines of the Sierras, but here, in halls of grander proportion and enchanting beauty, as representatives of an advanced civilization, to celebrate anew an era of progress freighted with greater responsibilities and inspired with even grander achievements in the life history of our beloved State—a worship consecrated to the shrine of Pomona.

The growing effort to harness the subtle forces of Nature to do our bidding in the upper realm of plant life, taxes to the utmost the research, skill, and practical application of the principles involved in technical science.

Alchemy of old, and chemistry of to-day, reveals to the student of Nature and human understanding the wondrous beauty everywhere wrought throughout the known universe by that great, primal, exacting, and inviolable law of chemical affinity. Neither sunlight, heat, nor moisture can evade implicit obedience and refuse to shed their benign influence to sustain and perpetuate organic life. If, therefore, the horticulturist seeks a mountain home and consigns to these soils, at increased altitudes, the seeds, the tubers, and the various fruit trees of the valleys below, although warmed into life by the same rays and moistened by the same dews or rains that flow from the higher to the lower levels, those germs locked up and lying dormant in these organic forms of life will awaken and manifest fuuctions, when springing forth obedient to inherent law, varying in a more marked degree than were the efforts of these dormant life germs aroused from their slumber at the lower levels of their former home. Environment works wonders, as chemical affinity, to which all forms and conditions of life are due, is called into active service only to comply with conditions under the law of correspondence.

If a soil is wanting in lime, iron, or organic matter, and the product sought requires one or all of the foregoing constituents, it is plain to the reasoning mind that this deficiency must be supplied to secure remunerative returns.

We have all observed, undoubtedly, that the apple, pear, or peach grown upon the mountain side clothes itself in raiment of rarer beauty and drinks in and stores up from the purer atmosphere more delicate and delicious qualities than seems possible from the grain soils and loaded atmospheres of the river valleys. And is it not a matter of record already that a discriminating public taste gives preference to the upland fruits and vegetables?

The successful horticulturist, as a rule, exemplifies a familiarity, more or less, with the chemistry of plant life, and when it shall become more general, it will be observed to have a greater practical value; and then our river bottoms will very generally be given over to the coarser products—those requiring less exacting environment for the best results. Then, also, will the mountain sides swarm with a happier race embowered in groves of golden fruit and trailing vines, immeasurably broadening our area thereby for the production of the nobler and rarer fruits of the soil.

We often regard with wonder and admiration the comparative exactness with which our physical maps are traversed by isothermals through all degrees of latitude, meridian, and altitude, as well as defining the approximate limits of various diseases to which human kind are liable, and yet the horticulturist may be to a degree skeptical in establishing quite as exact limits to the fruit isothermals throughout the length and breadth of California. But this will scarcely disturb our equanimity, however, for as yet we are laboring under the ban of an experimental age; floundering in an open and angry sea of doubt and uncertainty, and it may be that our charts and past records will require revision, gauged by the more exact requirements demanded by science and philosophy.

Not a petal of the flower or blossom, not a blush upon the luscious peach or dainty berry, but what yields a willing obedience to exacting chemical formula; yet the novice may oftentimes seem unreasonably persistent in contending against these exacting conditions of science and law.

If asked, however, why his calf or colt, for instance, is so poor in flesh and stunted in growth, he instantly comprehends the situation, but fails to extend his narrow limits of vision, not realizing that the same general laws of chemical affinity bring together the elements of matter to form the flesh and evolve the aroma of all fruits that under varying functions perform equivalent offices in replacing the wasted tissues of all animal forms.

The crystal age, the plant age, and the animal age, define the grand divisions of matter, as also the tangible side of all expressions of organic life.

Within this grand trinity of Nature also circles and centers all inorganic and organic substance. The life principle and function inherent in, and running through all, is largely interchangeable, a coördination that necessitates a mutual dependence. Endowed as California is with the richest heritage from the hand of Nature, in treasures of fine metals, and soils plethoric with all possible unknown resources, under the guiding star of science and reason what may not be anticipated, even at this early day, for the toiling millions that are to crowd in upon us? With this reasonable prospect in the near future, should not both State and National Legislatures be constantly importuned to accord additional facilities, that the masses may receive the necessary instruction so as to thoroughly equip them with the practical knowledge requisite in the pursuit of all branches of horticulture under the variable conditions of environment? That will tend also to lessen the large holdings of wild and untamed acres susceptible of the highest culture known to art, thereby opening avenues to the incoming applicants, granting them the privilege of contributing to the State and National treasuries their just quota of the taxes.

The family now barely subsisting upon a five-acre tract, under a more favorable condition suggested by the better standards outwrought

through an intellectual activity, could avail themselves of accrued circumstances to materially mitigate the exigencies surrounding their life of toil, and thereby also greatly enlarge their circle of usefulness.

The law of demand and supply in plant life is inexorable, and starvation is no less readily observed on the foliage of the fruit tree than upon the form of an animal. The neglectful and indifferent fruit grower must, therefore, be held responsible, although the public are powerless and the neighbor outpowered to mitigate or retrieve the injury and loss thus sustained. The loss of fertilizers available by the slothful class would retrieve a fortune thus wasted. This is painfully observable upon every hand, and millions of money annually disappear from the aggregate sum by this wanton destruction of this invaluable plant food.

The sewage and other fertilizers of our cities, if properly utilized, would largely return the money drawn upon them for the fruits and vegetables consumed. These streams of perpetual and accumulating wealth are usually consigned to the maw of old ocean as food for the finny tribe, and forever lost to the world. Thus, history is permitted to repeat itself in this day of chemical science and general enlightment upon the elements and necessary constituents of plant food.

The chemical function of plant life in the inviolable economy of Nature is to transform and transmit noxious vapors and other organic substances. The waste, and all refuse thrown off in rebuilding and sustaining all organic forms, is so much elaborated plant food to be again resurrected and reincorporated that at each round in the order of Nature, of the life, death, and resurrection of the elements of matter, the reunion of these elements may gradually raise from the lower or less developed to the higher and more perfect forms of beauty and usefulness all plant life. Thus, in the natural order of things, supplemented by human art and wisdom, the wild fruits and flowers unfold to delight and compensate the searcher after the more pleasing and valuable.

Night soils, of all fertilizers, must stand at the head as of the greatest value, and every ton of the same thoughtlessly drained off to an irrecoverable destination becomes an irreparable loss to the aggregate wealth of the world. Economists regard all organic waste, whether of animal or plant, as one form of the evolution of matter, and also modern thought, as that lost form in the more tangible world of cause, decreed in the prophecy at the advent of a world of fire mist, and fulfilled in the recognition of a world of endless mutations and infinite possibilities.

It may remain as an undisputed proposition that it is as essentially necessary to recuperate enervation or vital energy in the soils or plant, as in the animal, and a precinct or State that fails to return an equivalent for that taken from producing soils—to restore that which has already been extracted and stored up in the grain, the fruit, or vegetable—will as certainly bankrupt such soils in a comparatively brief period, as the banker who suffers drafts upon his institution to exceed the deposits.

To reach the highest degree of economy and excellence in horticultural pursuits, ideal standards may be sought by a series of experiments; and when attained, a record of the methods employed should form the basis of a practical application upon a more extended scale. By such methods, not only could standards be raised, but bank accounts also largely augmented. Anticipating the accretion of our present population, by natural and other causes, to a hundred millions or more within the limits of the national area during the nineteenth century, what more urgent necessity could be suggested to adopt better methods than to pursue a policy looking to a speedy reduction of the now large holdings of land to the minimum in acreage, as the basis of a subsistence by occupancy of families, large or small.

Thoroughness is the watchword of the hour, and those who heed the admonition will duly attain to a greater degree of material prosperity, a fund of most useful knowledge, as well as surround themselves with conditions more pleasing and attractions envied by the less thrifty, stimulating a passion also in others to excel, thereby becoming double benefactors to the world.

Fearing, however, that the time alloted to this portion of the exercises has already been exceeded, although the propositions announced have received but brief mention, I trust that the discussions that are to follow, of all important horticultural questions, will merit a more extended consideration at the hands of so distinguished a delegation of representative horticulturists now here assembled from all parts of the State.

Admonished, therefore, of the labor before this Convention, and the value of time, in closing I beg simply to assure my neighbors of the southern citrus belt, that from the vine-clad slopes of Shasta's snowy zone to bustling San Diego, there are thousands of "sly little nooks along the babbling brook," as well as broad acres yet unknown, waiting patiently for the touch of knowledge and skill to ultimately startle the more conservative and cautious with thundering train loads of the golden apples of Hesperides, to further add to the joys and common blessings bestowed upon mankind; and with this conviction in the ascendant, and also as an honored participant in these deliberations upon this auspicious and happy occasion, it affords me renewed pleasure on behalf of all the people of this portion of the Golden State, and more especially those of the Queen City, to again extend to you all, not only the right hand of fellowship, but also a most hearty welcome to a generous hospitality during your sojourn in our midst.

VOTE OF THANKS.

Mr. A. Block, Santa Clara: I move that a vote of thanks be extended to the Chief Executive of the State, for the interest he has shown and taken in horticulture and for his presence with us.

The President: In putting that motion I will ask that the Convention show their appreciation of the presence of the Governor at this meeting by a rising vote.

The motion was unanimously carried.

A vote of thanks was likewise given to Mayor Hazard and Dr. O. H. Conger for their presence and addresses.

AFTERNOON SESSION.

(President Ellwood Cooper in the chair.)

INSECT PESTS AND LAWS THEREFOR.

Essay by W. E. Collins, Ontario.

There is no branch of the horticulturist's work that demands so much of his careful and studious attention as does this. Having decided upon the class of fruit he wishes to depend most largely upon for profit, and selected his land with that end in view, he can enlist the advice of trustworthy, experienced friends and responsible nurserymen as to the particular varieties to be planted. He may even closely observe and follow their methods of pruning and cultivation, and be reasonably sure of profitable returns in due time. But in his fight with insect pests he will encounter difficulties not presented by any other branch of the work, and with which he must reckon and wrestle largely unaided. It can be no longer doubted, I think, that the various kinds of insects are more prolific and more tenacious of life in some localities than in others. As a consequence, each locality must conduct its own experiments in order to determine the most successful remedies to be employed for their extermination. Seasons differ from the preceding or succeeding ones. The rainfall is more or less copious; winds more or less violent, and differ in prevailing direction and character. Hence, these experiments, to be of value for after reference, must be conducted in a careful and systematic manner. A careful record should be made at the time of application, of the date, time of day, fog, clouds, rain, altitude, temperature, humidity, direction and character of winds, not only at the time, but for two or three days preceding and following; mode of preparation and quantity used. It is probably within the knowledge of every one present that a remedy successfully used by one has utterly failed in the hands of a neighbor. Such failures are far too common, and I attribute them largely to an imperfect preparation, a careless application, a neglect in observing some or all of the conditions just mentioned, or a disregard of the knowledge gained therefrom.

"In union there is strength," so coöperation in dealing with this question is just as important and will be as productive of good results as in the marketing of our fruit or in any other aim which such means may be lawfully employed to accomplish. The industries of this State are as varied as they are becoming important, and taken together form one grand aggregate, which compares favorably with many of the older States. In that particular one which we represent, and are here convened to discuss, it ranks with the foremost, and the growth which horticulture has made here the past ten years will be eclipsed by the phenomenal strides it will make the next five. Mining, agriculture, and various other industries have gone to the Legislature and asked for and obtained the legislation which they deemed necessary to enable them to conduct their ever expanding operations to the best advantage. The fortress has also been stormed in our behalf, and with good results. Since the first Act respecting insect pests was passed in 1880, we have had progressive legislation, and last session gave us the best yet, largely through the indefatigable efforts of the Secretary, Mr. Lelong, and Mr.

E. W. Holmes, representative of San Bernardino County. But we need more yet, and by coöperation we can get it. In our county, our Horticultural Board compiled statistics from which they were able to show the Supervisors that the fruit interests represented 71 per cent of the total assessment for that county, or 91 per cent, excluding railroad property. Many of the fruit-producing counties can do the same thing. And every one can show that it is entitled to the fostering care of the Legislature and the County Supervisors. I am sorry to learn that in a few counties these latter officials are so indifferent or obstinate, that they refuse their support to the Commission which they have created. Let such be relegated to their narrow spheres, and more enlightened men installed in their stead. Now, if we can substantiate these claims of importance, we are assuredly entitled to have our petitions heard and carefully considered by the Legislature. Let us see to it next fall that our representatives are men heartily in accord with this sentiment, and we shall have taken one great step in advance.

Each Act placed on the statute books evidences the fact that the intention of the Legislature has been to provide machinery whereby we might control this insect question. In 1883 the State Board of Horticulture was called into existence by a Legislature which did not forget to add that its members should practically serve without compensation. All praise to the worthy men who have paid their $5 for their commissions to serve their unappreciative fellows in a thankless, emolumentless office. We are to-day enjoying the beneficial results of their love-given labors, and no true horticulturist will deny the fullest meed we can bestow in return for their great sacrifices of time and convenience. But their territorial jurisdiction is so extensive, the conditions so dissimilar, that at best their work must partake largely of a directorial character, a kind of paternity as it were. The changes in its organic law, which were made in 1889, clearly reveal the point which I desire to emphasize, *i. e.*, that we must rely on our County Boards for effective work, always presupposing that they are constituted of intelligent, conservative men, acting in harmony with the State Board.

The Act of 1889 made it mandatory on the Supervisors to appoint a Horticultural Commission, on the presentation of a petition properly signed. In order that the object of the petition and the will of the people may not be defeated by parsimonious or obstinate Supervisors, the fifth section of this Act should be amended so as to make the compensation of the Commissioners not less than $3 per day and expenses, and of Inspectors not less than $2 50 per day, of actual service in each case. As it now stands the Supervisors may negative their action by allowing a nominal compensation. It can be safely intrusted to them not to fix it too high. We want intelligent, progressive, active men as Commissioners. If they are even aggressive it will not hurt any one, so long as they are not impolitic nor offensive. But a fair compensation should be paid, not only to Commissioners, but to local Inspectors as well, so that the best men may be induced to serve.

But it is in the matter of quarantine regulations that we need and must have more positive legislation. I am not sure but I was mistaken when I stated our legislation had been progressive. In reference to County Boards it has been, but in some other respects it has not. The vital weakness of all of it is that it relies upon disinfection as a sufficient protection against the spread of insects and diseases. The

experience of the past fifteen years has proved this a fallacy. We have sprayed and dipped and disinfected by various processes, still the scale bugs have journeyed far and near in blissful ignorance of the long and short haul clause.

Now, I expect I shall tread on the toes of the nurserymen, but they must not be too sensitive. It should be borne in mind it is the recalcitrants we are after. Every honest man among them will admit that the nurseries are, to a large extent, responsible for the spread of insects. Who among them, if he were setting out a young orchard, would not prefer to purchase his trees from a nursery in which or its surroundings these enemies could not be found? Then common honesty should deter him from offering for sale what he would not plant himself. The older fruit-growing communities I expect to demur to some extent, but they should not so soon forget the struggle for existence they have had, but join in the effort to endeavor to spare the younger communities a repetition of their experience. Where orchards and nurseries alike are infested the necessities of quarantine are not so apparent; but to those sections in which horticulture is in its infancy, where an increasing interest is being taken in it, and farms are being rapidly changed into orchards, or virgin soil under the magic influence of water is made to blossom and produce wealth for its owners, it is of the most vital importance that they should have the undoubted power to protect themselves against the reckless distribution of trees from pest-ridden districts. Where we find *Icerya purchasi* in the soil in boxes containing shrubs and plants; where we find *Aspidiotus perniciosus* plastered over the deciduous trees offered for sale, and in many cases actually shipped and delivered; where we find live *Aspidiotus aurantii* on green pears offered for sale by grocers and hucksters sixty miles or more from where they were grown, is it not time to pause and consider whether the means of protection we have been relying upon are not inadequate? When such conditions exist is it not wise to seek some other means to put a stop to this pernicious recklessness that threatens to overwhelm the profits of this whole industry? Mr. President, I live in a community where but one sentiment prevails on this question. They had rather deprive themselves than receive from any quarter that which would, if it gained a foothold, threaten extinction of what they have. By unanimity of sentiment and coöperation of effort they have succeeded thus far in keeping themselves to a very great extent free from danger, and in a single decade have risen from nothing to an export fruit trade this year of not far from $3,000,000; and this is only the beginning. I am convinced unless we coöperate in a more comprehensive manner than as yet, to put into force the laws we now have, and ask the Legislature for more clearly defined quarantine powers, our efforts to overcome these fruit pests must prove abortive.

A careful study of the legislation on insect pests shows it has clearly been the intention of the Legislature to give extensive quarantine powers. In every Act relating to the State Board or the organization and powers of County Boards, quarantine is mentioned as among their duties, but they fail to define in what manner it shall be executed. In that of 1889 relating to County Boards, it is made their duty to report to the State Board "what is being done as to quarantine against insect pests and diseases." But no mention of any power to quarantine is made.

In the Act of 1889 relating to the State Board, Section 6 provides for a quarantine officer "who shall have power to enforce all rules and regulations (made by the Board) regarding the spread of insect pests, *quarantining districts or nurseries* found to be infected," but not a word as to how quarantine is to be effected. In both of these Acts there is only an inferential intention on the part of the Legislature to confer quarantine powers. They stopped short of a clear declaration.

In Section 6 of the Act of 1883 creating the State Board, we find these powers clearly and well defined. It was there made mandatory on the Board, on the report of the State Inspector or other well attested facts, to declare infested districts under quarantine and subject to the rules and regulations of the Board in that behalf. But here again the Act failed, for in the powers enumerated to make rules and regulations for various purposes, *quarantine* is carefully omitted. Nowhere in all the other Acts on this subject is there a well digested plan of quarantine, accompanied by specific authority to enforce it, except in the Act of 1881, defining and enlarging the duties and powers of the Board of State Viticultural Commissioners, under which the State Board of Horticultural Commissioners were first organized. Sections 3 and 4 of this Act so nearly meet my views that I would like to encroach on your time long enough to read them. A careful perusal of the rules and regulations promulgated under this Act by the Viticultural and Horticultural Boards of the State, will prove to be time well spent. So, Mr. President, our legislation on this branch is, to say the least, vague. In the case of contagious diseases among men and animals, isolation and destruction of the affected ones is authorized by law. Is the fruit interest of the State of less importance than that of stock raising? True the higher order of life is not involved; the ravages of insect pests may not be compared to pleuro-pneumonia, smallpox, cholera, or even la grippe; but because they are not epidemical, they are none the less destructive of material interests. Fatality surely follows in their wake.

At first thought it may seem dangerous to intrust the power to control this matter into the hands of a county Board, but on sober, second thought, I think there should be no hesitation. County Boards are in closer touch with the people. They are neighbors, and naturally there is a community of sentiment and interest that does not exist where the official representative is governed by a distant authority. If an epidemic break out among human beings the county health officer assumes control; among stock, the animals are slaughtered by the same authority; if among bees, even they are not spared by the same authority. If the health of a community is endangered by the disregard of sanitary regulations or laws, the health officer of the county steps in with his restraining authority. If the officer exceed his authority, or allow a personal animosity to influence his acts, no one would question the wisdom of the law, but rather demand his removal. So the county is unquestionably the best and safest charge into which quarantine can be committed. Already, under the County Government Act of 1889, the Supervisors have been given powers to pass ordinances for the extermination of insect pests. Under the general powers conferred by that Act, good legal authorities give it as their opinion that Supervisors can pass ordinances absolutely quarantining infested districts. But we want a clear cut authority. The Legislature should not force us to go to the Supreme Court to learn our powers.

It has been suggested, if this power be exercised by counties, it will

result in retaliation by other counties, which would be injurious to the fruit grower. Not at all. Let them retaliate; that is their undoubted right, provided a correct spirit actuate it. We shall then have the strongest allies in nurserymen whose nurseries and districts are free from infection, because the most potent factor, that of self-interest, will move him to see not only that they are kept so, but that the neighboring orchardists do not jeopardize his prospects by allowing their places to become infested, or by introducing any suspicious stock into the locality.

It is always much easier to criticise than to prescribe a remedy; hence, if you ask what relief I have to suggest by way of legislation, I am at a loss how to best answer. But I think I can point out two or three ways whereby some improvement may be made. The Act of 1885, "to prevent the spreading of fruit and fruit tree pests, and to provide for their extirpation," is very good, and should be left to apply where County Boards are not organized. And in order that such portions may have the benefit of quarantine, I would amend the Act of 1889, relating to the State Board, which appears on the statute book as an amendment to the Acts of 1883 and 1885, but in fact supersedes them, so far as the sections enumerated are concerned, by reënacting that portion of Section 6 of the Act of 1883, relating to quarantine, and which is omitted in the later Act. This would efficiently protect those counties wherein the opposing elements, of whatever nature, were powerful enough to prevent the appointment of a County Board, or where the fruit industries had not yet gained sufficient headway to have their interests recognized at the hands of the Supervisors.

Now, as to the County Boards, there are two ways by which the power of quarantine may be had:

First—To add a section to the Act of 1889 something similar to what I have just suggested for the State Board; or,

Second—To give the Supervisors clearly the power to pass ordinances in that behalf.

In the County Government Act of 1889 are three clauses which would seem to convey that power now:

Section 25, defining the powers of Supervisors. Subdivision, Section 28, reads: "To provide for the destruction of gophers, squirrels, other wild animals, noxious weeds, and insects injurious to fruit, or fruit trees, or vines, or vegetables, or plant life."

Subdivision, Section 33, reads: "To make and enforce, within the limits of their counties, all such local, police, sanitary, and other regulations, as are not in conflict with general laws."

Subdivision, Section 35, is as follows: "To do and perform all other acts and things required by law not in this Act enumerated, or which may be necessary to the full discharge of the duties of the legislative authority of county government."

By the addition to subdivision, Section 28, of the words "or to quarantine against districts or places infested with such insects," I think the desired authority would be had.

THE CODLIN MOTH, AND REMEDIES THEREFOR.

Essay by C. W. Reed, Sacramento.

The codlin moth (*Carpocapsa pomonella*), or apple worm, originally came from Europe, and is believed to have reached California through fruit sent from the East for exhibition at our State Fair, about the year 1872.

Downing says: "The perfect insect is a small moth, the forewing gray, with a large round brown spot on the hinder margin." These moths appear in California the latter part of April, and early in May deposit their eggs mostly in the blossom end of all kinds of apples and pears. In a short time these eggs hatch, and the worm burrows in the fruit until it reaches the core, causing the fruit to ripen prematurely and drop to the ground. The worm when matured leaves the fruit and crawls up the body of the tree into crevices of the bark or crotches of the tree, and spins its cocoon. The moth in California soon hatches again, coming from its cocoon in the winged state, whence they seek their breeding ground—the fruit—and deposit their crop of eggs. Three generations will develop in some portions of California in one season, and the increase is so rapid that with late varieties of apples and pears hardly a sound specimen can be obtained if nothing is done to check its depredations.

There are many remedies for this fruit pest, all having more or less merit. Any means that will destroy the insect or the larva is desirable. Scraping off the rough bark and putting on bands of cheap straw paper, or old sacks, will make a trap by which thousands of the larva can be destroyed by examining these hiding places every week or ten days.

Some ingenious devices have been invented, made of wire, which allows the small worm to enter, but prevents his coming out after being developed into a moth.

The most satisfactory remedy that I have found to use is Paris green—one pound dissolved with ammonia to one hundred and sixty gallons of water, and sprayed on the fruit with an ordinary spray pump as soon as the blossoms drop, and again in about ten days. The mixture must be kept thoroughly stirred while being used, otherwise it will become concentrated and burn the leaves.

I have saved 90 per cent of a crop of pears by the use of Paris green, when at least 90 per cent of the crop the year previous were wormy. Swine, although they are troublesome animals in an orchard, do good work in destroying the codlin moth by eating the fruit that drops prematurely from the trees.

Growers will be well paid to use any practicable method in the most thorough manner for destroying this most destructive of all pests of the apple and pear.

PREDACEOUS INSECTS.

Essay by Alexander Craw, Los Angeles.

The subject of parasitic insects has been so well discussed at the semi-annual meetings of your honorable Board, and printed in your annual reports, that it would be simply a waste of your valuable time to attempt to add to your knowledge in this very important study.

I have written several articles for the local press upon predaceous and internal insect parasites, but since then scale insects that threatened the very existence of the fruit industry have been almost exterminated by Nature's remedy, thus showing that we are working in the right direction by introducing and assisting in the propagation and distribution of our insect allies. It would pay the State of California to have an experienced entomologist—one that would not have to wait for the slow process of red tape of our general Government, but could be dispatched by your Board whenever required. To show the force of this I have but to call your attention to the great good resulting from Mr. Albert Koebele's visit to Australia, and the successful introduction of the Vedalia. Had this been done when first brought to the attention of fruit growers, how many valuable orange groves could have been saved from destruction, the value of one acre of which would have more than paid the whole cost of the importation of the Australian ladybug.

I am pleased to report that the San Gabriel red scale in the neighborhood of Sierra Madre is fast disappearing by the attack of a small chalcid parasite. The cottony grape scale (*Pulvinaria innumerabilis*), the mealy bug (*Dactylopius*), and the soft scale (*Lecanium hesperidum*), all of which in their day caused considerable injury, have been almost exterminated by parasites.

The only new internal parasite I have to report is a *Tachina fly* that preys upon the spotted squash bug (*Diabrotica soror*). I called the attention of Professor Coquillett to it; he has bred the fly to the perfect state. He found it to be a new genus, and has written a scientific description of it, and named it after me, but I hope this will not impair its usefulness, as the last season over 30 per cent of this destructive beetle were destroyed by it.

RISE AND DOWNFALL OF THE COTTONY CUSHION SCALE.

Essay by George Rice, Alhambra.

But for the timely arrest and practical extermination of the cottony cushion scale, the final results of its devastation would have been incalculable. The story of its destructiveness is too fresh in the minds of all to be repeated at this time.

The damage caused by its ravages amounted to millions of dollars, and the wisest heads predicted that unless some sure cure or preventive should be secured, the time was not far distant when our beautiful and fruitful orchards would become barley fields, and the old time business of pasturing the lands with sheep and cattle would soon return.

Not only this wholesale destruction of our orchards, but the desolation of the beautiful yards, gardens, and parks, for which California is so famous, would follow; but let us not contemplate what might have been, but congratulate ourselves on the present happy condition of our homes, surrounded with the orange, lemon, vine, shrubs, and roses, and, in our congratulations, let us not forget the gratitude we owe to those who, by their persistent endeavors, by their trained and scientific knowledge, made it possible for us to-day to say, "This curse has passed by and we are thankful."

It may be of interest to many to read a very brief history of the rise and downfall of this worst of pests, the cottony cushion scale. Besides, it is well to record some of its history while it is fresh in our minds, and if any mistakes are made they can be corrected.

The cottony cushion scale (*Icerya purchasi*) undoubtedly originated in the acacia forests of Australia, where it seems to make its home. The first authentic date I can find in its history is 1873, when it was noticed in Cape Town, Africa. No date is to be found of its advent in Australia, but that it is indigenous to that country there is no doubt; however, it is only in late years that it has extended to their orange, lemon, and ornamental trees, shrubs, vines, and roses. That it has not received the attention in Australia which it has in this country is evident from the fact that over there they did not know what was killing the scale in some sections, while in other sections, and in New Zealand, the pest has full sway. The papers of those infested sections (papers received on last steamer) recommend the use of several of our old washes to control or exterminate the scale. They will probably hear of the Vedalia later on, and we will take pleasure in sending them a large consignment at almost any time.

The cottony cushion scale was brought to this country from Australia in 1868 or 1869, on trees and shrubs imported from that country. Attention was first called to it by Mr. R. H. Stretcher, of San Francisco, in a paper, accompanied with specimens, which were probably very much admired, which he read before the California Academy of Science.

In 1872 Prof. C. V. Riley, then State Entomologist of Missouri, had his attention called to this scale.

It was not until 1877, thirteen years ago, or five years after Professor Riley had his attention called to it, that the Entomological Department of the Department of Agriculture at Washington was informed of this pest. Professor Riley, in the introduction of his report as Entomologist for the Department the following year (1878), "refers to the serious complaints that came from the Pacific Coast, of injury by it (the cottony cushion scale) to orchards and ornamental trees." It was then in its incipiency, but was found to be a dangerous pest; yet if radical and heroic treatment had been used at that time it might have been stamped out. However, it is easy enough now to see what might have been done, but it should be a lesson to us in the future.

The spread of the scale was hardly noticed at first, but it soon began to increase very rapidly and caused much alarm. From Menlo Park it spread over Central California, reaching San Mateo, Sacramento, Santa Rosa, San Rafael, and many other places.

It was introduced into Los Angeles in 1878, and in Santa Barbara that same year, on trees received from Menlo Park, about ten years after its first introduction into the State. In the southern part of the State the scale found a congenial home in the mild climate, among the orange groves, and thrived and multiplied and set out on its work of devastation, which soon proved to be worse than if a destructive fire had swept over the country. It was three years after its introduction in Los Angeles before it put in appearance in the beautiful San Gabriel Valley, where it was taken on a potted plant. From the city and the valley it soon spread over hundreds of acres of orchards and gardens in Los Angeles County, and it seemed as if citrus culture was doomed.

THE DOWNFALL.

An era of soaps, caustic, kerosene, and poisons, made up into a thousand and one different cure-alls, ensued; in fact, almost every orchardist had a so called remedy of his own, most all of which really did more harm than good, but "the good time coming, long on the way," was when her ladyship, the Australian ladybug (*Vedalia cardinalis*) came to our rescue.

It was Mr. Alexander Craw, who, as early as 1880, first suggested that there *must* be a parasite where this terrible scale came from in Australia, to keep it in check, else the groves of that country would have been destroyed.

In 1881 we find recorded in the proceedings of the State Board of Horticulture a discussion by its members on the subject of securing and propagating parasites and beneficial insects. Mr. Felix Gillett, one of its members, advocated the propagation and importation of parasites. The Board fully recognizing the importance of the subject, kept persistently at work to secure a parasite for the cottony cushion scale. They petitioned the Department of Agriculture, memorialized Congress, passed resolutions at each and every Fruit Growers' Convention, corresponded with officials and orchardists in all parts of the world, and kept up the fight until their efforts were rewarded with success.

I know I tread on disputed ground as to whom credit is due in securing the Vedalia, and, through it, destroying the worst of all our pests, the cottony cushion scale. But, in writing its history in this brief paper, I intend only to give the facts as I find them.

Alexander Craw says over his own signature: "The facts are, Professor Riley visited Southern California in March, 1887, and called at the Wolfskill orange grove. After discussing the white scale question he advocated his expensive coal oil emulsion, and I our fumigator. I also said that the only hope I saw of any relief would be to send Professor Coquillett to Australia to study up what natural enemies were keeping the white scale in check there, and import them to California. He (Riley) opposed it. He was so emphatic in his opposition that I was very much surprised to see in the 'Riverside Press,' a week later, that he advocated, in an address before the State Board of Horticulture, the advisability of sending an agent, as I had suggested to him."

All efforts to secure help from the Department of Agriculture, Washington, failed, because the department was not authorized to spend the money, appropriated for that department, to send a man to Australia, *even* after we had positive information that there was a parasite waiting for us, that would, at least, check the ravages of the cottony cushion scale, if we would only go and get it.

All efforts to secure an appropriation from Congress failed, in not providing in the appropriation that was allowed that it could be used in sending a man outside of the United States. Thus the case stood late in 1887. Congress had, however, provided amply for an exhibit to be held in Melbourne in 1888, appointing the Hon. Frank McCoppin, of California, as Commissioner. Here was an opportunity, and it was improved. Knowing that Mr. J. DeBarth Shorb, of San Gabriel, who is the owner of large orange orchards which were badly infested with the cottony cushion scale, had interested himself in the matter, I wrote him as to how it came about, etc.

HOW IT CAME ABOUT.

The following letter explains itself, and is given in full:

SAN GABRIEL, CALIFORNIA, February 23, 1890.

Mr. GEO. RICE:

DEAR SIR: Your favor of the nineteenth instant, asking for the history of how the *Vedalia cardinalis* was introduced into this State, is received. I have the honor to state, in answer thereto: That one evening, some time previous to the departure of Hon. Frank McCoppin for Melbourne, he asked me how or what he could do as Commissioner, that would most benefit his State, California. Knowing, for some time past, through the Australian newspapers, as well as by private sources of information, that a parasite had destroyed all the cottony cushion scale in and around Adelaide, within a circuit of one hundred and twenty-five miles, I told Mr. McCoppin if he could secure the appointment of some entomologist of the Agricultural Department of Washington, to be sent on with him to secure the parasite and provide means of sending them here without dying on the steamer, he would do a grand work for his State. Immediately acting on the suggestion, he telegraphed on to Secretary Bayard, using my name, as he told me, as authority for the value of the parasite, and asking for the appointment of the entomologist.

Mr. Bayard replied, expressing his willingness to make the appointment, but regretted that there was no appropriation available to meet the necessary expenses.

Mr. McCoppin, replying, offered, very generously, to devote two thousand ($2,000) dollars of the appropriation made to meet the expenses of the United States Commission to Melbourne (and which was entirely under his control), and the entomologist was duly sent and did his work admirably. The *Vedalia cardinalis* arrived in good condition, were placed in careful hands, and by the same generally distributed throughout the State, with the result now known far and wide. The cottony cushion scale is a thing of the past.

I desire to publicly express my thanks to Mr. McCoppin for his generous and efficient act in obtaining for the orange growers of California this great blessing, the *Vedalia cardinalis*. Without its aid the entire citrus interest of California was doomed to destruction, a loss greater than generally appreciated throughout the State.

I also desire to call attention to the fact, that Mr. McCoppin's only desire was to serve his State in accomplishing the work he did, and that he did not consider himself in the matter.

Could I, with propriety, in a public inquiry like this, withhold my name entirely from connection with it, I would do so, and not attempt to share the credit when it belongs to Mr. McCoppin.

Very truly yours,

J. DEBARTH SHORB.

We find in the official records at Washington, that Mr. McCoppin had done as suggested in the above correspondence.

Mr. G. L. Rives, Assistant Secretary of State, communicated the facts to the Hon. N. J. Coleman, Commissioner of Agriculture, "requesting him to detail Professor Riley and his assistants to be sent to Australia at the expense of the Commission." In reply to this communication, Mr. Coleman, on June *twenty-third*, said:

> There can be no question as to the importance of the investigation alluded to, and I know of nothing to prevent my complying with the proviso that the party or parties I may send to do the work will go as an aid or aids to the Commission, and make a report which shall be part of the general report to the Secretary of State.

Three days later, June twenty-sixth, Secretary Rives, in a communication to Commissioner Coleman, says:

> I have to inform you that the matter of employing and compensating subordinate assistants has been left entirely to the discretion of Mr. McCoppin, subject, of course, to the eventual control of the Secretary of State. In the present instance the Department approves of Mr. McCoppin's arrangements. In brief, the gentlemen whom you propose to send, so far as they represent the United States in any capacity at the Melbourne Exposition, will be entirely under the direction and control of Mr. McCoppin, who will audit and pay all their accounts, and to whom they will report.

This, it would seem, should settle the question as to how the money, the most necessary part of the accomplishment of the end, was provided, unless we give the preponderance of credit to the keen-sighted and

trained entomologist, Mr. Albert Koebele. That Mr. McCoppin opened the way to secure the final result, and that to him the honor belongs of finally reporting to the general Government the discovery and importation of this most wonderful little ladybird, the *Vedalia cardinalis*, is a settled fact.

THE FINAL RESULT.

We had heard that there was a parasite in Australia that had almost entirely exterminated the cottony cushion scale, and it was to get these parasites that Mr. Koebele was sent to Australia. The parasite was known as the *Lestophones*, a minute fly that punctured the scale, laid its egg, which hatched out into a grub that made its meal of the scale, changed into a fly, to again repeat its work.

Mr. Albert Koebele left San Francisco for Australia August 20, 1888, and arrived at his destination in due season. He immediately sent a supply of the Lestophones to this country, which were duly taken care of on their arrival. In the meantime Mr. Koebele went to work to thoroughly investigate the scales, their parasites, and their workings, and was not long in discovering what our Australian friends *had not* done, that the "boss" scale destroyer was an entirely different kind of a parasite. It was the ladybird, the *Vedalia cardinalis*, he found to be the principal enemy of the cottony cushion scale, and he was not long in dropping Mr. Fly and making the acquaintance of her ladyship, Miss Vedalia cardinalis. He captured and shipped several colonies of beetles and their larvæ. The first importation reached here November 30, another December 29, 1888, and still another January 24, 1889. These colonies were sent to the Wolfskill orchard, in Los Angeles, and Dobbins' and Chapman's orchards, at San Gabriel, under the care of Professor D. W. Coquillett, of the Entomological Staff, Department of Agriculture. They soon multiplied and increased something after the form of a geometrical progression. Mr. Wolfskill and his foreman, Mr. Alexander Craw, who knew all the time "that there must be such an enemy in Australia," together with Professor Coquillett, distributed thousands to the anxious orchardists, who, hearing of their wonderful work, flocked in to get them. The same work was going on at the ranch of Colonel J. R. Dobbins, at San Gabriel, where the Colonel and his help gave their entire time to making up and distributing colonies to all who came for them, and they came from far and near.

While the good work of the Vedalia was going on in Southern California, the little ladybug was distributed by the State Board of Horticulture throughout Central and Northern California, wherever an orchard, garden, or shrub was known to be infected with cottony cushion scale.

By December 1, 1889, the work of exterminating the cottony cushion scale was practically accomplished. The money value of this Vedalia to the orange growers of this State has been incalculable. The saving of the orchards already infested, the protecting of the others that were sure to be blighted by this terrible curse, to say nothing of perpetuating an industry that it seems will be the king of all our horticultural pursuits, is simply grand, and cannot be estimated in the usual dollar and cent test.

WOOLLY APHIS.

Essay by E. A. Rogers, Santa Rosa.

The woolly aphis (*Schizoneura lanigera*), or apple blight, is a dreadful enemy of the apple. It makes its appearance on the cuts and bruises of trees in the form of a white down, which is composed of a great number of very minute woolly lice, that if allowed to remain, will increase with fearful rapidity, and produce a sickly and diseased state of the tree. Its home is also underground on the roots, which makes it hard to exterminate.

I fully agree with Luther Burbank, of Santa Rosa, that this pest is carried from place to place by the wind. A few years ago I planted some apple seeds; the next season I took them up and grafted them; the next season I took them to plant and sell, and to my dismay found them badly infected with the woolly aphis. There was an old orchard less than half a mile away, infested with the same.

They are most numerous on the Lady apple variety.

The Northern Spy is proof against them.

Luther Burbank has had the above roots sent him from New Zealand (where the woolly aphis is supposed to be most destructive). He grew and grafted them, and knows them to be proof against this pest.

REMEDIES.

During the summer months those on the body and limbs of the tree can easily be killed by touching them with a swab dipped in coal oil. To destroy them on the roots, spread gas lime around the tree, from one to four shovelfuls to the tree, according to size; the lime must not come in contact with the body of the tree; to prevent them crawling down the tree, draw the dirt away from the body of the tree, fill in with ashes, then throw back the dirt; this should be done in the fall, before the rains.

We have a *great many* old orchards in Sonoma County, which are more or less affected with this pest; the owners say apples do not pay. Every few years they are cut back, consequently such orchards get but little attention and the woolly aphis has full sway.

RED SCALE (Aspidiotus Aurantii).

Essay by H. Hamilton, Orange.

The insect, when first born, is an ovoid yellow sack, to many eyes microscopic. It remains in that condition less than an hour, when antennæ and feet make their appearance, and locomotion begins. If it is on a citrus tree it is at home, and begins at once searching for a place to locate for future development. Its first choice for location is on the fruit; second, a leaf; third, a tender limb; and fourth, the body of the tree. When it finds a good place—which generally takes a day or two—it inserts its beak in the fruit, leaf, or limb, and begins to feed on the sap of the tree. It now begins to grow and secrete a wax for a covering or scale. We must give it the credit of being a clean insect. It secretes none of the filth that comes from the white and black scales, and many other insects. It secretes only its own covering.

When this insect is fully developed—which requires two or three months—it is found to possess three skins, one ventral and two dorsal. The upper dorsal is transparent, the second is of a reddish brown, and gives it the name red scale. The body below the covering always retains the yellow color. The colored skin contains a center and two concentric rings. The outer one is open to allow space for the ovipositor. The male never becomes as large as the female, and is not round, but oblong, with exuviæ nearer the anterior end. The posterior end furnishes room for the development of its long wings. When the sun is low, morning or evening, the creature can be seen darting from branch to branch, and from tree to tree in the sunbeams. The limbs for locomotion furnished by Nature are very rudimentary and clumsy, and if the insect falls from the tree it is quite probable that it can never ascend the tree again. As soon as it locates, and begins to secrete its covering, it has no more use for legs, and they speedily disappear. They become involved in the secretion, and form a part of the scale. This description does not apply to the so called red scale of the San Gabriel Valley.

Reproduction begins when the female is two months old, and continues all the summer through, and into the winter. If an adult female be dissected and examined under a microscope of high power, only from three to four eggs, in various stages of development, will be found, only one of which will be sufficiently mature for exit, and the others graded to a minimum. The late Matthew Cooke thought that two to four per day are sent forth for a season, and that three or four broods follow each other during a summer, but it has become evident to me that but one per day is placed, and *that*, not in broods, but constantly until the storms of winter end the whole business.

The insect world is full of mystery. Great progress has been made during the last half century, but a multitude of problems remain unsolved. In 1852–53, Baron Von Siebold and Baron Von Bueleps, scientists in the employ of the Prussian Government, experimented in Silesia with the egg of the honey bee, using the most powerful microscopes, and unveiled the mysteries that had for ages involved *that* wonderful insect. The true parthenogenesis of that hymenoptera developed by these two gentlemen, has already made the world flow with honey. These experiments throw light on our pathway in our entomological studies.

The question has been asked a thousand times at our pomological meetings and elsewhere: "How do the scale insects, being wingless and footless, succeed in spreading themselves from tree to tree and from grove to grove so rapidly?" The stereotyped answer has been: "Oh, the birds, the bees, and gossomer spiders." Is it possible that Nature has been so lame in her provision for the spread of her own offspring? No entomologist has, so far as my knowledge goes, attempted to tell us anything of the time or manner of the fecundation of the red scale. When this is told it will explain, or solve, the problem. It is a fact well observed, that the wingless scale and phylloxera spread in the direction of the prevailing wind. An orange grove, infested with red scale, will spread the insects broadcast for miles away in the direction of the prevailing wind, and lodge them on vines, trees, and weeds, and every description of vegetation. I know this from actual observation. The Santa

Ana Cañon, in the latter part of the summer, is filled with them through its entire length; they are found on the mistletoe boughs of the sycamore, the castor beans, and on the tops of the gum trees. How do they get there? I will give my theory for what it is worth. The male, in coition, mounts on the wind, bearing his load with his long wings wherever the wind wafts him, and it matters but little to him where he leaves his load. I have seen pumpkins in the field nicely specked with red scale.

The picture, to the horticulturist, is not a pleasant one to contemplate, but it may be remembered that these insects cannot survive the winter on deciduous trees and annual plants. Their home is the citrus tree, and if that is kept free from them they must disappear.

Two methods for its destruction are now in use—the resin wash and fumigation by hydrocyanic acid gas—each of which are available. Several orchards in Orange County have been greatly benefited by the use of the resin wash. Some that yielded their owners no profit last year have this season yielded a handsome return. The experience of the past can be greatly improved the year to come.

The best time to use this remedy is early in the season before the scale infects the fruit.

Fumigating has not been sufficiently tested to speak positively of the result.

A parasite for the red scale (*Aspidiotus aurantii*) would be hailed with delight by all orange growers, but no effectual parasite has yet been found. The success of the *Vedalia cardinalis* on the white scale has inspired the hope that an effective parasite for the red scale may yet be found. But *it will not do to* wait for parasites. The fight must go on. We must destroy the red scale, or it will destroy us.

It is unfortunate for us that so many orange groves in this county are in litigation, and so many are held by non-resident owners, who do not appreciate the gravity of the situation. One of these groves, if neglected through the coming season, will breed more scale for distribution over the county than all the scale fighters in the county can kill.

Something must be done to remedy this evil. The Commissioners will be powerless unless the Supervisors sustain them. Articles are passing around the State in the public press proclaiming the discovery of a parasite—a cross between the *Vedalia cardinalis* and the twice-stabbed ladybird—that is devouring the red scale. The bug intended to be described is the *Chilocorus bivulnerus*, which has been common in Southern California for a long time, and has no efficiency as a parasite of the red scale or any other. The Los Angeles County Board last August inclosed a tree in Mr. Kercheval's grove, and placed thereon a large number of the so called parasites, the *Chilocorus bivulnerus*, and found them unable to make any impression on the red scale. Such misrepresentations may deceive the newcomer among us, and enable us to unload our real estate, but they bring no good to horticulture. The entomologist can see at once the folly of the proposition. The methods of reproduction of the two bugs are so different that no cross is possible.

The State Board of Horticulture of this State and the Entomological Department at Washington are doing all that need to be done to bring to light a parasite for the red scale, if one exists anywhere on the face of the earth. The work has been in progress over two years without success, and until success comes we must continue the fight with such means as we find at hand.

DISCUSSION ON INSECT PESTS.

THE PRESIDENT: You have heard the essays that have just been read on insects and remedies for their extermination. They are now before the Convention for discussion.

MR. ABBOT KINNEY, of Lamanda Park: All of us orange growers owe a great debt to those persons who helped in the introduction of the enemy of the cottony cushion scale into this community—the *Vedalia cardinalis*. There are a number of gentlemen to whom our thanks are due; I would therefore like to introduce this resolution, Mr. Chairman, if it is appropriate at this time:

WHEREAS, The introduction of the *Vedalia cardinalis*—the enemy of the cottony cushion scale—saved to California many of our ornamental plants and trees, and saved the great orange industry from destruction; therefore, be it

Resolved, That the fruit growers of California offer their hearty thanks to all in any way engaged in this most important result, and especially to the Hon. Frank McCoppin, and to Mr. Albert Koebele.

Unanimously adopted.

MR. LELONG: While the subject of the *Vedalia cardinalis* has been touched upon by my friend Mr. Kinney, I would like to make a few remarks before we branch off into a general discussion of the subject. At our last Convention, held at Fresno, the President, in his opening address, said: "Before leaving the subject of the introduction and the benefits derived from the *Vedalia cardinalis* in this State, I would suggest that some substantial token of our regard be presented to Mr. Albert Koebele. Such action would be a proper stimulant to future searches. It would be just, for the reason that he was exposed in a locality of intense heat while searching for parasites, and was reduced to a malarial condition that cost him much time and money." (Continuing reading from page 385, annual report). Now, Mr. President, when we arrived in Los Angeles the fruit growers of this section—I speak of Southern California—were circulating a petition asking for contributions among themselves, for the purpose of presenting Mr. Koebele with a token of appreciation. I was requested by them to bring this matter before the Convention. The petition has already been drawn, as follows: "Considering the great importance to the fruit industry of the discovery and successful introduction into California of the Australian ladybird (*Vedalia cardinalis*), and being desirous of showing our appreciation and regard for the discoverer, Albert Koebele, we, the undersigned fruit growers of California, subscribe the sums set opposite our names, for the purpose of purchasing a suitable token to be presented to said Mr. Albert Koebele as a souvenir of a duty well performed."

It is signed by several already, who have subscribed the amounts set opposite their names. And if I may be allowed, Mr. President, I would move that a committee of one be appointed from each county here represented, to secure subscriptions towards purchasing a token as indicated, and to report before the close of this Convention.

Motion carried.

THE PRESIDENT: A few names have been handed in to me to announce as the committee to solicit subscriptions for a token of our regard to Mr. Albert Koebele. The committee that I name for that purpose is Alexander Craw, Los Angeles County; W. E. Collins, San Bernardino County; Prof. T. N. Snow, Santa Barbara County; Frank A. Kimball, San Diego County; Sol. Runyon, Sacramento County.

DISCUSSION ON INSECT PESTS, RESUMED.

Mr. Carroll having criticized the action of the Inspectors of San Bernardino County in quarantining his nursery stock, in a discussion upon the essay of Mr. W. E. Collins, of Ontario, the President said: I will state that we are not here to discuss the laws and provisions that the different County Commissioners may deem fit to exercise. Also, that where a nursery is surrounded by insect pests it ought to be a sufficient reason, that is, very nearly a sufficient reason, to prevent those trees from being distributed around over the State without very, very careful inspection.

The essays that you have heard read, on insects and their extermination, are now before the Convention for discussion.

MR. COLLINS: Mr. President, I would like to supplement my own paper on insect pests, or rather quarantine regulations, by moving a resolution:

That a committee of five be appointed by the President, to consider and report to this Convention, at the earliest possible moment, what changes in the law are necessary to aid in the suppression of dissemination of scale and other insect pests.

My object in moving this resolution at this time is that the committee may have time to fully consider the subject and report to this Convention before some of the members may be forced to leave. And this being the first day of the session, if the committee be appointed now, probably after a meeting or two it may report to the full Convention, while if the subject be deferred to a later moment many would leave and there would be only a partial representation in the Convention.

The motion was seconded by H. P. Stabler, and carried.

MR. H. C. DILLON, of Long Beach: In view of the appointment of a committee of that kind I would like to offer a suggestion. I believe that every person who has had any experience in quarantining against districts, either as against cattle or against any kind of disease or pest, has found that they have been failures in operation. We ought, therefore, to go for the individual every time, and not for districts. And that is the suggestion that I would offer to any committee that may be appointed by the Chair. For instance, if a nurseryman has clean trees, which he has grown upon clean ground by the exercise of extraordinary diligence and by the use of everything that he can learn of in order to destroy these pests, he ought to be rewarded by the community by allowing him to sell his trees to any person who desires to receive them. That is justice to him and it is justice to the purchaser. Therefore, I would say that in framing any law of this kind it ought to be a law which shall say that the Commissioners shall inspect all trees that may be received at any point of destination, and if they be found to be free from disease they shall be delivered; otherwise, they shall be sent back.

PROF. T. N. SNOW, of Santa Barbara: Forty years ago I joined a society to suppress the worst pest that ever infested the earth, probably. I have investigated it since I have been on the Horticultural Commission for Santa Barbara County, to ascertain its origin and its history somewhat. I have traced it back to a very early date, and I have found no book that would give me the scientific name, and so I venture to name it to-day the *Vicanum arboris scientia*, or the black scale of the interior of New York, and I believe it exists up to the present time. We are in utter ignorance of the great pests. We don't know so much as we pretend to. I have found that out during the last forty years. For a few months I have been working with you, although not among you, to cause the destruction of the cottony cushion scale and other insect pests. I erected a large tent on the third day of August, and became the laughing stock of Santa Barbara for three or four weeks. Afterwards the laugh was on the other side, for my method was very effective. I learned to-day that "the white scale is virtually a thing of the past." If I am right in my investigations within a few weeks, the white scale is still hatching. But the Vedalia has been with us, and is after these young white scale.

THE PRESIDENT: I should like to inquire whether Professor Coquillett is present, and if so, whether he could give us some description of the insect that has been reported destroying the San Gabriel red scale—whether he knows anything about it.

MR. D. W. COQUILLETT: Mr. President, in regard to a parasite that has been preying on the San Gabriel red scale, I am hardly able to report anything definite. There is such a thing in existence, but it does not seem to multiply rapidly enough to keep the red scale in check; and this is true of the ladybirds that feed on the scale.

MR. J. H. KELLOM, of Tustin: We have a plan of getting rid of the red scale at Orange; it is by the use of hydrocyanic acid gas. It has been experimented with by gentlemen who are on this floor for two or three years; but new improvements have been made lately, and the questions about those improvements are in dispute between Mr. Coquillett and certain parties in Orange County. I have no particular interest in who discovered it, or anything about it, only I know it is a grand discovery. The plan is to dispense with all the blowers, and all the extra paraphernalia that they have heretofore used, and put the gas directly on the tree under a tent in the dark. My theory, which I have taken from Zell's Encyclopædia, is that it will not prove effective in the daytime, simply because the actinic rays of the sun decompose the gas and make it ineffectual in the destruction of bugs. But three or four parties down there are working now every night by moonlight with this gas fumigating, and I believe that they are making a grand success of it, and it is absolutely a little cheaper than the wash. The plan of operation is to use four tents—two tents on one wagon, and have two wagons—and three men will man the two wagons. They are made in such a way that they do not need any horses or animals of any kind. The three men will shove the wagon from one row of trees to another. At the top of a mast there is a cross-bar, and at each end of the cross-bar is swung a tent. As the wagon is moved on the tent is drawn up, and when it comes right over other trees they drop it down, and five minutes is all that is necessary for the work of moving. Then they put the gas in an earthen vessel under the tent, and give it just fifteen minutes and no more. While these fifteen minutes are passing, the same men pass the other wagon with the other tents along, and in that way in every twenty minutes four trees are fumigated, or twelve trees per hour; and allowing all necessary delays and uncertainties about the work, it is a simple and easy matter to fumigate one hundred trees in a day when they can do it in the daytime, but it can be done just as well in the moonlight. It is found also, in the use of this gas, that the thermometer must not go above 80 degrees; also, that there must be no fog, and that the trees are dry, because if the tree is wet the undue proportion of water in the gas weakens it. In these two remedies, without any parasite whatever, is found a simple and expeditious way of ridding the county of red scale. As I said in my paper (Report of State Board of Horticulture, 1889), the red scale is broadcast. It cannot live on the weeds; it can live only on the citrus trees in the winter. As soon as the rains commence it diminishes down to the present time, and now there are very few red scale to be found on any tree; but there are enough for seed, and they will loom up again as soon as the summer comes. The fact of the matter is, if the tree is not fumigated or washed within the next ninety days, next summer it will be just as bad as it was last. But with this work in the hands of good, honest Horticultural Commissioners in each county, the State can be rid of red scale. I would like to see a parasite, because that would make still less work; but until the parasite comes, why, the Commissioners that are at work at this business must be sustained by the Boards of Supervisors and by the horticulturists themselves.

Mr. T. E. Smith, of Santa Ana: I simply wish, in a few words, to second what Mr. Hamilton has said about this new gas treatment for red scale. There is no question in the mind of any one who has carefully examined the working of this gas treatment, but that it is entirely effectual and at a minimum cost. There is one drawback to it against the resin wash for people who have small orchards or limited means at the present time, and that is the cost of the plant. Mr. H. K. Snow, of Tustin, told me last week that he had just completed two plants—four tents, with the rigging on two wagons, exclusive of the running gear. It costs about $300 for the four tents and rigging. And I presume that Mr. Hamilton mis-spoke, in speaking of the gas when applied in daylight, not doing the work. It does the work when used in the daylight under a dark tent, but if the tent is removed immediately after the work is completed, or within a short time, there is some action, unknown, I suppose, to every one yet, but some chemical action takes place through the actinic rays, or through the rays of light, which causes injury to the tree. The tree is frequently very badly injured if treated in the daylight. But in both instances, where they are treated in the daytime, or at night, other conditions being right, the scale will all be killed. But as I said, it is too costly for some of us to use at present. Of course the time will come when people make it a business of going around from orchard to orchard and treating our trees. But in the meantime we must spray with the resin wash and keep the scale down until we can use this gas or some better remedy than the resin wash, and thus make orange and lemon growing pay.

Mr. A. Block, of Santa Clara: You can make the resin wash without any caustic soda whatsoever. I am using it for the San José scale, but not using any soda with it at all. I am using sal soda instead. The only difference in the work is simply this: that while I could make my soap, as I call it, resin soap, in ten minutes with caustic soda, it will take me three hours to make it with sal soda. I use a larger proportion of sal soda, in weight, than I would caustic soda. It takes a great deal longer to make it, but the work is effective; the destruction of the scale is positive. I don't use it in the winter, but in the summer, and my fruit is clean. I am sorry that I have not the exact proportions with me or I would give them to you. But you can make it

by using sal soda instead of caustic soda, and you can use less caustic soda by boiling it longer.

Mr. Muscott, of San Bernardino: I would like to inquire of Mr. Compere whether he has used this wash for the San José scale, and if so, what time it is tried?

Mr. Compere, of Los Angeles: I have used it for San José scale in some instances, and found it very effective. The only difference is, in place of using six pounds of caustic soda, use nine pounds of caustic soda and thirty pounds of resin, and you will have a very effective wash.

Mr. I. H. Thomas, of Visalia: In answer to a question about the lime, sulphur, and salt wash, I don't see the advantage of using fifty pounds of lime, because it is not the lime that kills the scale, it is the sulphur; and instead of using twenty pounds extra of lime in this recipe of mine, I would take that caustic and put it into sulphur. I used, this season, twenty-five pounds of sulphur, thirty pounds of lime, and fifteen pounds of salt. Now, a great deal of the success of this recipe depends upon the cooking of it, and also a good deal upon the lime. You want to get good, fresh lime, so it will slack readily. Take twenty pounds of lime instead of the amount given in the recipe there, fifteen pounds of salt, twenty gallons of water, and twenty pounds of sulphur; cook that all together. Slack your extra ten pounds of lime in the extra water to make fifty or fifty-five gallons. It will take an hour's good, thorough boiling to make that preparation correctly; and then spray it on, and I don't believe you will have any trouble in killing all the scale. I use the common California sulphur, and we made an estimate of the cost this season. The cost on a six-year old orchard was about 6 cents per tree, according to the recipe I give. Counting labor at $1 75 a day, sulphur at 2¾ cents a pound, lime at $3 a barrel, the salt at 1 cent a pound, makes the cost, on an average, about 6 cents a tree. My estimate is on an orchard of six or seven hundred trees. I would not like to spray later than when the bloom is half out. After the tree is in full bloom, I think spraying will injure some of the fruit. It is the cooking of the salt in with the sulphur which makes it dissolve. Heretofore I slacked the salt in with the lime in the barrel, and it didn't dissolve, and didn't adhere to the trees. This year, using the same proportions, and cooking it more, the orchard looks white all over. I attributed it to the boiling of the salt in with the sulphur, so it is thoroughly dissolved. (See annual report for 1889, page 172, Winter Remedy, A.)

Mr. A. Block: The best time to spray trees is in November and December; as soon as it can be done after the leaves are off.

A Member: Is there any parasite for the San José scale? If so, what is the insect? I know of an instance in which several San José scale on an apple tree limb were perforated, and it was thought it must have been done by some parasite.

Mr. B. M. Lelong: Yes, sir; the *Aphelinus fuscipennis*. The first account of this parasite was in 1880. It was discovered in Santa Clara County, but it has worked very slowly. The second account was in 1888, found in Los Angeles, on Washington Street. And since that time there have been colonies taken into Sonoma and Mendocino Counties, and they are being propagated now for distribution in the San Gabriel Valley. But they work very slowly. That is the only trouble.

The President: It is now approaching the hour when we must close the discussion for to-day. The gentleman from Humboldt County, Mr.

A. P. Campton, wants to get some information about the woolly aphis on the apple. If some gentleman would give a brief statement with regard to how to arrest the woolly aphis on the apple it will be in order to do so.

MR. COMPERE: About the only method I have found to exterminate them is by the roots, tree and all, and burn them up. That is the only remedy I have found to be successful.

MR. LELONG: The best way to treat them is laid down in the annual report of the Board, page 215. The remedy there recommended has done the best of anything.

MR. CAMPTON: We have tried all those remedies, with a certain degree of success, but are not entirely satisfied. We are living in the coast climate where the atmosphere is damp, and the woolly aphis appears to work more there than in any other place. I have seen them so thick that by giving trees a slight shake the ground will be covered and look perfectly white like snow. It is not so all over our county, but it is so along the coast. I had a young orchard and got entirely rid of the aphis, but the trees were only about three years old when I started in, and I did it by washing the trees thoroughly with lye and pouring it down around the roots. I think that we might get a remedy that would work better than that. It took me three years to rid my orchard in this way. If any gentleman here could give us any new idea we would be glad to receive it.

THE PRESIDENT: I will state for the benefit of the gentleman, that I have experimented for seven years on the woolly aphis with caustic soda. It is a certain remedy to keep the woolly aphis in check. Bare the roots every spring, and swab them as far as you can three feet from the trunk in a *circle* with a solution of caustic soda, one pound of caustic soda, 60 per cent, and one gallon of water. Repeat two or three times, if you see a return of the trouble. And also swab all places on the trunk or tree where there have been cuts or open places, by a swab. Simply touching the place infected will kill every insect touched.

COMMITTEE ON LEGISLATION.

For the committee on resolution offered by Mr. Collins, to suggest changes in the law, I will name W. E. Collins, H. P. Stabler, Alex. Craw, W. H. Aiken, and Colonel J. E. Jones.

The Convention then took a recess, to meet on the morning of the twelfth.

SECOND DAY'S PROCEEDINGS.

WEDNESDAY, March 12, 1890.

The President called the Convention to order promptly at 9:30 A. M., and the regular programme was taken up.

PLANTING, CULTIVATION, AND PRUNING.

TRANSPLANTING AND PRUNING.

Essay by G. W. VARNUM, Elsinore.

Horticulture is indeed a science and a noble *calling*. There is no more innocent enjoyment. What a terrible blow it must have been to our first parents when they were driven from their beautiful Eden, to wander homeless and houseless through earth's wilderness. But they certainly must have returned to their first calling, and with brows dripping with perspiration, worked the stubborn earth until they brought it into subjection, and again had a garden to remind them of their lost Paradise, and to furnish them the fruits necessary for their sustenance. Paradise! Where was it? I often think that it might have been in California, for surely there can be no more delightful country on earth, and no place where a poor mortal can be so happy and contented, as he can in California, particularly on Coronado, or in the citrus belt of Southern California. Northern California may be equally delightful, but as I have never been north of Los Angeles, I am unable to say anything about it.

When I purchased the trees for my first orchard I asked the nurseryman to show me how to prune a tree. He dug up a "Rawle's Janet," and cut off every limb within two or three inches of the trunk, and said, "That is the way to prune a tree." I did not like it. When I got home I planted fifty apple trees, but did not prune the tops; the roots I pruned smoothly where they were bruised in lifting. I also planted the *broomstick* as carefully as I did the trees. The result was this: the *pruned tree died*, and the unpruned lived, and grew rapidly, and in due time bore fruit. This satisfied me that it was not best to shorten in a tree when it is transplanted.

In 1860 I planted my second orchard, one hundred apple, besides pear and other trees. I did not dig holes, except for pears, but planted nearly on top of the ground, on land which had its first crop (wheat) on it the year before. I staked the ground, and scraped away about six inches of soil at each stake, set the trees at the stakes, pulled the rich soil on the roots with a hoe, mulches six inches deep with wheat chaff, and let them grow, and they did grow. They made three and one half feet of new wood that season. These trees, you may be sure, were planted whole, nothing but the ends of the roots pruned. They were taken up in the fall, buried root and branch in a trench two feet deep, and taken up and planted in the spring as soon as the ground was in proper condition.

I will state why I did not dig holes. After planting my first orchard I cultivated, by turning the furrow to the trees, for three years; they then stopped growing. I concluded that the roots were too deep, and turned the soil away until I got the ground level again. The trees then began to grow again as thrifty as they did the first season. I made up my mind that apple tree roots did not want to go deep, so I planted my second orchard as stated above, nearly on top of the ground. Pear trees, I noticed, sent their roots down, and I dug holes for them. Peaches do the same.

Downing, in his "Fruit Trees in America," says: "Trees should not be pruned much when transplanted." I will now give reasons why they should not be cut back or pruned. The tree has been mutilated enough by digging it up. Frequently half or three quarters of the roots are gone. What does the tree need? Roots. How is it to make new roots? It has a store of sap in it when taken up. It can, although deprived of a large part of its roots, still take up a little water from the earth. The sap which is in the trunk and branches at the proper time forces the terminal buds to swell, open, and develop leaves. These leaves digest, or elaborate, the sap, or rather it is converted into cellulose, after being taken up by the roots as water and carbonic acid. By the action of the sun on the leaves oxygen gas is given off and the sap is converted into cellulose, or plant food, or fabric. Ten parts of water and twelve of carbon represent one part of cellulose; and to make it out of water and carbonic acid the latter gives up all its oxygen. Sunshine decomposes carbonic acid and turns the carbon and water into cellulose. This function is performed by the leaves. If the tree is pruned, these terminal buds are cut off, and as they are the first to start, your broomstick has to depend on dormant buds (which are slow in starting, some remaining dormant for years) to furnish the plant fabric, which is needed to make new roots. Again, the cut extremities of the branches are open and the little sap left in the tree pops out at the cut ends and is lost. When the tree is not pruned the new leaves on the ends of the uncut branches start early and grow rapidly, and the elaborated sap finds its way through the combined layer, or inner bark, to the roots, and new rootlets are developed and start rapidly into growth, and soon make up for those lost in taking up the tree. A tree cannot make much, if any, root without leaves. The leaves are the *stomach* and *lungs* of the tree; without leaves the tree can do nothing. When deciduous trees shed their leaves in the fall they are done growing and making roots for that season. It is absolutely necessary that the tree should have leaves to be able to make new roots, unless a large quantity of cellulose has been stored up.

Now, plant your *broomstick;* what does it do? It loses what little sap it had by evaporation from the cut ends of the branches, and by being forced out by the power which causes the sap to rise in the tree, and that power you know is very great, capable of lifting many pounds by the sheer force which pushes up the sap. The broomstick has not enough roots of the right kind (for old roots lose the power of absorbing nourishment) to take in the fluids held in the earth in sufficient quantity for its needs. If it happen to be a good season it will struggle on and live, but will make but little growth. But if it is a dry season, unless it is frequently watered, it will put out a few sickly leaves from the dormant buds and will probably die.

I planted four peach trees at Elsinore; they had been *faithfully* pruned by the nurseryman who sent them out. One had *three* buds, one had *two*, another *one*, and the fourth had no buds at all. The three which had buds lived, and made a branch from each bud kindly left. The one which had *all* the buds rubbed off kept green all summer, but having nothing to start from at last gave up and died.

These are facts, gentlemen, and I want you all to try this experiment: Get ten trees as nearly alike in roots and branches as possible; prune the roots of the ten trees carefully. A bruised-off root may kill a tree almost as certainly as a man would die if he had a leg or an arm taken off by a round shot or a shell, and left the wound in that condition without calling the surgeon to make a clean cut surface, which would be the only way to save his life. Therefore, prune the roots smoothly with a sloping or diagonal cut, with a very sharp knife. Now, make broomsticks of five of the trees and leave the other five whole; don't cut a twig off. Plant the ten trees carefully, water and cultivate alike, and see which do the better. I will guarantee that after trying it once you will never prune a tree again when you transplant it, if you were to plant a million.

The next year after planting a tree, if there is any pruning to be done, I prune; or, if the season has been so favorable that the tree has made a luxuriant growth, showing that it has also refurnished itself with roots, I would cut out all superfluous limbs, all that crop each other, and, perhaps, take off those very near the ground. I would have the head low for many reasons; not over three feet to the first limb, then leave a limb every one or two feet, spirally around the tree, if possible, or so as to have a symmetrical head. It will take several years to perfect the head. Remember that the tree will grow many feet high, and for this reason it would not do to leave a great many branches, or they would be too crowded. This is for the young tree while forming the head. Apricot or peach trees, if on wet land, or often irrigated, will require severe shortening, or they will make fishing poles. As these trees are apt to overbear, it is well to cut back the last season's growth about one half, and you will have larger and finer fruit. This cutting back is done in winter. If your orchard is on high, dry land, and you do not irrigate, little or no pruning should be done. My apricot orchard is on high, very dry land, and it has not been watered for two years. It has been planted five years.. I have never pruned them, and I have never seen better shaped trees, nor have I ever seen larger or more delicious apricots than they produced; and I am not the only one who says so. I have two or three trees which get the water which overflows from my tank. These trees have grown rather straggling, but the fruit is not as good as it is on the unwatered trees. There are apricot orchards on wet land near my place which grow rampantly, but the fruit is not as large, nor is it of as fine flavor as mine.

The trunks of young trees must be protected from the sun, or the sap in the combined layer will be scalded and it will turn sour and the bark will die on the southwest side; the tree will then bend towards the northeast and expose more of its trunk to the sun's rays, thus making matters worse. The sour sap attracts the borer, which deposits its eggs in the diseased bark, and the tree is soon destroyed. Therefore, if you give your trees high heads so as to get up to them with your horse and cultivator, it will be well to wrap the trunks with white cotton cloth or some other material. I have found the leaves of the yucca very good for that purpose; two will envelop a small tree, and three or four will cover trees one or two inches in diameter. Stand them up around the tree, hollow side in; cut off an inch or two of the pointed end; then tie at top, middle, and bottom, and your tree is protected from the sun, rabbits, and borers. Soft soap put on with a brush about twice a year is one of the best applications I have ever tried to keep rabbits and borers away. It also leaves the bark in a healthy and vigorous condition. By making your heads low you have the trunk shaded. The fruit is convenient for picking, and the ground is shaded under the trees, which prevents evaporation and serves almost as well as a good mulching. The weeds will not grow as rank in the shade, and a few strokes of the hoe or rake will sufficiently loosen the soil about the tree where the cultivator does not reach.

Ornamental evergreen trees ought never to be pruned. You cannot improve them; their natural growth is as beautiful as possible, and pruning spoils them to an esthetic eye.

Orange and lemon trees should be let alone until they are three or four years old; then the dense spray in the center of the tree may be cut away, leaving all main branches which do not crop or chafe each other. I saw last summer what was left of a once fine orange orchard, which was nearly all killed by trimming the trees up five or six feet high, so as to be able to get up to them with the cultivator. The trunks were exposed to the sun and it killed them. Orange and lemon trees should be left with all their branches on until the head is large enough to shade the trunk. Then you may take off the lower limbs if you are crazy to prune. Olive trees require very little pruning until they are five or six years old. Take off the suckers, or better, heap up the earth around them and let them root; then take them off with a fine saw and plant them. This is the easiest way to raise them, unless you have a hothouse to give cuttings bottom heat. Keep the trunk shaded until the outside bark is hardened and impervious to the sun's rays.

The pear is another tree which needs but little pruning; so is the fig. If you want to ruin your fig trees, for several years shorten in the limbs and you will succeed admirably. Cropping or straggling limbs are always an exception; also any limbs which grow at a very acute angle with the trunk, particularly on apricot trees. Such limbs should be cut away before they get much growth, as they are sure to split off when the tree gets a good size. Where limbs of large size are taken off, the stump should be shaved smooth with a sharp knife, and then coated with grafting wax or shellac varnish, to prevent rotting.

OBJECTS OF PRUNING.

The first is to form the head; the second is to prevent the tree from overbearing, as peaches, plums, and apricots are apt to do, thereby making smaller fruit and breaking down the trees. The remedy already stated is to shorten in the last season's growth.

Some have a third object, that is to make what is called an open head, so as to let the sun shine on the fruit. I think this is fallacious. I find the choicest oranges, figs, apricots, and other fruits in the most shaded parts of the trees. If it was intended to expose the fruit to the sun, Nature would not make a dense growth of wood and leaves beyond the last year's wood, on which you find the fruit. A friend of mine in Missouri had a long trellis eight feet high, covered with Concord vines, which were loaded with grapes. He thought he would give them the much extolled advantage of sun and air, so as to ripen them quickly; so he cut off every leaf which shaded a grape. Did they ripen? No. The grapes remained green and soured on the vines and were utterly worthless. Leaves have several functions. One is to shade the trunk, tender branches, and fruit; another is to suck up sap, or rather to receive that which is forced up by some power not understood, partly by capillary attraction, but perhaps more by endosmosis. Another function is, as before stated, to give off in sunshine all the oxygen contained in the

carbonic acid which comes up from the ground with the sap, thus converted into cellulose, or plant fabric. Starch and sugar are chemically the same, and plants easily convert one into the other. The oils, acids, jelly, pulp, fruits, etc., are all formed out of the carbonic acid and water, or sap. Thus, after the leaves have assimilated or digested the sap, it is returned to all parts of the tree or plant to build up and ripen the fruit, as well as the tissues of all parts of the tree and roots.

I am in favor of judicious pruning, but I am opposed to barbarity. I don't believe in "Jack always keeping his knife sharp for the purpose of hacking off a limb every time he comes near a tree."

I think we prune to excess. There is no use in cutting grapevines here as they do in Europe. There the vines are trimmed so as to sustain themselves, because stakes are out of the question. Where poplar trees are shorn like a mule's tail for the wood for making charcoal for cooking purposes, wood is scarce. I have seen in Europe miles of poplar trees, on each side of the roads, trimmed up as high as a man dare climb; so the vines are trimmed to make them stand alone. I am sure our vines would bear five times as much as they do if five times as many eyes were left on each cane, instead of cutting all canes back to two eyes. If the ground is not rich enough to bring the fruit to its highest perfection, *fertilize* it. More fertilizing and less pruning would be, in my judgment, the wisest course to pursue. Why not prune walnut, pear, persimmon, and other trees, as we prune our fruit trees? There is as much reason for pruning them as there is for pruning other trees.

Gentlemen, we are near the twentieth century, and I hope the world is more enlightened than it was sixty years ago, and that the inhabitants will discover many new things and facts, among them the fact that an unpruned tree when transplanted is more certain to live and does far better than a pruned tree, and that when they feel determined to do some pruning they will curb their fury until the next year, when they can go at it without danger of killing the tree. If I have opened an avenue of thought which will lead to knowledge or good results, I will be thankful, and will feel well repaid for the trouble of engrossing so much verbiage.

CHERRY CULTURE.

Essay by GILBERT TOMPKINS, San Leandro.

Taking one year with another, there is no fruit that gives more satisfactory returns throughout this section of the country than the cherry. The rich valley land that lies around San Leandro, San Lorenzo, and Haywards, is unusually well fitted for cherry culture in both soil and climate. In former days San Francisco received a very large proportion of the entire amount of cherries consumed from the pioneer cherry orchards of San Lorenzo and vicinity. Many other sections of the State produce at the present day fine fruit in large quantities, and the virtual monopoly formerly held by this district has disappeared, although the business is still very profitable at prices about one tenth the size of those received fifteen and twenty years ago.

In my experience the best results have been gained on rich, not too light, valley land; adobe is not so well suited for the cherry as a lighter and more friable soil. On the other hand, I would not choose a soil containing much sand or gravel for the site of a profitable cherry orchard, although this may not be the experience of cherry growers in other parts of the State.

The trees are slow in coming into bearing. A sample of the fruit may be expected in a few years after planting, but there is a great difference between an occasional handful of fruit and a crop large enough to pay for the expense of cultivating the orchard and handling the fruit. I doubt if a cherry orchard will really pay in this section before it is eight years of age, although some varieties produce profitable crops earlier than others. The Rockport Bigarreau is one of the best standard varieties as an early producer. The Napoleon Bigarreau (Royal Ann) seldom gets down to actual bearing before the trees are nine or ten years of age. There are exceptional cases that differ from what I have just stated.

The cultivation required depends very much on the soil and circumstances. The Souther Farm orchard is plowed from two to three times a year, and weed knives and cultivators are kept going as they are needed. I have adopted the plan of pruning every other year; I think that is the best plan for any tree that is so apt to run to wood growth, as is the cherry, on our rich land. By leaving the trees unpruned there is not that stimulus given to the production of wood, and the energy of the tree is more generally used in forming fruit wood. Downing states that the generally accepted theory of the formation of fruit wood is the ripening of the sap in the limbs of the tree. If the branches are left uncut the ripening process goes on much faster than when the growth of the tree is perpetually stimulated by the cutting of the branches.

With proper handling cherries are one of the best of the shipping fruits. While many parts of the State produce good cherries, the area of land suitable is much less than for many other fruits; so with improved shipping facilities, we look for a steady and profitable market for all first class cherries.

ALMOND CULTURE.

Essay by Webster Treat, Davisville.

In California there are many districts that are adapted to the successful growing of the almond.

Almond culture on this coast has not been very profitable, for the reason that the Languedoc, an old French variety, has been propagated, and that nut is a very irregular bearer. The Tarragona is another variety. It is a somewhat longer nut than the Languedoc, and still rougher looking. None of these can be at all compared with the beautiful shapes and the fine, smooth appearance of the almonds of a number of seedlings raised lately in California. But now that new varieties have been propagated here, which have proven themselves to be steady, prolific bearers, and superior nuts in every respect, it is only a question of time, and I think a very short time, when California almonds will drive the imported article entirely out of the American market; and I can even see our growers shipping almonds into the European markets,

and our superior product selling at a higher price as against their home article.

It is not my intention in this essay to give an exhaustive history of the almond, for its biography is a long one, and, though it might be interesting to some, would not be information out of which much profit could be had.

Almonds may be divided into three general classes: the paper-shell, the soft-shell, and the hard-shell. There are, between these three classes, kinds of almonds that cannot be placed in any of them. Take, for instance, the Drake's Seedling; it is somewhat beyond the degree of hardness for a soft-shell, yet neither can it be called a hard-shell. I have examined different varieties of paper-shells, and find that there are two kinds—the proper or true paper-shell, and what may be called a false paper-shell. The false paper-shell has two quite distinct shells, and in removing the hull, the outer shell detaches from the inner shell and remains in the hull, while the nut comes out with only a very imperfect inner shell. The *true* paper-shell detaches directly from the hull, and has but one distinct and *paper* shell. The "California" is one of the latter varieties of paper-shells, and is also an extremely heavy and regular bearer.

The paper-shell almonds bring nearly double the price of soft-shells, while the hard-shells are sold only in limited quantities for the drug trade.

A portion of the trade in almonds is taken by the confectioners. They pay the most for nuts with perfectly smooth and plump kernels, always looking for smoothness before size. The confectioners want the smooth kernels for their fine candies, and this is the reason that the Languedoc does not sell to them, because its meat is rough and wrinkled.

The almond will do better on a thin, dry soil than any fruit tree; but when given the richest black loam, and the right amount of water, it will produce double what it will on a dry soil. It is a sure thing to say that the almond will thrive and bear excellent crops on any soil that will grow good peaches. The tree cannot withstand a large amount of water, but, on the other hand, it will thrive and bear good crops on a dry soil which would not support a fruit tree.

There is somewhat of a diversity of opinion as to the best root upon which to establish the almond tree. The late G. G. Briggs would have an almond on no other but a peach root, saying that it will make a heavier and quicker growth, and consequently large crops will come sooner. Others contend that as the peach does not live as long as the almond, the peach is not the proper root, as it would become useless long before the life of the almond tree above it should end. One fact is certainly established, and that is: the almond sends its roots down very much deeper into the ground than the peach, and is consequently much better adapted to a dry soil. In my own experience, it remains to be seen whether a peach root will or will not furnish sustenance for the almond tree above it as long as the latter lives. The peach root, in transplanting, will be surer to start, but the almond root once started will thrive on a poorer soil than the peach, for the reason that its roots are not all in a bunch like the peach, but are composed of a few very long lateral roots, and an extremely deep tap root.

After being planted, the tree requires so little care or attention that there is but little to be said on this part of the culture, and it requires only pruning enough to give a good shape. After that point is made, no pruning at all is necessary, except to keep the tree from getting too thick at the top, and to keep any suckers out. After transplanting I cut the tree to one foot above the ground, and grow three limbs from that point. Never shorten in, as with the peach and apricot, for the almond is like the prune, bearing its largest crops on the long, slender branches. But it also bears nuts on the little short twigs on the inside of the tree. These inside twigs do not die out as in the peach and apricot, but live and get more stubby and strong, bearing almonds every year; and because of the tree bearing a part of its crop close against and around the larger limbs, it is desirable to cut the tree off the first year to one foot high, and grow the main limbs from that point; this gives more limb surface for the small bearing twigs, and also tends to keep the tree nearer the ground. The almond is not troubled by any insect except the red spider, and this can be easily killed by spraying with the lime, sulphur, and salt wash in late winter, when the tree is dormant.

The process of gathering almonds and preparing them for market is very simple. When the hulls are opened pretty well, disclosing the nut, which is about the first of October, a large canvas sheet is spread under the tree, and the limbs are struck sharp blows with poles until all the nuts are shaken off. These poles are of the straightest grained Oregon pine, about fifteen feet long and one and a quarter inches square, with the edges rounded off a little. This striking of the limbs with the poles does not injure the tree at all, and it hulls a portion of the nuts. After gathering, the almonds are put through the hulling machine. The almond huller of the present day is rather an incomplete affair. It consists simply of an iron or wooden draper run by steam or horse power, carrying and rubbing the unhulled nuts against a stationary top-piece, which fits down just close enough to the draper to allow of the nuts passing through without breaking them. This rubbing and chafing takes the hull off, and then the nuts are separated from the hulls by hand. When the necessity comes for the invention of an almond-hulling and separating machine—and that will be soon, for California can grow almonds to greater profit than anything else—there will no doubt be invented a machine that will hull and separate the almonds from the mass of hulls, which will greatly cheapen the preparing of the crop.

After the almonds are separated from the hulls the nuts are bleached by sulphur fumes. My bleaching house is about twenty-five feet by eight feet, and I generally put in about four thousand pounds at one time, and expose them to the fumes of the sulphur for three or four hours; though the longer the nuts are bleached the whiter they become. Usually in bleaching soft-shells a little water is sprinkled over them before being put in the sulphur house, for the purpose of making them whiter. Care should be taken that no more sulphur is put in than will completely burn, for if too much sulphur is put in at one time, there will not be a complete combustion, and the soft-shells will smell of the sulphur, and the paper-shell kernels will taste of it.

My bleaching house is boarded with tongue and groove inside and out, and roofed with well laid shingles, and a flue about two feet high on the apex to help draft the sulphur smoke up. The floor is of one by three, set up edgeways, three eighths of an inch apart, or just wide enough to admit the sulphur fumes, and yet near enough to prevent the

nuts from falling through. The floor is about two and a half feet above the ground, and the lower space is boarded up with tongue and groove also, and fitted with small doors every five feet to admit of placing the pans of burning sulphur underneath the floor. It costs nearly two cents per pound to gather, hull, and bleach the almonds with our crude appliances for hulling and separating, wherein the greatest expense comes; but with a good huller and separator this could be reduced to half a cent per pound.

One of the many inducements to grow almonds is that the tree commences to bear at the age of three years, and some varieties bear an average of three pounds to the tree at that age. I saw blossoms on the "California" paper-shell tree this year, which tree was but one year old. It is probable that the blossoms will fall off, but it shows the very early age at which an almond tree may bear. When the tree is four years old, it will bear an average of thirteen pounds to the tree, and last year there were taken from one hundred and ninety five-year old trees three thousand five hundred and two pounds, which sold in Chicago at wholesale rates for 22 cents per pound. This is at the rate of $283 50 per acre on five-year old trees, planted twenty-five feet apart. Even from Languedoc trees I gathered one year, when they happened to bear a good crop, fully one hundred pounds from one tree, which was twelve years old. And with these fine new varieties that have been propagated in California, which bear much heavier than the Languedoc, and finer nuts, the prospect is for a very large yield when they are eight years old.

A person of no experience in tree growing can handle a crop of almonds as well as any one in the business, for the few points are so easy to learn that with a few written or verbal directions he can manage for himself. Another advantage of almond growing is that the crop ripens after grain has been harvested, and good help can then be obtained at a moderate price, and without trouble. Still another point is, that the almonds can be left on the tree, if for any reason they cannot be gathered at a certain time, and the grower can use his own time in gathering. Also, he can store the nuts, after preparing them for market, if he is not ready to sell them. All these are advantages not obtained in handling other fruits.

DISCUSSION.

The President: The essays you have just heard read are now before the Convention for discussion, and if it is proper for the Chairman to have an opinion, I should like to say a few words on the first essay, on transplanting and pruning trees. I have written two essays that are in the reports of the State Board of Horticulture for 1886 and 1887. I have been in opposition to this theory of scalping trees, and am very glad that another gentleman has taken it up, because I got into a hornet's nest with my theory. Regarding the essay that has just been read on the almond culture, although I know the gentleman very well—he is a very smart, active, reliable young gentleman—I think he will lead you seriously astray on the cost of gathering almonds. He puts it there, that with improved machinery you can positively gather the nuts at one half a cent a pound; I doubt if they can be brought from the field to the place of manipulating for any such sum.

Mr. Mark L. McDonald, of Santa Rosa: I just want to say a word. I listened very attentively to that first essay, and while I agree with him on some points that he made, yet I must disagree with him on others. I was convinced that the experience of the gentleman who wrote that essay is confined to one portion of the State, and had he been familiar with this great State of California, comprehensive as it is, extending many miles up and down this coast, and so well adapted to nearly every fruit that grows, he probably would have varied his essay somewhat. But I want to say on that point, that I feel at home among the fruit growers of this State; there is my interest, and there I like to be. But I also come here as a representative, arriving yesterday afternoon, as one of the State Board of Trade; came here on the invitation of the Chamber of Commerce to visit this citrus fair in this beautiful City of Los Angeles. We were received, and did visit this fair, which is magnificent; and invited to a seat upon the stand, and that we enjoyed very much and appreciated; and while listening to Mr. J. DeBarth Shorb, who delivered the address of the evening, what did we hear? While he spoke beautifully, and said a great many good things, before he gets through there is a direct thrust at the northern part of this State, and if you read the papers this morning you will see his language there. We came here to visit this place and to show our good will, from Oroville and all around, and are told that, if the reports are true, in the northern portion of the country the trees are dying, so extreme is the climate, a statement which is not founded on fact; he was mistaken in his information. And when we come down here, I want to say that I come from the County of Sonoma, the City of Santa Rosa, and there we can produce a great many fruits—the cherry that was spoken of this morning in that splendid essay—where they grow to such perfection; the prune, which no part of the State can beat us in producing; and so we might go on. We do not come in competition; we do not pretend to produce the citrus fruits in competition with Los Angeles, San Bernardino, or San Diego County; hence, our interests are common in building up this great fruit interest, and trying to promote the interests of this great State of California, which has not an equal in the United States either for climate or for the production of fruits. And I speak of this matter to say that it is not in the interest of the fruit growers of this State in promoting its great progress to entertain such sentiments—that one part of the State is in competition with the other. Mr. L. W. Buck, one of the largest fruit growers in this State, and who has paid the most attention to it, I think will agree with me. I want it understood that when I hear those sectional thrusts I am going to enter my protest. This is one State, and we are all engaged in one great enterprise; and I will say here that the fruit growers, using that term in the broadest sense—that the great State of California, when we bring it up to its perfection, as it is, and we all unite upon it—that the destiny of California is in our hands; and we must not be divided, but let us come together and entertain no such sentiments as I heard expressed last night. I hope you will excuse me for the time I have taken.

The President: I hope our friend Mr. McDonald will not give himself any uneasiness. I have attended all these meetings, and there is but one sentiment. The remarks of Hon. J. DeBarth Shorb last night I did not hear. *But that was not at the Fruit Growers' Convention,* and we are not responsible for it.

Mr. L. W. Buck: As my friend McDonald has spoken my name, I want to say a word. I don't know but he may feel a little out of sorts at something he may have heard. But I am not. I am glad to see the people of Southern California prosper and sell their property at high prices; because, when they do, some of them will come up north, and we will get a little bit of benefit therefrom. The southern part of the State has been the home of the citrus fruit up to this time. We raise a little up north, but we eat it ourselves, and don't try to ship it. It is somewhat the same way with the deciduous fruits in the southern part of the State. We are not in their way, nor are they very much in ours, and I think there should be the best of feeling here. I don't believe that any man that comes from the cold regions of the north down to this delicate climate we find here [laughter], I don't believe any of us envy their situation. We will go home satisfied with the homes we have got, and we hope they will continue to be with theirs. We certainly don't want to throw a stone at them in any way. Our treatment by the people of Southern California has always been generous. They are a very prosperous people, and I see no ground for a division. The State is not large enough for two, but it is just large enough for one.

Mr. A. Block, of Santa Clara: One or two points in the speech of last night referred to I think should have been omitted. But the same points were made a few years ago by the same gentleman in stronger terms, and I don't think they hurt much. The next year we had quite a large delegation from different sections of the north at the Fruit Growers' Convention of three years ago. I have seen the Wolfskill and other orchards covered with the cottony cushion scale, and it has afforded me pleasure as a citizen of California to know that we have been instrumental in procuring from Australia the means which has given the growers of this and other sections so much benefit. And we in turn will get a benefit from them indirectly. There ought to be no petty jealousies. There is no reason for designating one section as being inferior to another. When we meet we ought to meet as Californians, and I don't believe the people here indorse the sentiments expressed by Mr. Shorb last night. We are in accord with you, whether we come from the northern or southern part of the State.

Dr. O. H. Conger, of Pasadena: I wish to state to these northern friends that I stand here as a representative of Southern California, and say to them that we do not indorse any sentiment from any person or any paper that does discredit to ourselves or is calculated to make a division in this State on fruit culture. We do not indorse it. We have had to apologize to our friends of the north on other occasions for sentiments expressed by a few of our people that the mass of our people abhor. We do not indorse those sentiments, and I wish our northern friends to understand that the better element of Southern California, those who have more generous natures, are sorry that anything should have been said or may be said to create any feeling of distrust of our general feeling of fellowship and good will towards all the people of this State, north and south.

Mr. McDonald: I don't want to be understood as being the least bit offended. I like the people of Los Angeles, and like to see this section grow, and want to see them promote their citrus industry all that is possible. But I did feel that such sentiments should be corrected, and thought it could be done better through this Convention than in any other way. There should be no feeling between one section and the other. There is room enough for us in all our different departments.

DISCUSSION ON PRUNING, RESUMED.

Mr. Kellom, of Tustin: I would like to indorse what the gentleman has said in reference to putting out peach broomsticks. I believe he is right. I believe our practice has all been wrong. Within the last four weeks I put out a dozen Salway peaches. I went to a nurseryman who does a large business, and who sells trees in all parts of Southern California, and I told him I wanted he should prepare those trees for putting into the ground; prune them as he thought best. Well, he made broomsticks of them, and that is all there was to them. And I believe the argument adduced there by the gentleman is correct, and I think that it is worth coming to this Convention to learn how to prune peach trees when you put them out.

Now, one word, and but one word, about the orange. I think he is equally wrong about the pruning of the orange. He says don't cut inside of the orange tree. Nature has her own way to work, and let her do it. Let it grow as Nature dictates. Now, Mr. President, I have a thousand trees—I have two thousand trees—that I permitted to grow just as he recommends for six years, for seven years, for eight years, and last year I came to the conclusion that my trees were doing all the work on the outside, and I thought they ought to do some work on the inside. I put a man in my trees to prune out the heads, to thin them out, and he took out an immense amount of foliage. It cost me from 6 to 8 cents a tree. I thought it was a pretty expensive job for me, but it tells right away. In the crop that I have this present season I have got oranges enough inside of those trees, where oranges never grew before, more than ten times enough to pay me for the pruning. I believe in thinning out the head of the orange tree.

Dr. O. H. Conger: Upon that point I wish to say a word. I have had fifteen years experience' in Southern California, with the orange and the lemon especially. I commenced upon the doctrine advocated in the essay, and referred to by the last gentleman, to let the tree have its course, and I found it was a harbor for birds' nests, spiders' webs, and every sort of material that should not have any place in any tree. And, moreover, the limbs began to die. "Well," I said, "if the limbs are going to die I might as well anticipate what a little time more will produce—a worthless tree on the inside." It is understood, I believe, that a dry limb carries off sap from the tree as well as the foliage. That being the case, I could not see the use of permitting those dry limbs, or limbs that were producing no fruit and harboring all sorts of pests, to remain; so I cut them out so, as the gentleman has remarked, the balance of the top would have fruit upon the inside, and more or less exposed to the sunlight or heat, and the fruit was valuable. And the tendency to fruit, we know, is to the outside, to the limit of those limbs. Why do they blossom more generally upon the outer extremities of the top? Why don't they blossom as freely inside as out, if it is as natural? It is not so. And my trees are like an umbrella; they are thinned out, and the fruit is large and much finer than my fruit was when I first began to observe this by letting the inside remain as Nature designed or would make. There is no question in my mind but what the thinning out practice is correct.

As to the pruning up from the bottom, I regard that as conditioned upon the climate and exposure. If I was living in the wake of a strong current of wind, where storms occur occasionally, I should grow my trees lower; I should let the limbs form near the ground; I should head them in in order to make them strong to resist those winds. But where you are not exposed to those winds, I should trim up, at least so as to run my cultivator, as I use no plows to tear off the roots, as one essay referred to. That is like taking off the arm and leaving it without the dressing of a surgeon. Cutting off roots is like cutting an artery in an arm. I use nothing but a cultivator. Plows are a thing unknown to me in cultivating an orchard, because the roots are all through, interlacing, and the cutting of the roots takes away the life of the tree, or the means of supplying that life.

Mr. L. M. Holt, of San Bernardino: With regard to the question of prunning, years ago our best orchardists advocated pruning high, in order to get under the trees in good shape. They have materially changed in our section of the country their ideas with regard to this, because the heavy crops, especially on young trees, are on the lower branches. I refer to the orange. And if a person will take an orange tree from its infancy, make the head of the tree high to start with, he will find that he loses a very large crop in the first few years of his orchard at the time when he needs the oranges the most; and therefore our people have abandoned the idea of high pruning to a great extent, although they do work their trees up somewhat after they get older. We are located at Riverside, just as you are at Pasadena; we don't have any winds. [Laughter.] Our high pruning is on account of the orange crop, and not on account of the wind question.

Mr. W. H. Aiken, of Wrights: In the paper referred to, read upon planting and pruning, I think the writer has taken extreme positions. His experience has been mostly in Wisconsin, where they never did raise any fruit, because I have lived there, and in Missouri, where they have raised some fruit. He has never gained experience in fruit culture in California, especially the deciduous fruits, sufficient to speak with authority upon those questions. The *idea* of planting a tree by burying!—It would become its grave—as he says, by piling the dirt up to the limbs; especially a peach tree. Well, now, if there is any tree that should not be planted deep it is the peach tree. The warm sun of spring of course starts the growth of the peach tree at first. It throws its sap early. So that we see sometimes grafted trees that mature a little later. The early flow of sap from the peach root sometimes comes too early and too strong, so that the tree does not properly assimilate it. A tree, according to my idea, should be planted properly, so that the sunlight of Heaven could reach and warm the root to start the sap. His idea of pruning of course is not practiced to any large extent in California. We have been in the orchard business in Central California for many more years than you have in Southern California, and our orchards of deciduous fruits, of course, are very large; they are very productive and valuable, probably more so than the deciduous fruits of Southern California, although I am drawing no distinction from that, as you have not been in the business so extensively and so long as we have. "Train a child in the way he should go, and when he gets old he will not depart from it." So we train our trees as we would children; we endeavor to make them beautiful. We endeavor to make them fruitful; we are anxious to give them the form and the strength to bear fruit successfully. A fine looking tree is a good tree. It is pleasant to look at; its products will be valuable. The young trees in the central part of the State are usually taken from the nursery at one year of age. Many of our large plantings have been from the dormant bud. This can be done if done carefully, properly sheltered from the sun, and from anything that may strike and remove the bud. I last year put out a hundred prunes in dormant buds, and at least not over 10 per cent failed to grow, and made a growth from that dormant bud of from three to six feet. Taking a tree one year, from the nursery, in our warm California climate, I believe the practice is to cut it back from a foot to two feet from the ground, and build the tree from that. Take out each year such limbs as you do not wish to remain, bearing in mind not to allow the tree while young to become too thick with limbs. Just think of how those limbs, when they become large, would look, and how they would fill the tree too full, and how there would be too much bearing wood; the fruit would be small. We prefer to carefully watch and prune the tree into a handsome form, with plenty of bearing wood; not too much. After a tree comes into full bearing, from five to six years, very little if any cutting back need be required. The cutting back of old wood is not proper. The tree will take care of itself, the growth of the fruit will assimilate and take up the sap so that the tree will not become too high, probably, and do well. The allowing a tree to grow from the first setting out without pruning for many years will make it grow out of shape, and it will necessitate heavy pruning just when you otherwise would stop pruning. Then, you would have to use the saw, and I don't know but an ax, to get your tree down into shape; it would almost cease to become a tree; and you would find the fruit would be small, and the tree itself would be unprofitable.

Mr. L. W. Buck, of Vacaville: I find that the old saying is a true one, that doctors never agree, and that is just as true probably with fruit growers of this State as with any other class of doctors. And it is necessarily true, too. The difference of climatic influences, soil, and so forth, makes different treatment necessary in different parts of the State. Now, if I may say a word in reference to what my friend Aiken has said here—he being a northern man, it wont be considered to be sectional; but in some parts of the State, if you would carry out what he says (or, at least, that is my judgment) about not pruning a peach or an apricot (and, of course, all the remarks I may make pertain entirely to deciduous fruits, because I know nothing of the raising of citrus fruits), I believe that they would raise the kind of fruit that you see quoted occasionally in the New York City papers—peaches selling by the quart. Now, as a peach raiser in California, I don't want to raise any of that kind; don't want to raise them to sell, ship, dry, or keep. I want large, fine fruit, and that in the section I live in can only be obtained by thorough and systematic pruning and thinning. Now, we prune our trees heavily even if they are thirty years old, and I have a few that are more than thirty years old; and we prune them just as heavily as

we do a tree that is younger. You have got to give a peach plenty of sun or else you don't get good fruit. Now, the section of the United States that has in years past furnished the dried peach product of the market, has been the northern part of the Southern States, the States of Georgia, Alabama, Mississippi, Tennessee, and South Carolina. And if any one remembers back thirty years ago to the dried peaches that you bought in the market, you will find that they were scraps. They were not to be compared with the dried peaches that are produced by this State. Nor is there any other section of the United States that can put into the market a dried peach product that begins to equal the dried peach product of California. In my section, Vacaville, it is certainly very necessary that you prune, and I always prune heavily from the time the tree is planted. I prune for the first three years for shape; after that for the crop. A heavy pruning saves thinning, and the thinning in our section is equally as extensive as the pruning.

Mr. Aiken: I wish to correct my remark. I intended to except the prune and the apricot, of course. They grow upon the new wood, and they must be pruned as Mr. Buck says, three years. It is strange how men's minds will revert to what they do or know the best. We raise the prune almost entirely, and I was thinking of the prune tree. My friend Buck raises the peach and apricot.

Mr. C. C. Thompson, of Pasadena: If any individual should go away from this meeting to-day and get the idea from the discussion here that the absence of the knife on the first year of his orchard would make that orchard a success, I should consider that the society and all of us had made a failure in our discussion. Order is Heaven's first law, and to spare the knife the first year on the orchard would be certainly, to my notion, the cause of the failure in the orchard as far as uniformity was concerned. It might bear fruit—large fruit. But certainly we can raise good fruit, and at the same time maintain a uniformity in that orchard—order. Why, to see one tree all growing to one side, another all growing to the other side, another tree all growing on the ground, another tree all growing six feet above the ground, certainly to my eye, as to what an orchard should be, that orchard would be a failure. Now, I would like for any man to tell me how I am going to make that orchard uniform without the knife being used thoroughly the first year. Why, I know of no way to control a tree that heads four feet from the ground, and another that heads a foot and a half from the ground, except to take the one that heads four feet from the ground down to the same height as the other one, and strip the other one of its growth in such shape that I may make the buds all come out about the same height from the ground. Uniformity in an orchard is certainly beautiful. I catch these remarks by listening to people traveling along my street: "Why, look across the tops of those trees. It looks like it was sheared with a mowing machine. Every tree looks alike." The peaches are nearly all alike in shape and form, and I believe they are bearing just as fine fruit as though one tree went one way and one the other, and one tree headed high and another low. How is this going to be accomplished without using the knife the first year. I have heard it said in Iowa; "What is the use of cutting off a man's head if his heel is sore?" If there is a lack of root it is certainly necessary to remove a part of the top in order for the root to support the top. If a tree has an abundance of root it will support a large amount of top. I want all the roots

I can get, and then I will risk the top coming without the tree dying, as our friend from Elsinore speaks of. He has raised the idea that it is absolute death to trees if you cut the top off like a broomstick. He is certainly mistaken. I know that from experience; I know it from observation. Out of twenty acres of peach trees I set at one time, I only lost four, and he would say they were like broomsticks. They were, in a measure, but it was a broomstick that was shorter than my wife uses a good deal, and had but few more limbs on than that broomstick has. Consequently, those trees are all about the same height. I allowed about the same number of buds to grow on each tree to form the head, and out of that twenty acres of trees only four died from transplanting.

Mr. Theo. Deming, of Sacramento: Believing, as I do, that these semi-annual meetings are for the purpose of comparing notes and getting all the information we can from each other, and after listening with a good deal of interest to the essay of Mr. Varnum, from Elsinore, I thought, perhaps, it might interest this meeting for me to relate some experience which I have had in an orchard of apple trees, as he alluded more particularly to apples in that essay. I planted an orchard of thirteen acres of apple trees in Lake County. They were about as large as my little finger. I dug the holes rather deeper than I should again if I was planting, and cut off each tree so that there was not a tree in the orchard that exceeded eighteen inches in length. Of course, they were all in a dormant state, and nearly all those trees grew. A few failed to grow, and I found that in some instances the roots had been eaten by gophers, and in others that the tree had sunk somewhat lower than it ought to have been, from the fact that the holes were dug a little too deep; but out of the thirteen acres I don't think more than a dozen died, and to-day I doubt whether there is a handsomer apple orchard in the State. I was very much surprised to hear the statement made in the essay, that the trimming of trees, leaving small limbs, I think, two or three inches in length, would cause their dying. It is a statement that I never heard before. I have been interested in fruit growing nearly all my life, both in Indiana and in California, and all the reading I have been able to do, all the experience that I have heard from others, and my own experience, is contrary to that.

THIRD DAY'S PROCEEDINGS.

Thursday, March 13, 1890.

(President Cooper in the chair.)

FRUIT DRYING.

Essay by J. L. Mosher, San José.

The drying and preserving of fruits is one of the greatest leading industries of our State, and no other industry has so great a future before it.

The words "dried fruits" do not seem to be the proper ones for

expressing the quality of the evaporated fruits of to-day, for they are much different from the old style of "dried fruits" of our childhood. The masses have to be convinced of the superiority of our evaporated fruits, in order to overcome the prejudices of the "dark brown shriveled and dried up article," that has become so famous in "song, jest, and poetry," tough as leather, requiring hours of stewing and boiling to make them palatable, and then possessing but little of the natural taste of the fruit. With an evaporator it does not require any great amount of skill to produce a most excellent article, superior to all other ways of curing fruit, and rivaling as it does the ordinary canned goods. With an evaporator it is very essential to have a draught of air, hot enough to keep the fruit moist, and still carrying off the moisture. The more rapid the evaporation the better the result, both in color and flavor, as the starch, by the evaporation of the water, is quickly converted into sugar. The slower the evaporation, the less sugar is retained in the fruit, and for this reason a cold draught of air should never pass over the fruit. The velocity of air passing through, when drying, should range about nine hundred feet per minute. If the air, loaded with moisture, becomes stationary, evaporation ceases. The temperature should not exceed 200° Fahrenheit.

The fruit should be thoroughly *ripe* before placing on wire trays, and here is the greatest drawback. The acid of the fruit coming in contact with the galvanized wire forms a precipitate of sulphate of zinc, which is very detrimental to the taste of the fruit, and which I believe our customers claim to be the results of sulphuring. Here is an open field for our inventors to overcome this trouble. The results obtained in many experiments tried in my establishment have proved that dipping the trays in hot glycerine is very good, and we are now trying Japan and baking it on the trays, which, I believe, will be the best of anything yet tried. The zinc certainly must be removed in some way or other, or the fruit will be unsalable. Before packing, the fruit should be dipped in hot water for a few seconds, to kill all the germs and insects, and spread out to dry. The advantage in evaporated fruit is, that it can be shipped over the world without danger to its preservative qualities, and at a great saving in cost of freight, compared to the canned goods. In canned goods the fruit lacks ripeness, and sugar has to be added. In evaporation, the fruit can be entirely ripe, and the *natural fruit-sugar* retained while drying; and again, evaporated fruit is a *pure* article, and when soaked in water a short time will resume nearly its original proportions. Taking all this into consideration, evaporation is *the* process of the present.

EASTERN FRUIT SHIPMENTS.

Essay by L. W. Buck, Vacaville.

The California Fruit Union has agents in Omaha, Kansas City, St. Louis, New Orleans, St. Paul, Minneapolis, Chicago, Louisville, Buffalo, New York, and Boston, and the growth of shipments are shown in the latter city. In 1886, Boston received its first fruit car direct from California. In 1888, about one hundred, and in 1889, fully one hundred and fifty cars were shipped direct from California to that city, and while, perhaps, in no other city will the business show as marked a growth as Boston, the increase has been large to all points. This is due largely to the fact that freights have been reduced, facilities improved, and time in transit very much shortened, enabling the shipper to count with more certainty on the time and condition of arrival, as well as to cheapen the product to the consuming public.

The special train service has done much to accomplish this, as it has generally been the most certain service that we have had, as well as the cheapest; and the advantage of special trains of deciduous fruits can only be obtained by the organization of shipping interests. The buyer must help the grower, and the grower help the buyer, as deciduous fruit must be packed and shipped as quickly as possible after being picked, and much of it must have a quick and certain delivery to points of destination.

I suppose the same is true in regard to citrus fruits in the main, but of that I know very little, as in my section of the State we use our citrus fruits as you people in the southern part do your deciduous fruits—eat them.

The shipment of green fruit to the East has become an important and growing industry. Successful results are dependent upon several conditions, some of which are beyond the control of the shippers, to wit: climatic changes and unavoidable delays in transportation, but much depends upon condition and manner of picking, packing, and boxing, as well as the handling which the fruit receives before being stripped and loaded in the cars.

Too much care cannot be used in handling, so that the fruit may not be bruised in its course from the tree or vine to the car. Fruit should be carefully picked when in proper condition, which should be, with peaches, nectarines, and apricots, fully matured, but perfectly firm; and great care should be used in throwing out all wormy or defective fruit, as well as that which is undersized, as often the sight of one small or decayed peach or pear will make a loss of, perhaps, 50 cents per box on a whole line of fruit when sold at auction.

In the early shipment of fruit from California to the East, pears of various kinds, Gross prunes, and grapes were about the only kinds shipped; but now the peach has become prominent as a shipping fruit, and in all the markets of the East fine, large, highly colored California peaches have become almost a necessity to dress up the various fruit stands, command good prices, and seem to retain more of their flavor than any fruit, except pears.

Whenever the railroad companies will reduce the freight I think they will receive a much larger net revenue, in consequence of very much increased shipments, and whenever that good time comes, I believe California will, to a very large extent, supply the fruit market in the East, both green and dried.

The channels of distribution have been largely extended, and I believe the business is still in its infancy. The time was when growers could sell all their shipping fruit at good prices, but the largely increased orchard and vine planting has changed that, and made it necessary, in many instances, for growers to unite, and load and ship their fruit to the East. This is more easily accomplished through local or neighborhood organizations, which prevent one market from being overloaded,

while others receive none; and could all the shipping interests be united—both growers and shippers—good results would be reached, as without concentration and control the business will certainly be endangered by one party or locality shipping their fruit where it would be sold in competition with that of their neighbors.

The California Fruit Union has been in existence now four years, and, I believe, has accomplished much good. While started as exclusively a growers' organization, it was wisely changed so as to admit buyers as shippers with good results, as the larger the proportion of fruit that can be under our control the better, the weaker the competition, and the more regularly can all the different markets be supplied.

FRUIT DRYING.

Essay by W. N. Gladden, Healdsburg.

The importance of the fruit-drying industry to this State, and its probable magnitude in the future, cannot be well estimated. Never before in our State was there a better outlook in the markets for California dried fruits, nor brighter prospects for remunerative prices to the producer, than at present. In the face of discouragements, insect pests, low prices occasionally, and the howls of croakers, who always at such times cry, "I told you so; I told you that the fruit business in California would be overdone," it is indeed cheering and encouraging to see this interest steadily growing from year to year, and to find that these same low prices have, in one sense, proved a blessing to our fruit growers, in that they have been the means of introducing our fruits to thousands and multiplied thousands of mouths in the Eastern States that previously, on account of high prices, had never tasted, and thereby proved the superior excellency of, California dried fruits. This has created a demand which we cannot supply. And the demand will continue to grow with the rapidly increasing population of our country. It is a fact that at this time those markets are almost destitute of our dried fruits, and the cry comes to us, "Send us more."

In view of the situation, every fruit grower in the State should feel encouraged to go ahead in the planting and cultivation of orchards, the extermination of insect pests, and the preparation of our fruits in the best manner for those markets, and indeed for the markets of the entire world. But, now to the point: How to dry our fruits and prepare them for market. On this subject I want to begin at the beginning, and that is in the orchard.

Fruit for drying should be gathered from the trees with the same care as for canning, without bruising, when ripe, but not too soft; then hauled to the drying grounds, or cutting shed, on a wagon with springs; then carefully graded as to size and ripeness. As soon as a tray is filled, place it in the bleaching box, exposed to the fumes of burning sulphur. When dried, keep the different grades separate, and be careful not to dry too much. It should not rattle like bones, but should be somewhat soft and pliable, so as to press in boxes or pack well in cotton sacks. If not boxed or packed immediately after drying, it should be kept in a dark room, or protected by mosquito netting, or other means, from moths.

The importance of properly sorting or grading before drying is not fully appreciated by many who are engaged in fruit drying. I have seen large and small peaches, ripe and green, placed upon the same tray to dry, and the result is uneven drying, whether by natural or artificial means, and when the small pieces are dried to cracklings, the large are not nearly done. Then comes the work of sorting on the tray, picking out the small and dry, and leaving the large for further drying. This is more work and trouble than to properly grade before drying.

And then, such a motley, "measly" mess of it as this mode of drying makes, is not at all inviting to the eye of the dealer. In inspecting such samples, he will reach forth his hand, gather out the small, inferior specimens, the over-ripe, and, if it be peaches, and there should be one dark piece in the lot, he will be sure to find it, and call your attention to what he has found.

As to the mode of drying, whether by natural or artificial means, it should depend much on the locality. Where there is no fog and plenty of hot sunshine, I think it is better to "sun-dry," because about as fair and good an article can be produced at far less cost.

In regard to sulphuring, or "bleaching," as it is called, I have but little to say. So long as the market demands bleached fruit, we will all continue to burn sulphur. As to the process of bleaching fruit with the fumes of burning sulphur, it is too well known to require a description. Properly speaking, it is not "bleaching," but merely "fixing" or "setting" the natural color of the fruit, preventing oxidation. What quantity of sulphur to use for a given space of sulphur box, and how long fruit should remain exposed to its action, are vexed questions which I will not try to answer. I might say much on the subject, but it is not worth while, for nearly all fruit men will be governed in this matter, to a great extent, by their own experience. My practice is to sulphur twenty to thirty minutes, depending on the kind of fruit and its condition. The greener the fruit the longer the time required. All light colored fruits should be bleached. Dark colored plums and French prunes I sun-dry (the weather permitting) without bleaching. After drying, I dip pitted plums in boiling water before boxing or sacking. It improves their appearance and destroys all germs or larva of insects.

I am well convinced that many persons, through great anxiety to make an extra fair and fine article of fruit, bleach too much. Apricots, which look very fine and transparent, will be found to have a peculiar, disagreeable taste, due to over-bleaching. I invariably sulphur all light colored fruits, and will continue to do so as long as the markets demand it, but hold myself ready to abandon the practice whenever I can realize as good or better price for the unbleached article. I dry fruit for the money that I make out of it, and all that purchasers have to do is to inform me how they want it prepared, and that way goes. And that is about the way with all of you. The proposition that sulphur-bleached fruit is injurious to health has been discussed pretty thoroughly of late years, and I will not enter that field in this article, and will only say I am convinced that no person will be poisoned or injured in health by eating fruit properly treated by this process.

I desire more particularly to offer some suggestions which may aid us in maintaining and increasing the enviable reputation we now possess in the eastern markets for choice dried fruits.

The time was when it was said of certain inferior fruits, "Oh, they

are not fit for anything but to dry;" and it was really and honestly thought that miserable little green seedling peaches were very good for that purpose; but that time is past, and I hope forever gone.

If we raise nothing but good fruit, there will be no poor fruit dried. Our nicest canning fruit is the very article that will make the finest dried fruit.

In regard to peeling peaches by scalding them in a boiling alkali solution, I would just say: if you cannot, after removing the skin, rinse all the alkali from the peach, so as to prevent it turning dark when dried, you had better peel by hand or with machines. Already this lye-peeling business has caused some mischief in the market. I would like to hear from members of the Convention on this subject. I cannot say that I am in love with the process. From all I can learn, I think that many who used to peel with lye have abandoned it and gone back to machines.

One more thought and I am done; I refer to cleanliness. In all manipulations of fruit in drying and preparing, this is of the utmost importance. Have plenty of good clean water at your drying establishment, and let your cutters (women and girls are the best) wash their hands when necessary; this they will do of their own accord, as a rule. Men and boys are more negligent, and often have to be stirred up on this matter. Keep your trays clean and in good condition. Sprinkle floors and grounds every day, evenings and mornings, to prevent dust from rising and settling on the fruit. Keep it out of the dust and dirt. Remember one thing, you cannot make good dried fruit out of little green worthless stuff fit only for hog feed.

DISCUSSION.

The President: The essays that you have heard read are now before the Convention for discussion.

A Member: Mr. Chairman, in reference to the essay read by Mr. Buck, I, for one, as a fruit grower, would like some further information in regard to the organization he speaks of, which I understand has been in the central part of the State a great success. In Southern California we know by this time that we cannot raise as much deciduous fruit, that is, of peaches, pears, and prunes, especially, as we can find a profitable market for. I find the northern part of the State is far in advance of us in this business. They have had many more years of experience, and have doubtless learned a great many important lessons by experience, and we in the south would be very glad indeed to profit by their experience without having to pay for it as they have, perhaps, by mistakes in the beginning. I would like to learn the details of this organization—when it was organized, upon what principles, whether it is an incorporated company, whether there is any limit to the amount of stock one individual should have in it, and in fact any details of the organization of interest to fruit growers.

Mr. Buck: The California Fruit Union was formed or started in the fall of 1884 or 1885. A Convention was called in San Francisco, of the fruit growers of the State. Prior to that time the buyers had come from the East here and bought nearly all of the shipping fruit, or fruit that was suitable for shipment East. But in 1885 they failed to do it, and the result was that a very large amount of fruit stayed on the trees and vines, and never was harvested, because the growers were not prepared to dry, and consequently their fruit reached such a condition that it was absolutely worthless on the ranch, awaiting the buyer who didn't come. I think that that was the main motive in the organization of the fruit growers. There was this organization of the California Fruit Union, which, as I stated, was first an exclusively growers' organization. In 1886 they commenced operations, and shipped quite largely; and that year there was also an organization, or a partnership, call it whatever you like, of buyers of the State, which operated against, and shipped in competition with, the organization of the growers, under the head of the California Fruit Union. It was a disastrous year, both to the buyer and to the grower, as both factions shipped largely, and the fruit of one sold against the fruit of the other. There was no knowing how many cars went to Chicago, Minneapolis, St. Louis, or any other city. There was no control; and the result was that in many instances two or three or even five times the fruit was shipped to a certain point that could be taken care of, and the result was a disastrous sale. At the annual meeting of the stockholders of the California Fruit Union in 1887, the by-laws were so changed that shippers might join as stockholders of the Union; as such, without owning acreage. Some of the shippers joined the California Fruit Union, and we succeeded better. We had their assistance, and I think that we didn't do any hurt to them, and they certainly did us some good; and consequently, in 1887, it was smoother sailing. There was not the same loss as there was in 1886. In 1888 and 1889, the same. The average price in 1886 and 1887 I cannot give to you, but in 1888 the average price of all fruit sold through the California Fruit Union, I think was \$2 92 per hundred pounds, that is, F. O. B., loaded on the cars. In 1889 it was \$3 30, F. O. B. Of course, that does not include the cost of package, or the local charges for loading, and so forth. Now, while of course the prices are not always high, and in fact are often very low, we in the northern part of the State have been forced to this from the fact that the buyers could not or would not put their money behind the whole of the shipping fruit of the State, and the grower was left to the almost absolute necessity of shipping a part of his fruit.

Now, the California Fruit Union was started with a large capital stock, only a small portion of which has ever been taken; it is an incorporated company, association—an incorporation. And it has worked as the head, or moving center of quite a number of local organizations in the State, and, I believe, with very much advantage to the State, as we have moved out a large amount of fruit, and it has certainly brought something—if not high prices, we have got something for it. In 1889, the California Fruit Union and its members shipped, I think, fully two thirds of all the fruit that was shipped east of the Rocky Mountains, and, of course, that fruit was all under the control and management of the California Fruit Union, and the members did not ship to any point where we have agencies, except that they shipped to our agent.

Of course, there is considerable in the detail of the organization that would take some time to explain in full. It is governed by nine Directors, a President, and a General Manager; and we maintain an office in

San Francisco through the winter, and the office is moved to Sacramento in the summer.

Much depends upon the condition of the fruit when picked, and also a good deal depends upon the climatic conditions after the fruit is picked and loaded in the car. I don't care what the condition of the fruit as it leaves California, if it strikes over into the Missouri Valley in one of those hot, wet, sultry spells, it is only sure of arriving at a point of destination in poor to fair order. If, on the other hand, it starts here properly, and the conditions all the way through are favorable, it arrives in fair to good condition. Good condition, as a rule, means good prices in almost any market. Fair to poor means low prices, but little above freight.

There is much to be studied in the boxing of the fruit. The material used should be good, and it should be light, because the deciduous fruits that we ship, as a rule, must be shipped on fast time and high freight, and the California Fruit Union have certainly accomplished considerable in getting the time that we are now receiving from the railroad company. While we have never received as low a rate of freight as we would like, and as probably we will get when we, like you in Southern California, have a competing line of railroad, we certainly can ship, and do ship, a good deal of fruit, and get something for it. I was shown a basket here, which I think a very good one for the shipment of small fruits. By small fruits, I mean grapes, small plums, and apricots. They are shipped from the north in a basket like that, in a crate containing four or eight, as it may be single or double; and there has been a good deal of improvement on the weight and style of basket made. I think it is made here in Los Angeles, if I am not mistaken; and I understand that W. R. Strong & Co., of Sacramento, have, or are going to have, it for sale up there, and, judging from the sample shown here, I think it is a very desirable one. And while I say that I am not here to advocate or advertise any particular basket, only the lighter the box, the lighter the package, and the cleaner it is the better. Not only is that true of the basket but of the box.

In the northern part of the State we have quite a number of local organizations.

Large apricots should be wrapped, because they are too large to be packed in one of those baskets. In packing small apricots and plums we use a long strip of paper that makes three pieces about the size of this basket. If it is used as a long piece, we lay it in the bottom like that, and lay in a row of apricots or plums, turn it back between the first and second tier and lay in a tier, then turn it back and lay another one, which should fill the basket, and then the strip should be long enough to come back over the basket. If you should use a strip of paper, it should be long enough to lay in on top of the fruit. We use different sizes of boxes. The pear, the apricot, the plum, and the peach box are all of the same size, the only difference being in height. And, commencing with the earlier and smaller fruit, they use usually the four-inch box; then, as you come to the larger varieties of peaches, increasing up to six, although there are not very many six-inch boxes shipped. Four and a half, five, and five and a half inches high is the usual peach box. A four-inch box, or a four and a half, is a plum or apricot box, holding about twenty pounds in all cases. A pear box, I think, is nine inches, holding fully forty pounds when packed a little more than full, so that there is a little bulge in the box. Grapes are packed in either single or double crates, of about twenty pounds net to a single crate, or forty pounds net to a double crate.

It should be packed in all cases so as to avoid any shifting of the fruit in the case or package. With the peach you should avoid much pressure. And the box question is easily fixed, because if your box is not quite high enough, instead of putting your cleat on top of your box you put it on the under side of your cover, and in that way you raise the cover about three eighths of an inch.

About two thousand four hundred carloads of green fruit have been shipped to eastern markets during the past year. The dried fruit I can't give, but it has been a very large amount. I was talking with J. K. Armsby, in San Francisco, a few days ago, and as he is one of the largest handlers of dried fruit in the country, his remarks ought to be good authority. He said, that this year California had shipped East about sixteen million pounds of prunes, as against six million last year, and that not only the demand, but that the price had been very much better this year than last. He also said that the canned fruit market was suffering on account of the dried fruit, or rather, that the dried fruit of California had become so good that it was taking the place of canned fruit. I asked him if any other section of the United States was making the same improvement that California was, and he said no; that California was the only place that had made any improvement except a few places where they had started evaporators in Delaware, and a few other places, and they were not operating on a very large scale.

The reason that the budded prune, or the prune of commerce, is valuable and salable, and the fruit which sells more readily than any other dried fruit that we have, is the fact that it is a sweet prune. Poor people, people of medium circumstances, can buy a dollar's worth of dried prunes without buying two dollars' worth of sugar to go with them. Now, when you take a Hungarian prune, it makes a very sour dried fruit. It is a dried plum, not a prune. I don't believe a man would ever venture to dry them when he could have got the price for them that he could this season or last. The Tragedy prune is one that has gone to the front with a great deal of popularity as being a very early and a very sweet prune, and has brought exceedingly high prices. How long it will do so is more than I can tell, but that is the present status of the Tragedy prune. It is not raised to any extent except around Sacramento, and last year some twenty-pound boxes sold for $4 and more per box in the East. It is a good sized prune. It does not compare with a large Hungarian, but then it is a fine, large, sweet plum, or prune, or whatever you have a mind to call it. Quite a quantity of the Kelsey plums were shipped East last year, and they were not appreciated particularly. I don't know why. They did not sell as well as fine Hungarian or Gross prunes.

MR. AIKEN: It is well known that the prune tree is a hardy tree; it will grow, as far as the tree is concerned, in many portions of the State. There are portions of the State that have been proved, by a series of years, to be well adapted to the cultivation and growth of the prune. And yet prunes grown in several localities of the State are very indifferent. Prunes grown in sections of the State where a long season is allowed for their growth and proper ripening, produce a fruit of rich, fruity flavor, and a fine bouquet taste—a prune that grows large and dries heavy and brings the very highest prices in the eastern market. There are other places where the tree will grow where it apparently bears a crop, but it is found after the prunes are dried that they are substantially skin and bones, without this fruity flavor or bouquet; without the rich, dark, glossy color that indicates that the prune has ripened naturally, and fully ripened before drying. Such prunes bring a very low price in the market. I remember two years ago, at Chico, a gentleman brought me prunes, apparently French, saying that the San Francisco buyers would not pay for them, would not buy them, and asked me what the difficulty was. It was apparently a prune. It had grown upon a French prune tree. The trouble was it was grown in a location where the severe hot climate of the valley had caused the prune to shrink and shrivel, and fall from the tree before the natural ripening process had taken place. It consequently was small, and very thick skinned; it was difficult to bite it, containing, as it did, none of the proper juices that the prune should have. Therefore it was unsalable.

Now, while our friends in Southern California may grow prunes, I fear that year by year it may (in a cool year) prove somewhat of a success, and in a very hot and dry season would prove a failure. These things would have to be studied carefully: the elements of the soil, the exposure to the winds, the exposure to the fogs of the ocean. There are places in Sonoma County and in Santa Cruz County where prune culture we would suppose might be carried on, where, owing to severe winds of the coast, they crack open and make a very poor, dried prune, and, indeed, the culture is a failure. I have heard of several such localities up and down the coast. One gentleman, I think from Ventura, being near the coast, spoke of that as a fault. It is a fault that cannot be corrected. In Sonoma County, in the upper part, Santa Rosa, and above there, they raise a most excellent prune. It is a cool climate, and the fruit ripens with an excellent flavor. The same I can say of Santa Clara, and portions of Santa Cruz County. They at present are the prune centers of the State, and probably will remain so; while in these new portions, in this new orchard enterprise of Southern California, there may be places where the prune will do well. I hope they will. There is a vast field, as Senator Buck has stated, for the dried fruits of California and the prune. I don't think there is much fear of overdoing it. At my point on the Santa Cruz Mountains, in Santa Cruz County, near San José, we have this year a rainfall of eighty-five inches. To mature a prune, large, rich, and juicy, without a rainfall, almost you might say an excessive rainfall for Southern California, I do not believe that year by year, dry and wet, that prune culture will be a success. I do hope it will be, but from my long experience in prune culture I fear it will not be. I throw these matters out for your consideration in setting out orchards in Southern California.

MR. O. N. CADWELL, of Carpenteria: I do not believe that the prune can be successfully grown along close to the ocean between my place and Los Angeles, or even San Diego. I believe there has been a great deal of money thrown away in prune trees for our locality. In the valleys, or away from the coast, it may do to plant prunes; but for twenty-one years, take the time together, the raising of prunes would have been a failure at my place. The plums generally do not do as well as they do further north. I have been in the fruit culture in Lake

County, where they can raise good plums, and good prunes, I presume, too, but good plums I know do grow there. We can raise good plums now and then where we live, but they are not a success.

MR. A. BLOCK: There has been quite a discussion here in reference to the French prune. Will you allow me a suggestion? We all look to the Frenchman for characteristic pride. If a Frenchman goes to buy meat, he wants to buy it of the French *butchaire*. He says no American can cut meat as the French *butchaire* does. When he buys his bread, he wants it from the French *bakaire*. I, for one, admire his doing so. Yet, as a Californian, as an American, I would prefer that he should go to the American and to the Californian. I have some pride, and I hope that California will assert a pride of character and drop the name of the French prune. Let us call it the California prune. [Applause.] And I hope that hereafter the discussion will be in reference to the California prune. If I am in order, I move that this Convention recommend to the fruit growers of the State to adopt the name of California prune, whenever the name of French prune is to be mentioned.

The motion was seconded.

MR. MCDONALD: That is really a suggestion of great importance, and has been discussed a little heretofore; and I will agree with Mr. Block if we could get together and drop that name French, and call it the "California de Ente," or the "California de Sergent," or any other Sergent. Only if we can get the name and leave off the French, and have it distinctly California, I think it would be better. And right through this Convention is the place that we are going to make the change, if we can make it, so it will be universal throughout the State. I will join Mr. Block in any effort we can make in that behalf, if we can get at it intelligently and so it will not mislead; but we must do it so it will be known throughout the State.

A MEMBER: I want to testify that the California prune is already known throughout the East, and the French prune is really a drug on the market if the California prune can be obtained. I have had some experience in regard to that. Drummers in New York selling prunes have told me lately that the French prune is a drug on the market, and that they always call it the California prune. There are French prunes standing on the shelves all over, and they can't sell them if they can get the California prune. One reason is that the California prune is sweeter.

A MEMBER: We ourselves are using the French name, and putting it on the boxes. They are marked "Twenty-five pounds of French prunes, packed by John Jones, Santa Rosa." Now, let them call it "California prunes, packed by So-and-so, California."

JUDGE AIKEN: Mr. Chairman, the French do not call their prune the French prune. It is not put upon the market as the French prune. There are the De Ente, as well as others. That is the name of the prune upon all boxes and jars that come from France. Not known in the market—not rated—as French prunes. For a matter of convenience on this coast we have fallen into the error, I admit. Simply because certain cuttings or certain trees are brought from France we have called it the French prune; and we have called it the Petite because it is small. But that is a misnomer. It is not always small. Where it does well it is a large prune of its kind. It was originally a date plum, properly speaking, I presume. The French call plum a prune, and it is a date

plum—a plum that will dry with a pit in it. I have always said that the difference between a plum and a prune is, that a prune would dry well with a pit in. I rather agree with my friend Mr. Block, that if we could agree upon some name it would be well to drop the word French. Felix Gillett, a prominent prune grower in Nevada County, suggests the "California de Ente." The French simply name theirs De Ente. Now, if we could go into the market with "The California de Ente," which is proper nomenclature of the prune, it would be a suitable and an exact name. It would define the kind of prune, and it would come directly in competition with the prune that was sent from France under the same name. We simply add California to identify the prune. And I would amend Mr. Block's motion so as to make it identify that particular prune by using the French name De Ente—California de Ente.

MR. BLOCK: While I appreciate the effort of my friend in designating it, I hope that you will drop the De Ente. Prune is an American name, good enough for us. I want American names on all occasions. With regard to the description, De Ente, you have given it correctly. Why, you have got prune De Ente, prune Petite, prune Robe de Sergent. Let us call it California prune, and then if you want to designate what particular name it has, add that to it. But let us call it the California prune. Let us recommend to all the growers, instead of marking twenty-five pounds of French prunes coming from California, mark it "Twenty-five pounds of California prunes." That is plain; that is the English of it. Let us drop all foreign words.

Motion carried.

DISCUSSION ON FRUIT DRYING, RESUMED.

THE PRESIDENT: The discussion on selecting, preparing, and packing fruits is still before the Convention, and I beg leave to suggest that the questions asked by the gentleman from Pasadena, with regard to whether it is necessary to wet fruit with hot water to prevent eggs of the moth from hatching, is unanswered.

MR. THOMPSON: I ask whether it is necessary after the fruit has been dried in an evaporator, if it is packed immediately, or how it is kept free from the dried fruit moth.

MR. S. R. THORPE, of Ventura: It is not necessary if you put your fruit directly into cotton sacks and place where the moths will not have access. I will state, too, that the essay may be misleading in regard to dipping some fruits. If you dip your prunes in hot water or any other water after you have dried them, in order to soften them up to put them in boxes, you will get a product so black and so foul that you cannot sell them. If you will put your prunes dry into cotton sacks you will never have trouble with them. I have kept them that way over two years. I have put them into boxes after dipping them in scalding water, and in six weeks' time I have had a mess I could not sell. That has been the experience of others in the evaporating business.

MR. E. A. ROGERS, of Santa Rosa: The dealers would not buy my prunes unless they were dipped. They are better to look at. But for the eastern market they didn't want them. Men would not take them if they were dipped, while I found the local market of San Francisco wanted them dipped. Three different times there they would not talk of buying unless they were dipped.

MR. BUCK: I do not want an idea to go out which I do not believe to be correct, and that is that dipping fruit after it is dried spoils it. It certainly does not. And there are very few prunes, unless they are packed as soon as they are in the proper condition, that are not dipped by somebody, whether it is the dealer in San Francisco or the dealer on the other side of the Rocky Mountains. They are dipped to make them soft so that they will dry well. Over-dried fruit does not appear well, does not sell well, to anybody. Of course, fruit may be dipped too much, and be too wet, so that it will be in the condition this gentleman says, almost rotten. I have seen plenty of it. It can only be successfully done by experimenting to a certain degree, to see how much moisture you can retain in the fruit after you have dipped it. You have got to dry it out again; that is, the most of it. The manner of dipping by most fruit driers is to dip in a kind of basket submerged in hot water, taking it out and pouring into a pile and letting it stand twelve or twenty-four hours until it dries out; and if you don't get too much water in the fruit as it is dipped in the basket, you won't have any trouble with your fruit spoiling.

MR. THORPE: I was speaking of the apricots, principally.

MR. THOMPSON: I have been taught, and have practiced the teaching, that we could not produce a first class prune without a second course of treatment. What I mean by a second course is a scalding process to kill the germ of insect life, and also to give the fruit a gloss to please the eye of the American man, which is very fine and nice on fruit preparations. Those things had to be done in order to get the fruit desired in the market. What I meant by the question I asked is this: I have steamed peaches after drying and dipped them in hot water after drying, in order to kill this germ, and I have not been satisfied with either, from the fact that it colors the fruit. But at the same time I have been informed that dealers who buy fruit are in the habit of steaming it before they pack it, where they buy it in promiscuous lots. Now, as to the curing of the prune, I don't know whether I have made a success of it or not. I sold my fruit to Germain this year, and he says: "You are the only man in Los Angeles County that knows how to dry a prune right." That is the exact words of the foreman. Certainly, as long as I have got his credit, which ought to be pretty good, I don't want to abstain from dipping my prunes unless that is the latest thing since last fall. I got 8 cents for my prunes. The course I give is a treatment with lye, and then a treatment of glucose in water, scalding or boiling hot, after they have been sweated a reasonable length of time in a sweatbox, and then exposed to the sun an hour or two, and then pack them before they are exposed to insects.

JUDGE AIKEN: On this dipping of prunes I wish to hear from a gentleman present who has been probably the most successful prune drier of the State. Mr. Mosher, of San José, is here, and he has put up, as I think, some of the best prunes in this State.

MR. MOSHER: I don't know that I can say anything new in regard to the curing or dipping of prunes. My process for dipping has been one pound of glycerine to sixty gallons of hot water. I think next year I will use less glycerine.

A MEMBER: I think the best success I have obtained with prunes was

putting them in the sun until two-thirds dry, and then putting them in my evaporator and finishing them. This gives them a very nice gloss, and I think they are the best prunes I have had.

MR. THOMPSON: The eastern buyers, one gentleman said, don't want them dipped until he gets them in his possession. One man in Los Angeles, that I presented my peaches for sale to last fall, said, "Oh, your fruit is entirely too green; we can't handle such fruit as that at all." I told him there was no objection made by anybody else on account of the condition of the fruit. "Oh, well, we can't handle that at all; too green." I said, "You are the first man that I have heard say anything of that kind. Now I am going to tell you the reason you don't want them; you wont tell me." He said, "We want them dry so that they will rattle." I said, "Yes, you want to take the life out of me, every drop of my blood out of me; dry me out entirely, and then take it and add the juice to it yourself, and put it on the market and get all there is in it; and I don't want that kind of thing. I want to sell my fruit so I get the benefit of some of that weight. I don't want you to get them all dried out, and put the weight in and get the benefit of all that yourself." That is the reason they don't want it dipped.

MR. MOSHER: I will state to the gentleman, that after they are dipped I put them in a bin, and leave them there for several hours—four or five hours; not too long. In this pile they get very hot, and I watch that they don't get too hot; and then, after they get through this little sweat, I spread them out and let them get dry enough for packing. They dry very quickly. I bought some dried prunes, that were quite dry, this year from neighbors, and by that process I found they gained about one half of the grade. They probably after dipping would only go sixty-five or fifty-five; they grade them sixty and sixty-five. I have not had any experience with glucose.

DR. J. P. WIDNEY, Los Angeles: I am a fruit buyer, not a fruit grower. It may be I shall speak about something that was already covered in the paper, but I would like to call your attention to one or two points. The points are these: that it seems to me enough attention is not paid to the proper drying of fruit and putting it upon the market in proper shape. I expect, after years go by, we shall find that dried fruit is of more value to this State than oranges. The orange belt is small, while the belt that will produce apples and peaches is almost unlimited, and in the aggregate I expect that dried fruits will be our most valuable product. In going into the market to buy dried peaches they simply call it dried peach, good, bad, and indifferent; there is no discrimination made. There certainly must be a vast difference in the varieties of fruit that will make a good dried peach. As it is now, I think in a fruit orchard they dry everything mixed together, at least they come so in the market, and we have a very inferior article. In the orange culture we are selecting varieties. In the drying of peaches or apples, it seems to me that to make the best result the varieties should be marked, and they should be kept upon the market, not as dried apples, but as the dried Bellflower or dried Pippin, naming the variety, and the producer will soon find it is desirable to do so. So with the peach. Therefore it seems to me there should be a discrimination in varieties.

In the next place we have learned that a dried grape is not a raisin, that a dried fig is not the fig of commerce. There is a change which takes place in the curing. Most of the fruit which I buy in the market is simply dried—dried until it is burnt up. It seems to me that there might be developed in the peach and in the apple, by a proper system of curing, very much such a superiority as we find in the cured grape as compared with the dried grape; and yet we haven't got it in the market. It may be you gentlemen are doing your work better, but we don't find it in the market.

I find one article that has been cured which is eatable, and another article which has been dried and is uneatable. Yet the two are put side by side, with no distinction, and marked at the same price, and I take my chances in buying. I have found in my own household that the sun-dried article is far superior to that which comes from a drier. It seems in the rapid drying there are lost some of the properties that are retained by drying in the sun.

It seems to me that if these three points were observed that the dried peach and dried apple would become a much more important article of commerce than it is to-day, and pay the fruit grower much better prices. I give these suggestions as a fruit buyer, rather than a fruit grower. I hope that those of you from the northern part of the State will not go home with the idea that we can't raise prunes in this part of the State. Thirty miles south of here we have an orchard of five thousand trees (prune orchard), a mile and a half from my home. Those trees are young. They bore a little fruit last year for the first time. They look well and very promising, and if I were called upon to state the four fruits in Orange County, the infant county of the State, for profitableness or commercial value, I would say the orange, second the walnut, third the prune, and fourth the olive. Why, it is astounding that we have raised this year sixteen million pounds of prunes, and last year six million pounds. The California prune in New York and Boston to-day runs from 1 cent to 1½ cents per pound higher than any Mediterranean fruit; and the time, in my opinion, will soon come when we will rule out entirely the foreign prune; and whether we call it the California prune or not, we will have in the United States nothing but prunes raised in California.

Mr. Blanchard, of Santa Paula: I dislike to see anybody engage in any business or other enterprise and not make a success of it. I will take a few minutes, and state more fully than I have the reasons for what I have said. Mr. Louis Pellier was the first prune plânter, perhaps not in the State, but in San José. When he came there he was a miner. His neighbors laughed at him planting those prunes. They proved to be a great success. I came down in 1872 into Santa Clara Valley, Ventura County, where George P. Brigg came in about 1861 or 1862, a great fruit raiser, from near Marysville. He had an idea that by going down into the southern part of the State he could get fruit into San Francisco much earlier than they did in the Sacramento Valley. He bought a large tract of land, and set out a large number of trees of many kinds. His experience was very disappointing to him. He found that many kinds of trees would not leaf out until midsummer, and instead of getting fruits into the market earlier than from the Sacramento Valley, they were very much later. Disgusted with his enterprise there, he droppd it and left. We used to compare our rainfall with that of San José, Santa Clara County, and for the first ten years it was almost identical, averaging about fourteen inches in San José and fourteen inches at the point at which I was living in Santa Paula,

Santa Clara Valley. I first thought that the reason many of the northern fruits, the plum, the cherry, the gooseberry, and the currant would not grow there, was to be found in the soil. But occasionally we had a season when the cherry trees would bloom full. Then I was convinced, and I think I am right, that the difference is in climate, and not in soil. I have seen two or three times, in the Santa Clara Valley, a cherry tree not as full as I ever saw them in the mountains or Sierras, but I have seen quite a pleasant sight of cherries. But they are exceptional. I have classed the prune with the plum, but the places where they would do well in the south are an exception. I have discouraged those with whom I have been brought in contact and talked about planting fruit trees, from planting prunes. For, as I said, I don't like to see money wasted in any enterprise. The plums that come to us are the plums, perhaps, that grow in Japan, and those generally do well in Santa Clara Valley, Ventura County. But the prunes, so far as I have observed, in Santa Barbara County, and in our county, as a rule do not do well, and do not pay to cultivate.

A Member: Mr. Blanchard's views and mine agree exactly as to prunes and plums. They are not a real success on the coast from Santa Barbara this way. I wasted money in the prune business I never recovered. There may be a heavy crop of prunes this year—trees promise now that they will come out promptly, also the plums—but they are not a real success. We can raise a few nice prunes now and then. Sometimes two years in succession our trees will be full; now and then they will be so full they will all break down if they are not thinned out. In consequence the prunes are almost worthless. They do not blossom or leaf out as they should. They wait along sometimes until July or August before they start a leaf, and sometimes I have seen plum trees that have made a growth of four, or six, or eight feet even, the year before, that would not start a leaf for the whole year, and then come out smiling the next season. It is not the soil that does this, it is something in the climate that we cannot explain.

A recess was then taken.

AFTERNOON SESSION.

(President Cooper in the chair.)

OLIVE CULTURE AND CITRUS FRUITS.

Olive Culture and Observations Abroad.

Essay by C. F. Loop, Pomona.

As the palm in tropical regions is regarded as peerless, so in the higher zone or semi-tropical belt, the olive stands preëminent in importance as soon as we can understand its marked characteristics, utility, beauty, and longevity.

In the first bulletin issued two years ago by the State Board of Horticulture, in a prefatory note we find this statement: "The olive is now more prominently before the people of California than any other tree." This is, without doubt, a fact. Fruit growers from the north to the south are reading, studying, and watching the result of importations already made and those which are being made, and the fruiting in this State of the new varieties brought from the Mediterranean.

It is to deepen this interest already created by the publication of the Board, and to aid those who are asking for information concerning these new varieties mentioned in the first bulletin,* that I have prepared this paper.

The assertion with regard to the importance of the olive we reiterate then without fear of contradiction, for its real value to man was understood and acknowledged in the beginning of human history. It was accepted as one of God's best gifts for man's comfort. From this point of view it is frequently mentioned in the sacred writings. And being associated with the customs and sacrifices of the Hebrew religion, it became to the inhabitants of Palestine an emblem of peace, strength, and plenty. In reading Greek mythology our interest is awakened when we find the olive invested with a divine origin, Minerva causing it to spring from the ground.

A Roman writer of an early age places the olive in the front rank, calling it "the first of all trees." Pliny says the vine alone is worthy of being compared to the olive.

Another evidence of importance of the olive is the extent of the plantations made in the early ages, and the continuity of vegetable life and cultivation in those plantations. Go to Antibes, a place between Connes and Nice, on the Mediterranean. Here you find the ancient Antipolis of the Greeks, and some of the most remarkable monuments of Greek and Roman occupation in past ages.

These ruins, the poet says, are shadowy with the remembrances of the majestic past, the dust of decay giving only echoes of the anthems of old victories. Looking away from the ruins your eye is delighted as it rests upon the olives brought by the Greek colonists, covering the fertile hillsides as far as the eye can reach.

Go to Tivoli, a few miles beyond the outer walls of Rome; there you see the foundations of Adrian's Palace, Macaenas' Villa, and the shattered columns of the Temple of the Sybil mentioned in the writings of Virgil, the Latin poet. Overlooking these extensive and magnificent ruins stands a group or plantation of olives whose history, tradition says, is not only interwoven with these relics of antiquity, but also with the history of the Eternal City itself. And to-day you find larger plantations on those purple hills than at the period of her history, when, in the zenith of her power, imperial Rome ruled the world.

Go to the Garden of Gethsemane, near Jerusalem, and look upon those majestic trees, beneath whose shade angels, with silent tread, ministered to the world's Redeemer. The Temple of Solomon, the palaces and towers built before and after the Roman conquest, are all in ruins, while these olive trees, claiming the attribute of comparative immortality, remain as witnesses to intensify the truthfulness of the events which have entitled the place to the appellation of the Holy City.

Monsieur de Candolle, a French writer, has made interesting research concerning the olive among the Hebrews, Arabs, Greeks, and Romans, and in his report has given us a credible account of the manner in which

*"The Olive in California," by B. M. Lelong.

this tree has been carried—as the star of Empire has led man westward, around the world, where climatic conditions favored its growth and cultivation. It is evident, he says, that the olive existed first in Syria and in Greece. There the oil was first extracted, and the original varieties were cultivated under distinct names. The Hebrews and the Tyrians, and afterward the Arabs, carried it along the coast, while the Greeks, and after them the Romans, carried it along the opposite shore of the Mediterranean, leaving in Spain and Portugal a mixture of Greek and Roman names indicating two distinct importations. The ancient Romans, it seems, had ten varieties of olives. Three of these are mentioned by Virgil, and Pliny gives us the name of one, making four. One of these, called in the French catalogue Columella, has come down with very little change even in its name.

As new colonies were planted along the shores of the Mediterranean, and new settlements were made in the interior valleys, varieties were multiplied by trees grown from seeds; and as they differed from the parent stock in color, size, shape, or in the appearance and habit of growth in the tree, each received a new name. In southern France more than fifty varieties are under cultivation now. While in Italy, from Lombardy on the north, including the Island of Sicily in the south, there are three hundred names given in the different localities, and about one hundred varieties found having some special mark of difference. It was perfectly natural to give a local name to a new olive originated by a family under new conditions; hence, we find the name indicating the color of the fruit, as Verdale, Rouge, Blanche, Pigale, or from its resemblance in shape to something familiar, as Manzanillo, or the Uvaria, having the fruit in clusters like the grape.

But let us take a nearer view of the olive where it has been in cultivation from time immemorial, especially those varieties now fruiting in California, in which we are deeply interested.

Arming ourselves with letters from the American Minister and Consul-General, in Paris, to the Consuls of our Government on the Mediterranean, we left the French capital one bright summer morning, traveling by rail south in the direction of Marseilles. Sitting in our compartment, and moving at the rate of forty miles an hour through a country which has been under the hand of the husbandman, the gardener, and the horticulturist, for two thousand years, aided in their work by a fertile soil, bright sunshine, and summer showers, we were greeted by point after point in landscape gardening rounded into beauty, as the exciting panorama moved before our eyes. One point of interest worthy of mention here, was the palace and lovely gardens of Francis I, where originated the luscious grapes known in California as the Casselas de Fontainebleu.

After midday we passed the divide between the headwaters of the Seine and the River Rhone, entering the Valley of the Ouche, bounded by the slopes of the Cote-d'Or, whose sunny vineyards, before the advent of the phylloxera, were famous throughout the world. To become owner of one of these Cote-d'Or, Baron Rothschild paid a sum equal to a king's ransom.

Passing through the richest part of Burgundy, in districts surrounding Dijon and Macon, we were able to notice the great damage caused by that fell destroyer, the vine pest. Some of the plantations appeared as though fire had passed over, destroying all verdure and life, leaving in its track desolation and financial ruin to the owner. It is not regarded as an evidence of weakness when the native of Burgundy is seen shedding tears over the dimmed glories of the Cote-d'Or, or the impaired beauty and value of the Clos-Vougeot.

The vine growers in California during the last three years have been able to understand this misfortune, and to join in the wail of grief arising from the heart of the people of southern France over the destruction of their valuable and beautiful vineyards.

My guide book gave me no intimation, and my landlord at Lyons could not tell me just where to look for the first trees in the olive belt; but gave the assurance that before the day was done I would see olive trees enough to cause perfect satisfaction, even if I had traveled six thousand miles in the quest, and were as anxious as Jason in search of the golden fleece. I was, therefore, not a little startled on rounding a curve among the red hills, in the vicinity of the ancient City of Avignon, to gain my first view of that wonderful belt which is coextensive with the shores of the great sea. It was not only interesting but exciting to begin my observations and study among olive trees covering the hills and valleys over which Hannibal led his army into Italy, and where, as I moved from point to point, monuments were seen of the age of Julius Cæsar, indicating the political jurisdiction of imperial Rome.

But having now reached the border of Beulah Land, and begun in earnest the work which I came to do, I will use, to a certain extent, the notes taken upon the ground during many succeeding days and weeks, in and around the centers of this industry in southern France and Italy.

My first observations, as I said, were in the northern limit of the olive belt of southern France, in latitude 44 degrees north. This line on the Pacific Coast would pass through the middle of Oregon, and, if continued eastward, would pass through South Dakota. They have certainly an advantage in temperature, owing to the disposition of the regular aerial currents and the conformation of the shores of this great sea; and as the beginning of human effort in the cradle of civilization was in countries upon its shores, we may pardon the belief still held by the inhabitants that the Mediterranean is the center of the world. If you express a doubt upon this point, and attempt to give them an idea of the aggregate of human interests towering upon the Western Continent, they will at once refer you to the location on the Riviera of the Garden of Hesperides, and you gracefully yield the point without argument.

The local name of the olive which I found near Avignon was the Rouget. The oxide of iron in the red soil evidently gave the fruit its color and its name. The limestone cropping out freely on the hillsides shows the source of nutriment for its wood and leaves. According to local report, this olive withstands the cold incident to this location, and the winds which are at certain seasons exceedingly disagreeable. Like the Mission olive with us, it yields a good quality of oil, and is prepared and used on the table, and this, with its variations, the Caillet Rouge and the Verdale, are cultivated in situations exposed to cold along the limit of the belt. Hardiness and a firm growth of wood are essentials in such situations. In warmer localities, and nearer the sea, in the Department du Gard, and in the country surrounding Arles, where the extensive plantations give a marked character to the scene, we found a number of varieties. Among these the Picholine has a prominent place

on account of its productiveness, resistance to cold, good quality of oil, good table fruit, and its comparative freedom from insect pests.

The tree here, where it originates, is of ordinary size, with straight branches, fruit of good size, terminating in a point, leaves a beautiful green. This tree takes its name from Sen. Picholine, the horticulturist who produced and called attention to it as a distinct variety.

There are about a dozen of the old varieties cultivated in the districts and provinces of southern France which give satisfactory results in quantity and quality of oil. One, extensively planted in the country surrounding Toulon and Hyeres, which, in the estimation of competent judges, gives the finest oil in the world. In the French catalogues this olive is called the Cayon. It was brought to France originally from Genoa, Italy. It offers the great advantage of rapid growth, with little difficulty as to choice of soil, bears early, and yields regularly a large crop of fruit. This has been imported under the name of Rubra, and gives promise of sustaining its European reputation when transplanted to our soil.

Another variety growing in the same districts, under the local name of Le Brun, so named from its dark or blackish colored wood, has been imported under the name of Atro-vialacea. This tree is of slow growth, attains great size, resists cold, requires a good soil and cultivation, fruit firmly attached, so that it does not fall easily from the effects of the wind, which is sometimes very severe in the winter when the fruit is ripe. The oil is yellow in color, very rich in quality, and is always in demand.

When asked to name three olives growing in southern France yielding the finest table oil, Monsieur Audibert, a noted horticulturist connected with the national gardens of acclimatization at Hyeres, named the Rubra, Atro-vialacea, and the Picholine.

Another olive in the front rank, extensively found in plantations along the Mediterranean, in the neighborhood of Nice, Villefranche, and San Remo, and in the interior as far as Grasse, is the Pendoulier. It takes its name from the drooping habit of its branches. It attains a great height, and throws out long branches on every side. It is the largest olive tree now in cultivation in southern France. Like the Cayon, it yields a good crop in alternate years, which is the rule in the olive belt everywhere. The fruit matures slowly, black when quite ripe, and yields a fine quality of oil of light color, without flavor of the fruit, and without odor, and on this account is employed as a vehicle for perfumery. We have also imported this tree under the same name which it bears at Nice, and the time will come when the oil obtained from it will be in demand here in California, when flowers will be cultivated here in large plantations, from which the delicate perfumes of commerce are obtained.

In Italy, as I said, there are a great many kinds of olives, but only about ten or twelve varieties which possess special interest for cultivators in California. Those known as the press olives, grown on the warm, fertile hillsides and plains of Tuscany, producing the celebrated Oil of Lucca, which, before the day of adulteration began, was unrivaled in the Italian market, possess a deep interest for us, and if we can transfer from Tuscany to California the Razza, Leccino, Morinella, Belmont, Rosselina, Grossajo, and a few others for table use, and with careful attention with regard to soil, climate, and location, produce similar results, I think we shall be doing a good work in our day and generation. Our methods of propagation now enable us to multiply rapidly, so that in a few years the nurserymen of California will be able to supply the demand for young trees which will be adapted to each location, from San Diego to the foothills of Mount Shasta, where it is desirable to plant the olive, and to intelligently recommend the varieties which will give the best results in oil and table fruit in each locality. If I am not mistaken, about twenty varieties, including those recently imported from Spain by Mr. Rock, of San José, are now growing in different counties of California. Last year I imported six varieties from southern France—three for oil and three for table use—and by the end of this year we expect to have fifty thousand plants rooted in the greenhouse. This year I have imported from Tuscany, Italy, ten varieties—six for oil and four for pickles.

Of olives imported from France, we have: For oil: Rubra, Atro-vialacea, Picholine. For table: Regalis, Uvaria, Manzanillo.

Olives imported from Florence, Italy, are: For oil: Razza, Grossajo, Morinello, Belmonte, Rosselina, Leccino. For table: Olivastra, Santa Catarina, St. Agostino, Ascolana No. 1 and No. 2.

Those mentioned last are the famous white olives of Ascoli, described and illustrated on page 88 of the annual report of the State Board of Horticulture for 1889. These olives are said to cost, in London and Paris, 20 cents apiece.

It is my intention to import three varieties more from the eastern shore of the Mediterranean. One of these is grown on the Island of Mytalena and two in Syria. The special interest which these olives excite in my mind is their freedom from bitterness, no process being required to discharge this principle from the pulp.

Those who have attempted to cure the Mission olive for the table, can readily understand the great advantage of working with an olive where there is no danger of injuring the pulp by the use of lye or lime.

If necessary, I will make one more journey to the Mediterranean and bring these olives to California; have them multiplied in the greenhouse, and put within the reach of the cultivators in our olive belt, where I am sure they will be appreciated. And now, before closing, permit me to give you a few items suggesting impressions while traveling through this olive belt of southern Europe.

First—The trees were as different in appearance as the apple, the willow, the well grown Bartlett pear, and the magnificent live oak, which has been growing on a rich soil for a thousand years. Some varieties growing on the shore down to the water's edge, if transferred to the interior, would languish and die. Some varieties doing well in the interior, would not give satisfactory results on the shore. The trees, whether along the shore, on the plains or hillsides, were growing on red soil. The only exception to this which I noticed, was the district near Naples, where volcanic upheavals had given the surface soil a dark purple color. The trees growing there, on the plains near Naples in that dark colored soil, were of great size, and noted for their fruitfulness.

In some places, passing along the edge of an interior valley, where the steep hillsides were terraced and planted with olives, and all work of cultivation must be done by hand, the view was discouraging. The stunted trees were standing in soil baked by the summer sun, as hard as an adobe. The stems of the trees were from ten to twelve feet high,

with a top as flat as a table, having been cut back to increase fruitfulness. On the other side of the train lay a plantation on level ground, extending from one to five miles in width, with trees having the appearance and shape of the grand old oaks in Windsor Park, with a soil as red as that which the traveler sees in passing over the Gloriatta Mountains in New Mexico, on the Santa Fe route. The contrast to the eye was very striking, between the results of intelligent, well directed efforts in promoting growth of wood and fruitfulness on the plain, and planting on the very steep hillside, where the trees were left during the long, dry summer without cultivation of any kind.

Second—The fruit of the olive tree differs in color, size, shape, and in its qualities, each great oil district, like Marseilles, Toulon, Nice, Grasse, Aix, and Lucca, producing an oil with marks peculiar to its own location. This oil being made in the cells of the pulp by the hand of Nature, must be expressed and clarified, and then it is ready for use. Differing in color, flavor, and purity, it is esteemed according to its intrinsic value. Some varieties give a small quantity of the finest quality of oil. Other berries are large and pulpy, having little oil, and on account of size are prepared for the table. Again, the fruit differs with regard to bitterness. This principle of bitterness is more or less perceptible in all the varieties, except the green olive of Syria, which carries only a small per cent, considered essential in table fruit, hence in different districts different methods of curing prevail. In one place immersion in strong brine will answer, in another lime is used, in another lye or caustic soda is used to discharge this principle of bitterness. The people of southern Europe use the ripe olives with the bitterness discharged. Go to the corner grocery and watch the laboring man coming to get his supply of olives for his supper. On receiving the order the grocer takes a long handled dipper and passing it down into a large earthen jar, holding a half barrel, brings up the required amount and pours them into the laborer's pail. In the jar the ripe olives with the bitterness discharged are in a brine just strong enough to make them palatable, the air being excluded by olive oil a foot in depth above the brine.

In conclusion, let me remind you of an historical fact, to bring clearly into relief the statement in the first olive bulletin, with regard to the importance of this fruit tree in California. When the Franciscan friars, one hundred years ago, came to found their missionary colonies, among the essentials of comfort which they brought were the Mission olive, and the Mission vine. At this day we recognize their wisdom in the selection. In this respect they did their best. And the good work begun by these wise men has been carried on by the fruit growers of California, and we trust the work will be carried on in the future, until every location where this noble tree can be cultivated with profit shall have an abundance of the finest press olives in the world, as well as a variety of the best for table use, thereby saving to our own people a large amount expended annually abroad for oil and bottled fruit. And I hope, at some future meeting of the fruit growers of California, to place before you samples of these table olives, prepared by my own hand, including the green olives of Syria and the delicious white olives of Ascoli. My observations of the olive belt were confined exclusively to southern France and Italy. I did not go to Spain or Portugal.

VOTE OF THANKS.

DR. CONGER: I move that a vote of thanks be tendered to Mr. Loop. Motion carried.

CITRUS FRUITS AND THEIR CULTURE.

Essay by THOMAS A. GAREY, Garey.

In response to the request of the State Board of Horticulture to write an essay on "Citrus Fruits and their Culture," to be presented at this Convention, I herewith present a few concise thoughts upon this most important subject.

Among citrus fruits the orange is of first importance, with the lemon a close competitor. It is now ten years since I wrote and published my work on "Orange Culture in California." In the introductory remarks in that work the first paragraph reads: "That the culture of the citrus family of fruits is destined to become one of the leading industries of the great State of California is no longer disputed by the intelligent, reflective, and progressive mind. That it is now and will continue to be the principal incentive to immigration into this State is an acknowledged fact." How prophetic my language was is now apparent. What has made Riverside what it is? What is making Pomona and other localities in California noted? *Orange culture.* What has been the greatest inducement to immigration? *Orange culture*, with climate as an adjunct. Witness the thousands of cars, whole trains of our golden fruit, now dispatched annually to eastern markets. "California oranges" are now a familiar article of commerce in all the great centers of civilization east of the Rockies. It is the greatest advertising medium we possess. Deprive "California on Wheels" of its citrus display and you take from it its chief attraction. An individual as an audience never tires of listening to the history of our peerless groves of golden apples, the handsome, symmetrical, and electrifying golden glory of the Pacific Coast.

The principles underlying successful citrus culture are: First, selection of a site for the orchard. Location is of primary importance, while the quality of the soil must be adapted to the successful propagation of the orange and lemon. Location must always be considered first.

The table or mesa lands near the mountains have been proven to be the best localities adapted for the finest and best flavored fruit. In my work on "Orange Culture," page 19, I wrote: "I predict that the future orange orchards, famed for the beauty and quality of their fruit, will be found on our high, dry mesa lands, and that the product of the orchards of the valleys and low lands will find a second place in the orange markets of the world; hence, take warning, and start right by making a careful selection of a site on which to plant your orange grove." The advice contained in the above paragraph is as useful to-day as it was when written.

Second, selection and purchase of trees. This is a prime factor in the future success of the venture. Do do not invest in cheap trees; plant a less number of trees if your bank account is limited. Trees for an orchard should have straight trunks, and evenly balanced heads as tops, and be of good, strong, vigorous growth.

Third, transplanting to orchard. Transplanting to the orchard is generally considered simple and easy, and, with few exceptions, it is done in too much of a hurry. The question is not, how shall I proceed to plant my trees in the best manner to insure a quick and permanent growth; but how can I plant my trees in the least possible time, and with the least expense? All possible dexterity consistent with the success of the venture is commendable and desirable, but when a proper degree of care is sacrificed to great haste and careless planting in order "to finish the job," it is reprehensible in the extreme.

It is of primary importance to know in what month to transplant the trees. I have found that May is the best. The ground is then warm, and the weather is mild, being neither too hot nor too cold. There is usually more cloudy weather in this month in Southern California than in any other, not excepting even the rainy season. February is my next choice. June is better than March, and July is better than December or January. I would rather plant in August than in October or November. Plant in May in the southern part of the State, and in February in the northern part, and you may reasonably hope to succeed.

Fourth, cultivation. Cultivation must be thorough and persistent. No weed should be allowed to grow; the orchard cannot be kept too clean. There is a diversity of opinion as to the depth to which an orchard should be plowed; some favor shallow plowing, some deep plowing. I approve of and advise plowing not to exceed two or three inches in depth, adjoining the trunk of the tree, and within a radius of four feet from it, increasing the depth gradually from this point to the center of the spaces, the greatest depth not to exceed six inches.

Fifth, irrigation. Time has proven that successful orange culture cannot be attained without ample irrigation. Some may claim that (orange) orchards can be successfully grown without irrigation, but I am decidedly of the opinion that he who undertakes to plant and raise an orange orchard without water, on our dry and best fruit lands, will ultimately fail. I am inclined to believe that lemon culture on our deep alluvial loams, where the capillary attraction is perfect, can be made a success without irrigation. I am now preparing to plant ten acres in Eureka lemon trees, on mesa lands in Santa Barbara County, where no water for irrigation is obtainable, and feel confident of success.

Thorough and systematic pulverizing of the soil will, of course, assist in bringing up and retaining moisture, and it will lessen the amount of irrigation required on any lands, to a considerable degree. I take the position that when a practical and economical system of irrigation shall have been adopted, and the water now developed and what can be developed, shall be put into practical use, we shall have an ample supply to enable us to cultivate orchards on all the arable land adapted to this branch of horticulture in this district.

Sixth, fertilizing. The arable lands of California are generally exceedingly fertile. Fields have been cultivated to ordinary annual crops in various localities for generations without receiving any kind of fertilization, and they yet produce crops equal to those of former years. Two crops are taken off annually in many instances, and with no apparent diminution in yield. Thousands of acres have been cultivated to the cereals for a consecutive period of twenty-five years and longer in large portions of our State, producing abundant crops annually, when the rainfall was ample. Perhaps no country responds more promptly and faithfully to the demands of the husbandman, without fertilization, than the arable lands of California. Large orchards are producing abundantly without having received any artificial fertilizers. This has led many to think fertilizing a useless expenditure; it is, however, thought by many progressive horticulturists that our orchards will grow more thrifty, produce more abundantly, and a finer quality of fruit, with a liberal supply of well decomposed manure. I doubt not that this is true in principle, and that a judicious supply of manure applied annually to our orange orchards will certainly stimulate the tree to a vigorous and healthy growth, and produce an increase in size and productiveness, and a better quality of fruit.

Seventh, pruning. There is much diversity of opinion on this important branch of the science of horticulture. Various methods are pursued; from that of allowing the tree to branch at the ground, to that of commencing to form the top at an unreasonable height; from that of severely letting them alone, allowing Nature full and unrestrained sway, to that of a continuous cutting and hacking. There are involved in pruning several principles, among which are the following:

First—The removal of the branches from the trunk of the tree, to admit of cultivation close to the tree with a horse and cultivator.

Second—The removal of part or all of the limbs that cross or rub one another and that grow too close together, diverging from one point.

Third—Thinning out the center of the top of the tree, cutting out all non-producing branches, to admit of an ample supply of air and light.

A wide diversity of opinion exists on the first proposition. There are strenuous and enthusiastic advocates of low pruning, allowing the branches to grow within two or three feet of the ground. The usual arguments in favor of this method are that it shades the trunk of the tree from the direct rays of the sun, and that it also shades the ground, thereby preventing evaporation, as it is claimed, to a great degree; hence, a moist condition of the soil.

The advocates of what is termed "high pruning" are no less enthusiastic in defense of their theory. They argue that it admits of better and more thorough cultivation, even close to the tree, and at less expense than if the top be allowed to form near the ground. They say the entire surface of the ground, and especially the soil near the trunk of the tree, should be well cultivated, not only for the purpose of destroying weeds, but to pulverize the soil for the retention of moisture, and that the direct rays of the sun should, as far as possible, fall upon the whole area of the orchard.

One most experienced orange grower thinks the soil needs the warmth of the sun as well as cultivation, that the trees may receive the full benefit of the moisture in the ground and that the fruit may be fully developed.

Much more could be said upon this branch of the subject, but I leave it with the intelligent fruit growers to pursue the plan best adapted to the several localities adapted to citrus culture.

On a basis of an orchard of ten acres I would plant six hundred Washington Navel, three hundred Mediterranean Sweet, one hundred Malta Blood, one hundred Paper-rind St. Michael.

The subject of markets and overproduction I will not discuss in detail in this paper.

In conclusion, may I not consistently inquire if the present mania, unprecedented in its intensity, to plant orange orchards, is not in danger of, in a few years, glutting the market with even so luscious a fruit as the orange? Would it not be well to plant a portion of our orchards to the olive and fig, both of which, in my opinion, are destined to soon become leading and profitable industries of our favored land?

The Bartlett pear, best canning varieties of peaches, apricots, and prunes, are now, and no doubt will long continue to be, profitable to produce.

LEMON CULTURE.

Essay by HARVEY C. STILES, National City.

We, as fruit growers, all know, or have it yet to learn, that to produce an article of merit is one thing, to furnish it to the consumer at a price which will give a fair remuneration for our labor, is another; and perhaps the latter consideration is the more important, at least it is the more disagreeable one to have staring us in the face. Yet it must be decided. It is the old contest between the ideal and the real. The orchardist's life is the ideal one, from the time he selects his location and plants and watches his trees, till his fruit is boxed for market.

Then he is a tradesman, and has need for a different set of faculties from those which have enabled him to choose the proper soil, location, and climate for his specialty; to determine what varieties, what stock, what methods of planting he shall adopt; what are the complicated influences of pruning, training, fertilizing, irrigating, picking, curing, packing, and the thousand and one other points which go to decide whether his product shall be denominated a triumph of his art or only mediocrity.

There is certainly quite enough in this category of puzzles to satisfy the true orchardist, to which each separate item is a study of absorbing interest, without his entering thus into the radically different world of commerce. And yet the question of disposing of the product must be met. In countries where the product is dictated, so to speak, by peculiarities or rigor of climate, we must meet it as best we can. But here, in this land whose planting time is always, we are masters of the situation, if we look before we leap.

We may choose from the products of the world for our specialty. Let us then choose that one in the marketing of which we shall have the least competition; that product to which the least area of the world is adapted, which is in universal demand, and to which our country is most perfectly adapted. That product, I believe, at least in my locality, is the lemon. Even in countries where the lemon does not do so well as some other products, and not nearly so well as here, it is considered one of the most profitable crops that may be grown. How appropriate then to plant it where it grows better than anything else, and where the product is unsurpassed.

The area adapted to its perfect production is extremely limited, as we shall see by referring to a map of the world; and we shall discover, also, a very curious and suggestive fact, viz.: all those lands and countries well adapted to the production of the lemon are noted as the sanitariums of the world. To them man journeys, and says: "Here is the perfect climate; here let me live and die."

Is it not so? Lisbon, Italy, southern France, Sicily, California—lands of the lemon, lands of history, lands of poetry and song and romance. It is appropriate that in these countries, where flock the sick, the infirm, the invalids of the world, for comfort and healing, should be grown this fruit, which has such valuable medicinal qualities.

A Florida wag has said that good oranges grow only where there are mosquitoes, yellow fever, and alligators. Now, we don't believe this; but there is a grain of truth in it—just enough to spice the assertion sometimes made that "San Diego oranges are not nearly as good as the Florida product." San Diego possibly (probably) lacks some of the aforesaid qualifications of a good orange country.

We have a lemon craze in Southern California. The sooner the area so well adapted to the lemon is planted out the better. Let us plant lemons, but let us not plant them in situations not so well adapted to them as to some other products, or where they will grow only at a disadvantage. Let us not plant them in hot, back valleys, for they are nearly always correspondingly cold in winter, and the lemon is extremely sensitive to frost; while the orange, if not too cold, will probably do even better there than it will nearer the coast. And let us not plant them in the cold, frosty valleys near the coast, for the same reason. But let us plant them in our warm, dry mesas and sunny slopes, and in the valleys where there is no frost in winter, nor extreme heat in summer; where the atmosphere is ever kept so moist and mild that the sweet, pink-tinted blossoms can expand and perfect fruit every day in the year. My choice of a location would be a high, well drained mesa, with a southern exposure, and a rich, red soil with a depth of six to fifteen feet. I should also like it to be several miles from the sea, for several reasons, one of which is the greater ease with which the trees could be kept free from scale insects. However, I do not consider this a deciding point, as the destruction of the black scale, even close to the ocean, is only a matter of a few cents each year. Some of the finest lemons I have ever seen were grown in Hon. F. A. Kimball's grove only a few rods from the salt water. They were also on adobe soil. I do not consider the adobe soils objectionable, providing it is well drained, either naturally or artificially, although it is of course more disagreeable to move around upon as much as we must necessarily do in gathering the constantly ripening crop.

So we see that, after all, the three principal requisites are: freedom from frosts, a sufficiently mild and humid atmosphere, and plenty of water. I believe a bearing lemon tree, in this favorable location, will use five times as much water as an orange tree of the same size, for the simple reason that it will produce five times the amount of fruit during the year.

As to fertilizers, it is only a question of time when all soils will require them, and the sooner their use is begun, the less will be the deficiency to supply. The adobe soil will be last to require fertilizing, as it is strongest in plant food; but even it must soon become impoverished by the tremendous drain the bearing trees are constantly making. I know of plenty of ten-year old trees, which produced last year thirty boxes each, or about nine thousand lemons. We cannot expect any soil to give us such crops every year without some return. I wish every one starting a citrus grove could be impressed with the importance of having the trees headed low. This is especially true of the lemon; one of the most

obvious reasons being economy in the repeated pickings. Besides, experience and observation have demonstrated that the greater proportion of fruit for many years will be gathered very near the ground. I do not know if this latter fact is due to the shade, which is thus procured or not; but it is certainly true, and I believe teaches the importance of a judicious shortening in, to produce a closer head than the lemon naturally produces. The value of these low hanging branches, to protect the trunk of the tree from the fierce heat of the sun, is also evident. If large two or three-year old trees are to be planted, they should be cut back close to the ground, and as they grow up the shoot selected for the tree should be trained to the natural pyramidal form, with a main upright stem, from which the branches are sent out as nearly as possible at right angles. All "forks," or branches, starting at a sharp angle to the trunk should be removed during the first year, else the tree can never bear, without splitting, the immense loads of fruit we expect from it.

For the same reason, the branches should be judiciously shortened in each year, at first, to make them strong and stocky. The comparatively few trees which have been trained to grow in this manner are shining contrasts to the stunted, sun-scalded, high-topped trees whose branches, when loaded, must necessarily come down to the ground, and, as they are not strong, as Nature intended them to be, they split down, and by the wound thus made in the trunk the health of the tree is impaired.

One-year old buds are generally preferable in starting a grove, as they are, or should be, less injured by loss of roots in transplanting, and by the subsequent necessary cutting back. Still, the earliest returns may be procured by planting two or three-year old budded trees.

There are many decided advantages, beside the important one of economy, in planting good, strong orange roots right in orchard, and budding them as they stand. I omitted to state that almost invariably on a light, deep, sandy soil, the lemon is not a success. The trees make too long and slender a growth, and do not bear well, while the fruit is large and coarse. This is also the case where the climate is too hot.

When we consider the prices commanded by imported lemons now, and the immense quantities of them imported, our prospects are certainly bright. And when we can furnish the three million boxes imported annually, of sweet rind-cured California lemons, we shall certainly receive a much higher price for them than we do now for our uncured, common, mixed, and seedling product.

THE LEMON AND ITS TREATMENT.

Essay by N. W. Blanchard, Santa Paula.

The State Board of Horticulture have invited, to be read before this Convention, an essay on "Lemon Culture," also an essay on "Curing the Lemon." My topic being "The Lemon and its Treatment," I know what to say without traversing the fields embraced in the first two named topics. Perhaps, therefore, if I give an account of my orchard, my method of picking lemons, with some experiments that I have made in curing, I shall be acquitted of my duty.

My orchard is in Santa Paula, about twelve miles from the ocean, in the valley of the Santa Clara of the south, and has about the same climate as Los Angeles City. The soil is a sedimentary clayey loam, very deep and very rich. The lemons are upon orange roots, and my bearing trees were budded twelve years ago into six-year old stocks. They have been allowed to grow without pruning, except to cut out the suckers from the inside of the trees. The limbs touch the ground, and in some instances lie upon it and cover half the space between the trees, these being twenty-five feet apart in triangular form. On the theory that lemon trees need less water than orange trees, I tried the orchard with less frequent irrigations, but now irrigate as often as I do the orange trees, finding it best to do so.

The lemons are stem cut, and are gathered by taking all, without regard to color, that will pass through a two and one quarter inch ring. During the more active ripening season the lemons are gathered as often as once a month; for instance, the orchard was picked early in January, again early in February, and again early this month, and the picking is not yet finished; indeed, there is scarcely any month that I do not have lemons to gather. I thus avoid having any very large lemons, unless they are overlooked. The lemons are handled carefully, hauled at once from the orchard, washed from a tub of water with a brush, for we have some smut, placed one layer deep in trays, two by three feet and three inches deep. These trays are slid into a rack for the lemons to dry and wilt a day or two or three in the shade. They are then piled in the curing house, one across another, up to the ceiling.

The curing house is a two-story building, on the north side of and under tall blue gum trees. The lower story is made double walled, the walls a foot apart, filled between with sawdust, with an inner and outer door. From this lower story a ventilating flue sixteen inches square runs through the ceiling and upper story and roof. The lower story is divided into compartments, the object being to keep the rooms cool and dark, and to avoid a circulation of air. The more the doors are open, or the more air circulating around the lemons, the more rapidly the curing goes on. I can prepare my lemons for the market in two or three weeks, or keep them several months. I do not know how long they may be kept without becoming too soft, for I have not yet had time to sufficiently experiment.

I have over nine hundred bearing trees, from which I sold last year two thousand five hundred and forty boxes of lemons, and at the same time the crop was considerably injured, for the first time, by the severe local frost of January 17 and 18, 1889.

In the autumn and early winter of 1888, I had filled one room of the curing house with some six hundred to eight hundred boxes of lemons, the trays being piled one above another so closely as to almost or entirely exclude air from the fruit. I had looked at them several times, and thought they were doing well, and left them perhaps two months in the spring without opening the doors, and when I did so I found the air almost hot, and of course suffered a large loss. I would say that at that time they had a smaller ventilator than the room now has.

On November 9, 1888, I put two very green lemons, just off the tree, into a gallon glass fruit jar—lemons as large as would go into the jar—and screwed down the cover with a rubber packing, and put the jar into a cool, dark closet. They were left there till March fifteenth following, over four months, when I found a few light spots appearing on the

lemons. They were then left until April nineteenth, when I found the inside of the jar covered with moisture, and the lemons half colored up.

The jar was opened and a strong smell of vinegar escaped, and the outer part of the rind of the lemons was so soft that it would rub off with the touch, yet there was no rottenness, and the specimens afterwards dried up. I think the main point in order to keep the lemon some months, is to take it from the tree before it has become in any manner soft, while it is still very firm, and it does not matter if it is quite green, for if it is given time enough in the curing it will change to a fine lemon color.

I believe the character of the soil is also a determining factor in the keeping quality of the lemon. It is asserted that the citrus fruits in the countries bordering the Mediterranean Sea, grown on clayey soil, will keep better than those grown on lighter or sandy soil. My experience and observation prove this to be true in regard to the orange, and I think it must be true also in regard to the lemon.

I will add that lemons two and one half inches in diameter, when cured, will go about two hundred and fifty to the box; two and one quarter-inch lemons, about three hundred to the box; and two-inch lemons, three hundred and sixty to the box.

Mr. Blanchard added: Mr. President, while I have the floor I would like to state one peculiarity I have noticed in my orchard, and which, if any one can give an explanation of, I would be glad. I have noticed that in budding my trees to lemons, that when the bud would shoot off and make a tall growth, growing right up into the air, it immediately commenced to fruit. In other instances, where it made a short growth, with many branches and a thick growth on the tree, it would take four times as long to come into fruit.

The President: Now, as the subject of lemon culture, as well as the other essays are before the Convention, and as the request has been made to me that Dr. O. H. Conger, of Pasadena, be allowed twenty minutes, or such time as will be necessary for him to explain his theory with regard to growing the lemon from the cutting, there being no objection, I would call upon Dr. Conger to make that explanation. Let it enter into the discussion of the subject of lemon culture. [Applause.]

Dr. Conger: Mr. President, and Ladies and Gentlemen: The time having been allotted to me on this subject of "Lemon Culture from the Cutting," I will commence by calling your attention to the excitement that prevailed here in Southern California about ten years ago on the China lemon stock as the proper stock to bud the orange on. Mr. Thomas and Mr. Baldridge particularly, will remember my attitude at that time, simply from the fact that I combatted the theory. I hadn't at that time had any experience. The China lemon roots were budded to the orange and sold very extensively over this country. I protested. I said it was unreasonable to expect the two extremes of sugar, or sweet and sour, to meet in that form of budding one to the other, and have as a product a definite result of the one only. To illustrate, I asked the question: "If an ounce of sugar, dissolved in water, and the equivalent of citric acid, and which we know is the product of the lemon, dissolved and added to that solution of sugar, would produce a definite and distinct acid property to the taste?" We all know that it would not. I said: "Can you bud the orange to the lemon and say that Nature shall absorb one function, that the root shall entirely control the bud, or that the bud shall entirely control the root, when the sap from the root is to ascend that tree, and be elaborated in the leaves of that tree, and return not only to produce wood structure but to produce the fruit?" To me it seemed unreasonable. I combatted it on that theory. If you will go up Spring Street, a little way above First Street, you will observe there exposed for sale, monstrous great oranges, nearly six inches in diameter, carrying all the characteristics of the Washington Navel orange. There you will see the product of this budding the Washington Navel orange on the China lemon root. It is absolutely worthless in a commercial sense. It is only as a curiosity that it is exposed for sale. No longer does any person in Southern California grow the Washington Navel orange upon the China lemon root for the market.

Now, Mr. President, and gentleman, I called your attention to that fact for the purpose of putting every one upon his guard in thinking that the lemon budded to the orange root will produce as strong a solution of acid property as they will upon their own stock. I say I send out this word of warning.

A gentleman came up from Long Beach the other day, looked my lemon trees over that I put out fifteen years ago from cuttings—in fact, raised from cuttings that I obtained from Mr. Richardson, of San Gabriel. These cuttings were cuttings from cuttings. They were at that time, I think, about five years old. I said to Mr. Gillett, of Long Beach, "Come up and see my orchard before giving your order for cuttings." He came up last week. He ordered his two thousand five hundred cuttings, after looking over my first settings and those of later date.

Now, the point I wish to make is this: that you are absolutely running a risk in regard to the quality of the lemon by budding a lemon to the orange. When, in the market, they call your attention to the imported lemon, we understand to-day that they are raised principally upon orange stocks. What I pretend to say is that there is soil by acres, by hundreds and thousands of acres, in Southern California at least, where the cutting will do as well for a root as the orange stock. I claim, therefore, that that is the natural soil for the lemon. I do not pretend to stand before this intelligent audience and claim that the orange root does not produce a nice lemon for market. I claim simply that the lemon from its own stock, not the seed, but a bud which you can obtain by the cutting, and in no other way, is a better lemon.

I obtained those cuttings without any knowledge, upon hearing Mr. Richardson's statement and seeing his orchard, of what they would do. I hadn't any experience; I hadn't read anything in regard to citrus culture. My life has been spent in other pursuits. I innocently took these cuttings, and put them out to grow my trees, as I would plant a rose from cuttings. I have obtained that result without foreknowledge, without any data. I am speaking of that result. I havn't a theory. I bring this before this Convention for you to consider. But, at the same time, consider the location, the soil. I would not guarantee a cutting in adobe soil or in a heavy clay soil. I have not had that experience; I would not put a lemon on an orange stock in that soil with what experience I have had, if I could obtain the better soil for it. It is on that theory, Mr. President, that I say this precaution should be taken, that in the future we will send to the market the best products that is known to the world. That is my point. Because our lemons are, in fact, superior

to all the tests that have been made of the imported lemon already. But I say as our lemons are a better quality in all respects, especially the Eureka lemon, than anything that is imported to this country, I have a direct interest in seeing that this State shall send the best lemon back to Sicily that the world knows of at the present time, instead of importing the five millions annually that we now do from that region. I stand before this audience to declare the fact that there is danger, having this experience with the China lemon, in any soil, that after the tree reaches a certain age it may take on one form or the other. The saccharine property, taken naturally from the root, may assume control and reduce the acid quality that we are seeking. I can't understand that one function is annihilated for the benefit of the other. It is utterly impossible in considering plant life. The late Mr. Marshall Wilder was authority, I believe, on deciduous fruits. Mr. Downing is another authority. In the writings of both we will find where the apple and other fruits have been amalgamated with other properties. So it is not confined to citrus fruits. In planting I first dug a trench two feet deep on either side of those cuttings, and filled them with water, having pulled out the roots to their full length. I dug holes in the orchard as deep as I thought proper, and drove an iron bar down as far as I could at the bottom of them, and put those radicles down that hole. In sandy loams you do not have to put on the same quantity of water to accomplish the same purpose as in adobe soil, if you have fertilizers sufficient to supply the demand of the tree. I had that experience in this way: My orange orchard was upon high mesa ground on Orange Grove Avenue, Pasadena, and in one corner there was a section of adobe soil, or cement, of an iron character—iron and lime, possibly; at all events it was cement. It was so hard that you could not pick it when it was dry. There were eleven orange trees that I had covered that ground with, not knowing from the surface indications what the subsoil was. That was my first experience. I found they didn't do as well as those twenty or twenty-five feet away. I looked at them. They had a little round cabbage head, as I called them; small leaf, stunted, while the others sent out great long shoots and vigorous leaves. My curiosity led me to dig around them, and I found the roots to correspond with the top—a mass of hair roots, little fine roots, within five or six inches of the surface of the ground. The radicle had rotted away. I dug into the soil, and found, a foot below the surface, this cement, and that, to my mind, was the reason of finding those trees in that condition. I dug them out, and went down through the cement about two feet, and came into the sandy soil. I replanted the trees so that the roots could go below, and in the second year they could not be told from the other trees of the orchard.

Now, Mr. President, and gentlemen, if you place your trees within two feet of a subsoil that is impervious to the water from the surface or from below, you have got to feed those trees as you would feed a cow or animal of any kind; water them and feed them regularly. That explains the reason of the necessity of an abundant use of water in a great many places. If you put orange or lemon trees upon soil that has no substratum of impervious soil, you can accumulate winter rains and store them up in the soil, to be returned almost during the entire season, especially before the fruiting stage. I raised those trees to the fruiting stage without one single irrigation. Any gentleman of this audience can go and see them to-day. For eight long years they never had a particle of artificial irrigation. That soil hasn't any bottom, so far as I know; there is no substratum to cut off the water. But the moment that they began to bear, or the second year, I discovered a deficiency; that is, I thought I discovered the fruit was not developing as it ought to. I then irrigated forty trees, adjacent to forty which I left without irrigation. There was every difference that could be imagined in regard to the size, appearance, and general characteristics of the orange on those trees that were watered twice and those that I did not water. I immediately went into the public press and stated those facts. Now, could I do more or less? I said to the community: "Don't depend upon an orange orchard that you haven't water with, because when they come to the age of fruiting there is another function developed." They hold there in suspense tons of water when you have a large crop upon your trees that is neither given off to the atmosphere to be absorbed nor for any other purpose; hence, you have got to supply that demand, and it can't be supplied except by putting it onto the roots. That is common sense. I went, therefore, just as far as my judgment—just as far as the indications of the tree warranted. I withheld the water, because they made all the growth that was necessary, and many of them more than it would seem possible under that rigid exclusion. Those are facts that men came from all over the State—Mr. Wetmore, from San Francisco, and others—to see. I claim nothing for that. I never set a tree in my life before fourteen years ago. I knew nothing whatever about this; I came upon it through accident, feeling my way along. Happening to get the right kind of soil for this experiment at the start, which I was not at all aware of, I have made those experiments simply by watching and waiting, and trusting to the future developments as they would come along naturally in their order.

Now, if there is any lesson to be drawn from this, it is that you can make a perfect lemon tree grow from a cutting in the proper soil. You can grow a lemon tree on an orange in any condition of soil. My point is that you cannot make as perfect a lemon on an orange root as you can on its own root and own stock, and it is nonsense to say that you can't get radicle roots from a cutting in the proper place.

I could talk some longer in detail, but the substance of what I have said I trust will be sufficient to cause every person who contemplates putting out lemon trees to look well to his soil, as Mr. Garey and others say who have had experience, at the start. Then, the water question. The lemon grown upon its own root or stock does not require the water in its natural habitat as it does on the orange stock; and when those essays speak of irrigating the lemon, Mr. Blanchard's for instance, it is on an orange root, is it not? It has got to be supplied the same as an orange tree, because it is on an orange root. It is not because it is budded to the lemon. It is simply because it is on the orange root. There are thousands of acres of land throughout Southern California that would produce crops of lemons without a drop of water. Mr. Bonine, a neighbor of mine, is putting out ten acres to-day, from the result of experiments. He has not a drop of water except what is pumped from a well eighty feet deep. What I mean to convey is to put your stocks to fruit where they naturally belong. As Rev. Mr. Loop has said, in the three or four hundred varieties of olives they put them in the soils best adapted for the particular variety. We know there are endless varieties of soil. We should use our judgment and take advantage of those better conditions, that we may in the future hand down to posterity an absolutely improved result, something that will be lasting.

Mr. Thomas: I would like to ask my friend Dr. Conger if he knows how many trees he planted ten years ago, and I would ask him how many of those trees are alive, and also with reference to any other trees grown on lemon cuttings that have not died? Some nineteen years ago I planted a lemon orchard in the City of Los Angeles on some stock that was raised from cuttings. After awhile the roots became rotten and decayed, and the trees commenced dying. I put ashes around them. That arrested the progress of the disease somewhat, but most all the trees died. That has been the experience of all those who have planted (that I know anything about) lemon trees on their own roots. And for that reason I have always advised people not to plant any lemon trees except on the orange roots.

Dr. Conger: My answer to that is this: In the first instance I never lost a tree—not one. There never has been a gum disease on my place, except where my reservoir gave way the third or fourth year, after I put out my orange orchard, by a gopher working; it flooded quite an area of my orange trees. Four trees were attacked with a gum disease which I attributed to that flooding. Not one lemon tree from my cuttings ever showed gum disease. Now, if I should be thrown into the Pacific Ocean by a set of ruffians who wished to play tricks upon me, and would pull me out upon the warm sand and rub me, put blankets over me, bring me to, get me all in good shape, and take me and douse me in again just as I would recover from that shock, and keep it up, how long would I stand it? [Laughter.] Well, that illustrates the whole question. I say where you have to put on water don't put out lemons. Put lemons where you can control them the same as the engineer controls the steam of his locomotive. Any soil that you can feed and water and control the moisture and food in that manner, you can dictate to your lemon product just what you please. I will throw them into bearing in any period I may wish if I am in a soil that I can control in that manner, which I have done. And to-day, if I was to engage in the lemon culture, I would select a deep sandy soil, that is rejected by some one, Mr. Garey, I think, from the fact that I would have it under absolute control. Then I would have them blossom in September—or August rather, which I can do. Then my product would come out in the spring, when I would want it. I would not have to lock up my money five or six months, which I am doing to-day, to carry my lemons, in order to have them ready for the proper market.

Mr. Johnson, of Montecito, says that seedling lemon trees are never attacked with gophers, whereas his orange trees are constantly attacked with them, and he has to fight them all the time.

Mr. Kinney says that his lemon trees are attacked on lemon roots and lime roots both the same.

Mr. Wheeler: I would like to ask three questions about lemons. First, I would like to state to the orange growers here something I heard yesterday with reference to the soil most adapted to oranges. A gentleman from Riverside—I presume he has said the same thing to others—Mr. L. M. Holt, told me that in a few weeks he had had his judgment of fourteen or fifteen years reversed. He had always until then been of the opinion that the soil best adapted to the orange culture, both as to the growth and quality of fruit, was a fine, sandy loam, with a gravelly subsoil. But he said that at the last fair at Riverside, nearly all the premiums were given to fruit grown on the clayey soils—the clayey soil commencing, I think, at Arlington, with some few exceptions of sandy streaks, and gradually growing more sandy into the town. He said these premiums were given, almost without exception, for quality of fruit grown on clayey soils.

Now, my experience in Pomona, where I have been farming on a small scale for six years, is this: My orange orchard was set out four years ago. It is on a sandy loam, in some places a very gravelly soil, occasionally a fine sandy loam, with a gravelly subsoil. I know that my fruit is as good in quality as any at Riverside. Last year I did not irrigate but twice, the first time in the middle of July; and the soil is, as you all know, much more easily cultivated than clayey soil.

The three questions I would like to ask about lemons are these: First, as to the soil most suitable. We heard to-day, from a gentleman from Santa Paula, that he preferred a heavy, sedimentary soil. I heard at the last County Pomological meeting, at Pasadena, from a man who gave a talk on lemon culture, concisely, that he would prefer a soil which would cost him $60 an acre to clear from rocks, to a heavier soil.

The second question is as to the curing of lemons. During the last few months I have read various apparently directly opposing methods of curing them; several substantially like that pursued by the gentleman from Santa Paula. There has also been a long article copied from a Florida paper, giving a description of some process there, which, I think, is this: The fruit is picked of the right size, green or not, put into boxes, I should judge from the account equivalent to fill our ordinary orange box, put into an almost air-tight house, heated artificially until it reaches a temperature of about 90 degrees, and there kept for five days. And that article said then the lemons would be perfectly cured, and keep, I think it said, for a year. Those two methods seem to me opposing, and I would like to ask the lemon growers here if they think that method would give that keeping quality to the lemon.

The third question is whether they have noticed any difference in the keeping qualities of the different crops or pickings of lemons. Some one in my town told me that those picked in October and November kept very well; those of successive winter pickings kept less well in proportion.

A MEMBER: I had correspondence with the gentleman who wrote the article in the Florida paper. He says in his article the lemons so prepared will keep a year. Does not say he has kept them a year. He is a physician, living in Campaign, Illinois. He says they won't keep at all in Florida in that way, but in Illinois they will.

MR. PAINE, of Redlands: As a matter of fact, I want to state in connection with growing lemons on lemon roots, that nearly everywhere in San Bernardino County lemons there grown from seed or cuttings—they were planted so long ago I can't tell which—so far as I can observe, are all either dead or dying in every section of the county. It may be owing to the fact that they have been irrigated, as they necessarily are on the mesa. But it is very uninteresting to see that result. And I have observed quite largely in the county generally. I have been there since 1870.

A MEMBER: I would like to ask the gentleman of San Bernardino if there is not a hardpan underneath there not a very great distance down.

MR. PAINE: It varies; but it is uniformly the case in all parts of the county, whether there is hardpan or not, that the lemons are either dead or dying, and for that reason we have found it impracticable. Lemons on orange roots do not die quicker than oranges from other diseases, but uniformly the lemon dies where it is on a lemon root or cutting.

DR. O. P. CHUBB, of Orange: Before the discussion on this point is closed, I want to say that we must not lose sight of a general principle prevailing in all cultivation, and that is that the greatest amount of vitality and vigor must be at the bottom of all our experiments. By reflecting a moment, you will see how we have obtained the great results in all the progress we have made—the cultivation of animals as well as plants from a vigorous stock. And we have adopted it in all of our cultivation and progress with successful results. We have found that the vines, when giving way by phylloxera, have been restored by grafting on the native, vigorous stock. We have found by planting nurseries of orange stock, that the wild, native seed is better than selected seed from Mediterranean Sweet, or any other cultivated variety of orange. We have found also that the finest orange grown in Florida—in fact I may say nearly all the oranges grown in Florida—are grown upon the wildest, most objectionable stock in itself that can be found, the wild, sour orange; and yet the finest flavored orange, to my taste, that I ever partook of, was that from the Indian River country in Florida. Showing to me that it does not necessarily follow that the product of improvement must partake of the character of the stock always.

Now then, the matter of our oranges on China lemons has been referred to. I have had experience in that, and at once came to this conclusion: that the mistake is in grafting a stock of superior vigor upon one of less vigor; the tree thus outgrows the root, and the vigor, which should have gone into the root, goes into the fruit. Besides, the tree soon becomes worthless, from the fact that the root cannot sustain the top. On the other hand, we have grafted the lemon, budded that into the orange stock, and never have found such results. We find that we produced a first class orange from that; and not only that, but one capable of being perpetuated under almost any circumstances where lemons can be grown. No one pretends to deny that a lemon tree grown from a cutting will produce specifically the fruit that the tree produced from which the cutting was taken; but will the vigor of the tree propagated in that manner last so long as it would by being propagated upon more vigorous, and I may say, resistant stock? My opinion is, that all progress in vegetable or fruit growing must recognize that principle as a basis. We must retain the vigor, the resistant property, the life principle, at the root, and then we can go on with our cultivation and improvement to any extent.

MR. ABBOT KINNEY: Mr. Chairman, in antiquity they used to burn heretics. I think if we were living in those antique times we would have to burn Dr. Chubb—a man that comes in here and says the best orange he had ever eaten was an Indian River orange. [Laughter.] I have been to Indian River myself, and the average oranges in Florida, including the Indian River, which are very fine oranges indeed, are sweet; I think probably average sweeter than they do here in this country. In speaking of the flavor or characteristic of fruit from memory, I think one is very liable to err; but from my experience with those oranges, as well as with other oranges in different countries—in the Mediterranean orange country itself—I should say that we here in California have the very worst orange that can be found in the world to eat, and also the very best orange that can be found in the world to eat. I believe I have eaten the worst orange I have ever tasted in California, and the very best. That is what I think I can say with security. In the fair at New Orleans, in which we competed with the Florida and Louisiana product, I think I am right in saying that we took the prize over them in every respect. We competed with them there on fair ground, and took the prize away from them; and so it seems the fair thing to say that we really do have the best oranges. It is a question that has been raised here by Mr. Garey, who is an old experienced grower, that this soil and situation question is a very important one, and we ought to bear that in mind all the time. You can find very poor and very good oranges in California.

I was shown to-day an orange from Florida which had the purple scale on it. I have never seen it before; I had heard of it. But it is the worst looking, most disfigured fruit from scale I think that I have ever seen. It is a very dark scale, and speckled entirely all over—a very ugly, disagreeable looking scale. I was impressed by seeing it with the extreme danger of introducing this new enemy into this country, and I thought I would like to ask the Quarantine Officer what efforts are being taken to exclude it. If I am correct in judging others by myself, there are a great many trees imported into this country direct from Florida, and also from other countries. At my railroad station I got an invoice of trees myself the other day, and I don't know of any one being there to see what was on them, or what there was of danger amongst those trees. I should be very glad to see quarantine regulations adopted that would protect us from this scale.

If no one else has anything to say about olives, I will make a few remarks more in the nature of questions or suggestions than anything else. I would like to ask any gentleman here whether he knows the kind of olive that is eaten. I don't mean the character or particular variety, but the kind of pickled olive that is eaten in Italy. I don't know but that you know that, Mr. President. I traveled to Calabria when I was a very young man, many years ago, and my recollection is that all through that country they eat nothing but the black olive. I can't remember now ever having seen a green olive similar to those we get here, known as the Italian olive. If you have eaten the two different kinds, you will know they are entirely different in flavor and character. The Queen olive that we get here, the principal green olive, is a large olive, generally in vinegar or something of that sort; whereas, the black olive is pickled in salt, first having gone through a process of lye. As far as the process is concerned in California, that is the way I treat my own olives. And it is entirely a different flavored article. As far as my taste is concerned, and those whom I have heard speak of the matter, they all prefer the black olive. If it is true that that is the olive eaten in Italy, in the home of the olive, or one of the principal homes, that is the fruit we ought to imitate them in curing. The difficulty of obtaining the California olive properly cured is very great. You get them soft sometimes, and sometimes with the bitter still in them; and other times with the bitter out and the oil and flavor out as well. And it seems to be rather a delicate and difficult operation to get the bitter out and leave the flavor and oil in. But when you do that, when you really get a perfect quality of black olive, or partially green—I don't mean to say they are all necessarily ripe, but as you pick them, partly green and partly ripe—that you get a very fine article of food, indeed. It will form a meal with bread and butter—just the olives and bread and butter—and it leaves a delicious flavor in the mouth for quite a time after you have eaten them. My experience in olive growing, in other respects, is entirely limited to a few experiments in making oil, which was a failure. But I pickle all of my own olives for my table, and we never eat anything else; never think of eating a green (pickled green) olive.

Mr. Paine: The Citrus Fair held in San Bernardino was designed to hold but one week, but on account of the rainy weather was held for two weeks. There were exhibited from a few trees some oranges grown on sour stock. The seed had been planted in this country, the trees grown, and different varieties of our oranges budded upon them. At the close of the fair, when parties exhibiting had taken or were taking their fruit away, it was remarked by some one that the oranges on those plates that were exhibited as grown on sour stock were decaying. The attention of myself and several parties was directed to that, and we found that that was the case; that during that time of two weeks there the oranges grown on sour stock were decaying, while those grown on our stock were sound. I heard it also stated from those who have shipped oranges from Florida that you do not expect oranges grown on sour stock there to keep more than two weeks.

Mr. Lelong: This question came up some time ago for discussion in the city, and a good many have asked the question that if the stock is a good stock why not get it because it is so cheap; and that if it is not a good stock that it grows so thrifty and the trees do so well on it that in ten years you can keep on replacing as they do in the orchards in Iowa. They plant the tree, and keep on planting in between, so when the tree dies out there is one near by that produces something. And I think Mr. Kinney, Mr. Baldridge, Dr. Conger, and a great many here well remember when they first began planting oranges budded on the China lemon root. Thousands of cuttings were then planted. We budded them, and in two years we grew a tree that can be grown on no other stock one half its height. A lemon cutting one year old was the size of an orange tree three and four years old. We would bud that in the spring, and when June came we had a bud three to four feet high. We used to sell them as high as a dollar and a half per tree. That was a very quick return. Many preferred that stock, because they said they would fruit so much quicker, observing the rapid growth of the buds. But with the first crop the trees began blowing over, and every tree had to have three or four stakes around it, and baling rope tied from the tree to the stakes to hold them up, the same as when trees are planted on shallow hardpan. That was the result of China lemon stock. Thousands of trees were planted, and just about the second or third year's fruiting the trees would blow over, and had to be taken out and replaced. I don't suppose there are any orchards which were budded in that way in this county now. In those times there was such a demand for trees budded on the China lemon that seedling California Sicily lemons were budded to the orange, and also upon thousands grown from the cutting. Those were also treated in the same way, and the result was the same. I don't know of any orange orchard fruiting to-day budded upon this root. Where the lemon has been planted on its own roots it has not done well, excepting a few cases where the conditions have been favorable. An orange grown on this China lemon stock generally grows very large, but the fruit itself deteriorates so much that in many instances is rendered worthless. Of course, if you want to buy oranges for size and looks, those are the oranges to buy; but when you come to eat them they are very insipid and acid and have a very thick rind. There is a sport, however, that has been planted throughout this section, believed to be a good variety of lemon to plant as a stock, and is quite hardy, and that is the best lemon stock I know of. Nothing seems to affect it, but the fruit produced from it is far inferior to anything that I know of.

Now, with regard to the Florida stock. Mr. Haywood, of Orange, I think was the first in this State that ever planted orchard trees budded on that stock. To-day it has been reported that that orchard is dying out. I think Dr. Chubb could tell us something about it. Mr. Haywood sent to Florida, got the seed, planted them, and budded the trees with choice varieties. Afterwards a great deal of that stock was imported into California, and in the last three or four years considerable has been imported and planted in orchards. In the northern part of the State I think there are over two hundred thousand trees budded on that stock, and nurserymen claim that it is a much hardier stock. But I find that wherever (you can see it here in the nurseries) the bud is two years old on the Florida stock it is nearly twice as thick as the stock below. It shows the stock is hardy. The grain is much closer, and it does not seem to swell out as much as our sweet stock, and in time you will find that the lower part will be much smaller than the upper, the same as you see some varieties of apricot on peach stock, as much larger on top than below.

I want to tell you about another tree of this species. Years ago, when I was connected with the Wolfskill orchard, in fact when I went there in 1869, there were trees there already budded on that stock, and they may be there yet. They are in that little orchard that Mr. Wolfskill retained for himself. They were large trees, budded by old Mr. Wolfskill. It was of a very hardy kind. The stocks below were much smaller than the bud above, and the trees seemed to have been dwarfed by the operation.

The Japanese, instead of making a tree grow high, dwarf it by budding the sweet orange upon the Citrus trifoliata (a sour species), and the smallest tree they produce brings the biggest price in Japan. Awhile ago I saw where they offered £500 as a premium to whomever would produce a tree twenty-five years hence that could be laid upon the table in a pot, and the tree not to be over twelve inches high. That stock is very hardy, and in this respect is similar to the Florida sour stock. Mr. Weeks, at Alhambra, has a Satsuma orange which is the same as that imported by nurserymen from Japan, and called Oonshu. The trees of this variety budded on the California sweet stock produce fruit three or four times as large. The quality is much better, and the trees are quite a good size. Take a tree three or four years old, on the sweet stock, and it is four or five times larger than any tree that you can see budded on this Trifoliata. The Trifoliata dwarfs it. The sweet stock makes it grow up. That is the difference.

Dr. Clafflin, of Riverside: I suppose the design of this discussion is

to draw out the facts of the case with regard to the sour stock of Florida. And I would like to say that inside of two weeks I stood in and went among the trees within a grove known as the Spear grove, near Sanford, in Florida, the trees covering about five acres of ground and being fifty-four years of age. About one half of those were budded on the sour stock and the other half on the sweet. Of those budded on the sour stock all are living, and are thrifty trees. Of those budded on the sweet stock nearly one half are dead from what is known there as the foot rot.

With regard to the size of the trees below the bud, the sour stock has grown so that the sour part is equal in size to that of the bud. They look the same as our trees do budded on the sweet stock.

With regard to the size of the trees grown on the sour stock, I think as a rule in that grove, and in other groves in Florida, the size of the trees at the same age is a little less on the sour stock than on sweet, but only a little less. It has been a very dry winter there, and during the two months or over I spent there this winter, I had a chance to see the difference between the sour and sweet stock, both in small trees and large, and it seemed to me that the sour stock has withstood the dryness better than the sweet. I have no trees to sell; am not interested in any way in the sale or propagation of the sour stock. I only wish to bring this out so that our people in California may arrive at the facts in the case. I have tried to notice such things and learn all that I could about the sour and sweet stock, as well as other things, while there.

Mr. Lelong: Isn't it a fact that the stock known as the sour stock is not subject to this "foot rot" which they have there, which kills the other stock?

Dr. Clafflin: That is a claim that is made for the sour stock all through that State, that it does resist that condition known as "foot rot." It is a fact in Florida that the sour stock is not subject to foot rot.

Mr. Lelong: In regard to the fruit, did you find any difference in that grown on sour stock and that grown on the sweet stock? Which is the best?

Dr. Clafflin: I had but little chance to know in regard to that, or of the keeping qualities of the fruit. I have eaten the fruit picked from the trees side by side, and could not see any difference in the quality of the fruit grown on sour stock and on sweet stock.

Mr. Lelong: The "foot rot" there looks similar to the disease called here "gum disease," but its effect is said to be somewhat different. This "sour sap disease" that we have in California oozes out from under the bark, and if you once remove that and paint it over or put grafting wax over it, it heals over and checks it. You can entirely cure a tree that way. It has been done. But where the gum disease gets a strong hold on the tree the tree goes. You can't cure it.

Recess until 7:30 o'clock P. M.

EVENING SESSION.

At 7:30 o'clock the President called the Convention to order, and the regular programme for the evening was taken up.

FLORAL CULTURE.

Essay by Mrs. Jeanne C. Carr, Pasadena.

Within the past ten years there has been a vast increase in the popular interest in floriculture, arboriculture, and landscape gardening, which is most gratifying in itself, and especially so as indicating the final triumph of man over wild nature, and over his own selfish and destructive instincts, which have hitherto allowed one generation to impoverish many succeeding ones, by the reckless destruction of forests.

It is only in public institutions like our State University, or the Stanford, that floriculture or arboriculture can be thoroughly studied, in representatives of all the great families of trees and plants which adorn this speck of star dust, our earthly home; but, happily, the culture of a few plants in one's window, or upon a city house lot, is an open gate into the treasury of the vegetable kingdom.

The floral adornment of our cities, the transition from a naked, barren plaza to a decorated park, marks an important stage in the development of public taste, and exerts a wholesome influence upon public morals. For every dollar expended in maintaining the public parks of our cities—such inviting pleasure grounds as the Golden Gate Park at San Francisco, for instance—a dollar may be deducted from the expense of policemen and jails.

The decorated, gardenesque park has become the high water mark of public taste and progress in all our large cities—the one luxury which reaches down into the lower levels of the people's life.

The floral embellishment of the grounds surrounding all the great hotels are among the most seductive features of their suburban advertisements; and flowers are the most indispensable and costly features of private hospitality. The forests of the Amazon, the tropic regions bordering the Indian seas, are ransacked to furnish rich men's tables; and this apogee of floral luxury has developed a new school of art and artists. Here, where Nature is so lavish that a barefooted boy may travel upon a floral carpet, which wealth could hardly provide for the satin slipper, there is little danger that floral decoration will run into the extravagance of mere display. No man is too poor in the land of sunshine to wear a rosebud in his buttonhole; the lowliest cot may become a bower of beauty in the rose growth of a single season.

Nevertheless, the floral and arboreal capacities of this favored land are in the infancy of their development, and so varied are the sources from which new materials may be drawn that there is no excuse for any lack of variety. In our public work the winter beauty of deciduous trees has never been sufficiently recognized, or the sanitary importance of having winter sunshine on our sidewalks. As we become familiar with the life of the Japanese, a nation of horticulturists, we find many instructive lessons in the adaptation of horticultural knowledge to the necessities of dense populations. There trees are honored as much for beauty as use, the time of blooming cherry trees being almost a national festival, and every article of household use, and even their apparel, bearing testimony to their love of birds and flowers. Cherry trees adorn the streets of the villages in Switzerland, nor is there loss of crops in consequence.*

*Emulous of these examples, the writer planted and cultivated an avenue of walnut trees upon half a mile of sidewalk—to realize how far we are below the Swiss standard of tree morality.

We have not exhausted the arboreal treasures of Australia and New Holland, while New Guinea is, in part, a terra incognita to the botanist.

A severe check was given to the culture of the acacias of Australia and New Holland by the prevalence of the cottony cushion scale, which, thanks to that blessed bug, Vedalia, is already a matter of tradition. More than sixty species of acacia were planted out on the State University grounds of Berkeley in 1873, and a still larger number of eucalyptus have been grown by Hon. Ellwood Cooper and others during the past year. Eucalyptus ficifolia, the most brilliant of this remarkable family of trees, bloomed for the first time in California in 1879. It was grown from seed by Mr. Charles Schurff, of Pasadena. The trees, not more than six years old from seed, were about twenty feet in height, and well covered with vivid scarlet flowers, in size and shape resembling the blossoms of E. globulus.

Among the shrubs most enjoyed at Carmelita are many old favorites: the Japan quince, Laurestinus, Sweet elder, Lilacs, Syringas, Weigelias, Fabianas, Hakias metrosederos, double-flowering Pomegranates, Nandinas, Daphnes, Pittosporums, and Genistas. The largest trees, now ten years planted, are leriodendrons and tilias, or, "humanly speaking," tulip trees and basswoods. The former were flowering profusely in the spring of 1889. Larches, sequoias, and pines of many species have been grown from seed planted in January, 1880, and, according to their nature, appear to have lost nothing under artificial conditions.

The large family of succulent plants, of which the "houseleeks" are a type, are well represented. First planted in Oakland and Berkeley, the original representative collection of sedums, sempervivums, etc., sent to me by Asa Gray, are now numbered by millions, and have spread from San Francisco Bay to San Diego, the most effective of Nature's carpet plants, and especially valuable in dry climates.

Nor do we love our Shakespeare less among our "carnations and streaked gillyvors," "violets dim," "pale primroses," "bold oxlips," and the "crown imperial," "lilies of all kinds, the flower de luce being one."

A thousand feet of hedge is composed entirely of Ribes speciosum; which, being evergreen, and a profuse bloomer, is one of the loveliest of our cañon plants.

Some good beds of Anemone Japonica, the cactus dahlia, Yucca filamentosa, Agapanthus, are planted in open places; clematis, wisteria, and Cherokee roses, cover buildings not otherwise attractive. Much use is made of Iris pumila as a border plant, and of Iris sambucina to prevent the washing of banks.

Plumbago Larpentæ is cherished for its prolonged bloom, and associated with the yellow corchorus. Such old favorites as the flowering almond, both the rose colored and pure white varieties, naturally group themselves near the spireas and flowering currants.

Among these old favorites, blue and white vincas weave a dense carpet, and are seldom disturbed; receiving a light top dressing of manure before the winter rains.

In the "reserve garden" is kept a plentiful supply of yuccas, grown from seed, and agaves from suckers, there being no limit to their use in decoration. A variety of the more delicate bamboos is highly prized for the same purpose. Of climbing plants we thought Carmelita possessed a fairly representative collection, until a recent visit to the garden of Mrs. Theodosia Shepherd, of Ventura, opened our eyes to new wonders of the floral world, wonders which must be seen to be appreciated. Cacti, of which a description would read like "Jack and the Bean Stalk," climbing to the eaves of a two-story house; meadows of callas; various novelties too numerous for description, and a boundless supply of old favorites, witness to the energy and skill of one of the most untiring horticulturists of the Pacific Coast.

Southern floriculture is receiving additional encouragement from the establishment of a branch water garden for the cultivation of aquatics in Los Angeles, which is under the personal supervision of Mr. E. D. Sturtevant, of Bordentown, N. J.

What more fitting step could be taken in the onward march from better to best, than sowing the lotus land with this imperial flower? I cannot guess. It was the one missing link in our wonderful chain of symbolic floral gems. Most opportunely, too, when Stanley is enjoying his welcome home, Mr. Sturtevant brings us the blue lily of Zanzibar. Not only these, but water poppies, water hyacinths, the lattice leaves of Madagascar, curious pitcher plants, and the rarest bric-a-brac of the floral world. And while we are wondering over these novelties, we may be sure that new surprises await us. I seem to hear the voice of Nature singing far down the corridors of time:

"No numbers have counted my tallies,
No tribes my house can fill;
I sit by the shining fount of Life,
And pour the deluge still.
And ever by delicate powers
Gathered along the centuries
From race to race, the rarest flowers
My wreath shall nothing miss."

A PLEA FOR ANNUALS.

Essay by Mrs. Ellwood Cooper.

This little paper is intended as the first of a series of efforts I propose to make toward writing up the groups of ornamental plants as they arrange themselves in my mind, annuals being first on the list. Although of minor importance to gardeners in general, they have their place in the world of flowers, the loveliness of many of them attracting the notice of every lover of the beautiful.

All acknowledge the pleasing effect of color. The azure canopy above, and the varied hued landscape around us, the violet tints on the mountains in the evening light, and the gorgeous coloring on the clouds around the rising and setting sun; these awaken in the beholder emotions of pleasure and delight. No less pleasing is color around our dwellings. Contrast the impression made on us as we pass, in traveling, a garden without flowers with that which we have when approaching one where we look upon brilliant geraniums and yellow acacias, festoons of passifloras, and wreaths of pink roses.

Then, too, color plays a most important part in the department of use. Nations have it in their ensigns, and traffic needs it for signals. It is stated somewhere that the first step the barbarian makes toward clothing himself is in decorating his body with some bright color. And so important is the capacity to discriminate well between colors that

persons whose business it is often to watch for signals are now obliged to pass examinations, for the purpose of testing their judgment in color. How necessary then it becomes that we do not neglect the development of this important faculty, as it can, like any other, be improved and invigorated by exercise and use. Here comes in my plea for annuals; so many and so varied are the colors and shades which they give that no better school for the eye could be had than a garden where they abound. Why send our youth into studios to be trained in color before giving them the advantage of study in a garden. So easy are annuals of culture, and so soon after the seed is sown do they come into bloom, and so much have florists done in adding shade after shade, that there is no reason why we should not all be surrounded by their beauty.

So much have the assiduous florists done in the development of color, that from one species alone a garden could be made varied and beautiful. Take the zinnia, for example, ranging as it does through shades of red, yellow, purple, orange, and pink. What more is needed to make the surroundings of a cottage brilliant? Almost as much might be done with asters, or stocks, or the phloxes, to say nothing of the glory of the poppies. But there are many kinds to select from, and by varying the time of seed sowing a garden could be kept bright in California the year round. In this management of annuals is a most interesting study, which I recommend to all lovers of floriculture.

Vines and climbers are not wanting among annuals, there being fifteen or more that can be trained on trellises or palings or to the side of the house for scenic effect. First among them are the morning glories, sweet pease, nasturtiums, the ipomœas, Japan hop, cardiospermum, eccremocarpus, and the lately introduced Mina lobata, with its attractive flowers of red and yellow; they are all useful and beautiful.

For greater effect, care should be taken to sow the seeds of plants producing the same color next one another, putting the reds together, the yellows together, and so through all the colors.

We see the proof of this in the blue expanse of the ocean, in the masses of golden sunlight, in the sketches of violet, purple mountains, and in the extended verdure of the landscape. We can imitate Nature, in a small way, by massing the colors in the garden, and at the same time have the benefit of comparing and judging the quality of different shades of the same color. In this practice is the beneficial exercise of the color faculty. Different temperaments are differently affected by color; one person being pleased with one, while another delights in a different hue. There are some writers who assume that temperament manifests itself in choice of color. Here, then, is a study in the philosophy of mind suggested among our flowers.

The seeds of most annuals do better if sown in the fall, the earth seeming to be the natural place for them to strengthen the little germs preparatory to germination, so that when the rains come they spring up, many of them, if the weather is mild, and make well established plants by spring, which will give abundance of bloom well on into the dry season.

If the weeds are kept away and the ground put in order—raked up a little and enriched some before the rains—the seeds being allowed to scatter themselves, there will be nothing to do the following year, or for a succession of years, but to thin out the plants. In this way they do the best; and this taking care of themselves, doing their own sowing, is another advantage of annuals.

Select the beds for the different colors and sow your seeds respectively, and you will have the work done for years. For those who have not much time to spare from other and sterner duties this is a good way to do. This is the way to get the most for the expenditure of time and means. There is no reason why every garden throughout the State might not be stocked with these lovely annuals. Most of them are hardy and would do well in any part of it. They require little care and repay well the little there is bestowed upon them.

I have neglected to note the fragrance of many annuals. Who does not appreciate the delicious mignonette, and the fragrant atmosphere surrounding sweet pease and the stock jilly, and many others? But I have said enough. Let us all set about to see that our gardens are effective in their beauty, thus testifying that we are a flower-loving people, and that while we study the useful we do not forget the beautiful.

VOTE OF THANKS.

MR. MARK L. MCDONALD: I move, Mr. Chairman, that the thanks of this Convention be tendered to each of these ladies for those most beautiful and valuable contributions.

Motion seconded, and carried unanimously by a rising vote.

ORNAMENTAL WILD FLOWERS AND SHRUBS WORTHY OF CULTIVATION.

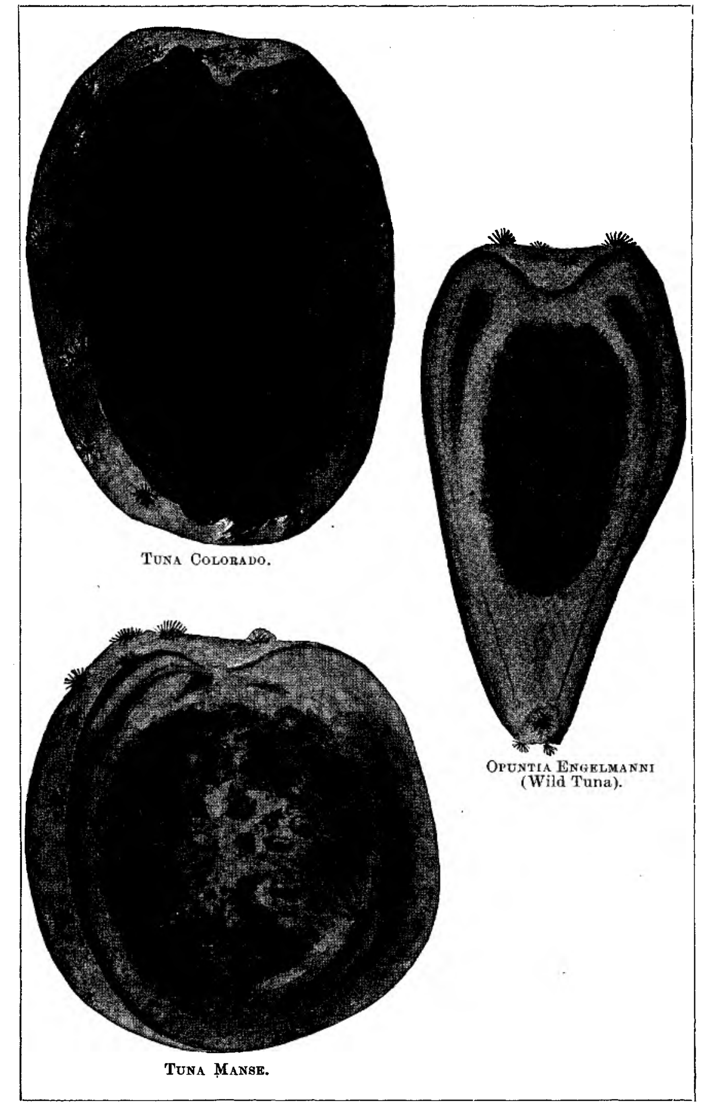
Essay by C. R. ORCUTT, San Diego.

"In all parts of the civilized world, the refinement, innocence, and happiness of the people may be measured by the flowers they cultivate," says an eloquent author. I would add that the wild flowers of a country must furnish a truthful index to the adaptability of that land as a home for the human race, for where they abound, there, too, man may seek for fruitful toil, pleasure, and rest.

Where may lovelier flowers, more brilliant tints, or more delicate coloring be found in greater profusion than on the mountains and mesas, in cañon and meadow, throughout the length and breadth of California? And where may a more perfect earthly abiding place be found for man?

California has probably already furnished to the horticulturist a greater variety of beautiful flowers than any other State in the Union. Foremost among those already introduced into cultivation is the abronia, a trailing plant with prostrate branches, and bearing umbels of sweet-scented flowers. Abronia umbellata is the best known, with its rosy, lilac flowers, and it slightly resembles the verbena. Abronia arenaria, with its waxy, yellow flowers, has also given great satisfaction in cultivation. These grow in great abundance along our sea coast; but other lovely varieties are wasting their sweetness on the desert air of the

FRUITS OF THE CACTUS.



EDIBLE PRICKLY FRUITS.

Mohave and Colorado arid regions, awaiting the appreciation of man. These plants are especially adapted to dry, sandy, or saline soils, and are excellent to prevent the shifting of sand.

The collinsia, of which we have several species, is another familiar flower in eastern gardens, a free flowering, hardy annual, with flower stalks from a few inches to two feet in height, each bearing several whorls of handsome, vari-colored flowers. The purple and white Collinsia bicolor is one of the handsomest in the genus, and abounds on rich hillsides and in shady places.

Eschscholtzia Californica, with its finely cut, glaucous green foliage, was one of the earliest to receive an introduction into the gardens of the civilized world, and is now everywhere known throughout Europe and America. The flowers vary exceedingly in color, ranging through the many shades of orange and yellow to white; in one form described as greenish, in others almost becoming red. It is usually an annual in gardens, but along the sea coast and in moist situations it becomes a perennial. By some botanists the many different colored forms are considered as species, and for horticultural purposes it may be well to treat some of them as distinct.

One of the beauties of the California landscape in springtime is the massing of color on our hillsides and in our valleys. Acres, and often hundreds, and sometimes even thousands of acres, will be of a brilliant uniform hue, owing to the preponderance in the vegetation of one variety of flower that is in bloom at the time. Usually, however, each flower is confined to a more limited area, and one may wander first from a patch of pure white nodding krynitzkias to a bed of brilliant rosy pink gilias, while just beyond exists a mass of royal purple, the whole encircled by a sea of gold.

What must have been the feelings of the earlier botanists when they first entered upon these confines of Nature's garden. These earlier botanists were able to view the landscape with appreciation as keen as horticulturists, and the gardens of Europe were soon enriched by their labors.

We cannot here attempt to review all the flowers which thus early met with due appreciation, or we should have no space for those which are still asking admittance within the floral circle.

Phacelia Parryi is one of the loveliest of the annuals of Southern California, and a universal favorite among those who have made its acquaintance. Every one who sees it face to face feels an instant admiration for its beauty, and a kind of friendship for it, such as we experience in our intercourse with the pansy and other flowers which confront us with something akin to a human expression.

The plant delights in warm, sunny exposures, on the banks of cañons, among the foothills, in fertile valleys, and on the hillsides. It extends, in San Diego County, from the seashore to the confines of the Colorado Desert, southward to near San Quintin Bay, Lower California, and perhaps beyond. It has an open, rotate corolla, of a rich and brilliant royal purple, well set off by the dark green foliage. Occasionally a flower may be found of a paler color, sometimes nearly white. With nearly all of our native flowers that are normally purple in color, I find albinism a common occurrence, though rarer in some species than in others.

For cultivation, I should call this one of the most desirable of the many pretty annuals which California affords to the horticulturist. It is capable of most effective display, and under favorable conditions will produce a profusion of flowers for months.

Phacelia Parryi is a lasting memorial of one who has just passed away. Dr. C. C. Parry, by his explorations, has introduced many a plant worthy of cultivation to the world of botany and horticulture. News has just reached me of his death at his home in Davenport, Iowa. To him belongs the honor of introducing the lovely Lilium Parryi, which we all admire. The Notholaena Parryi of our arid regions, a retiring and modest fern, faithfully reflects in these the character of one who made friends wherever he went. Dr. Parry was one of the earliest and best friends of the writer, and his death will be felt by many who have been similarly benefited.

Nolina Parryi, a large, liliaceous plant, is another of our desert perennials worthy of attention—equally as ornamental as the yucca.

Phacelia Orcuttiana bears a smaller flower than P. Parryi, and is white, with a golden center. It is a handsome, showy plant, one or two feet or more in height, and may be used with good effect in a garden or conservatory. It grows abundantly in the mountains of San Diego County and Lower California, and seems to spring into existence wherever a brush fire has devastated a section of the country.

Gilia dianthoides bears a flower which in size and beauty is out of all proportion to the plant itself, which consists only of a slender, wiry stalk, half an inch or so in height, with narrow, inconspicuous leaves; but from this stalk appears one or more rotate, rosy pink flowers, half an inch across. The flower is of such a texture, and is borne so near the ground, that it is scarcely available for any decorative purpose; but a field carpeted with them, as they shine in the morning sunlight, cannot fail to kindle admiration. Under favorable conditions the plant attains a larger size, and forms a dense mat spreading out over the ground. In cultivated fields, or by the roadside, I have found single plants, spreading out in this way more than a foot across, completely hidden by the numerous wide-awake flowers. A single plant would thus form a lovely bouquet of itself; and we may hope that in cultivation it would well repay any attentions paid to its beauty. It is not rare to find a plant with pure white flowers, especially among the foothills. A similar species (Gilia Orcuttii), with white flowers slightly variegated with purplish red, was collected in 1883 on a mountain in Lower California, but has not since been seen. Another equally beautiful species (Gilia bella) was discovered on the high tablelands of northern Lower California among the Piñone pines; and I have since seen it abundantly on the mountains bordering the Colorado Desert. It has the same characteristics as Gilia dianthoides, but is more brilliant and darker, with flowers of a smaller size.

This family (the Polemoniaceæ) has given many of its members to enrich our gardens, the best known of which is probably the Mexican Phlox Drummondii. The mountains of California yield to the botanist some lovely varieties of phlox, as yet, I believe, unknown to cultivation. The State is especially rich in the multitude of forms of Gilias, several of which, like Gilia achillæfolia, G. capitata, G. tricolor, and others, have gained a permanent place in our annual seed catalogues. Many more besides those already mentioned are worthy of a place in our

gardens, and, with their bright, sunshiny faces, must eventually win their way.

The lœselias are closely related to the gilias, and the three alpine forms of northern Lower California are worthy of attention.

The primula, or primrose, family gives us the American cowslip, or shooting-star, the nearest relative in California of the English primrose. Dodecatheon Clevelandi shows itself, generally, in early spring over the hills, mesas, and valleys of Southern and Lower California, especially near the coast. The flowers pass, in different individuals, from clear pearly white, through lovely shades of pink and rose red, into a brilliant phlox purple, and a large field thickly dotted with their nodding heads is a vision of loveliness familiar to Californians. For many years this and other forms throughout the United States have been known to botanists as the Dodecatheon meadia of Linnæus. Within recent years Mr. E. L. Greene has studied our Californian forms, describing several as new species, and naming that of Southern California in honor of the earliest resident botanist in San Diego, Mr. Daniel Cleveland, whose early collections brought many new plants to light. Every child in springtime is sure to gather large handfuls of the fragrant flowers, and each has some pretty name for them, such as rabbit-ears, Johnny-jump-ups, or mad violets.

This flower should become as general a favorite as the cyclamen, which it surpasses in beauty and the ease with which it can be cultivated. The perennial roots are easily transplanted, and no difficulty should be experienced in making it thrive in eastern houses and gardens. In California they may be planted as borders to beds, or grouped in masses, or dotted thickly over a garden as if they were wild. The broad leaves form a pretty rosette before the one or more spikes of flowers appear, and the flowers are admirably adapted for bouquets and for the use of florists.

Lathyrus splendens owes its name to the pioneer botanist of California, the late Dr. Albert Kellogg, whose botanical labors are so well known. For many years this, the loveliest vine native to West America, was lost sight of, and by other botanists the name was considered a synonym of the common lathyrus of Southern California. In the spring of 1888, in the month of April, Dr. C. C. Parry and Mr. C. G. Pringle, two of our most noted American botanists and explorers, invaded the then almost unknown territory of Baja California, traveling from San Diego southward overland to the shores of Todos Santos Bay, thence inland to the then almost deserted mining town of San Rafael, and back to San Diego.

It was my fortune to accompany these experienced botanists, and soon after crossing the Mexican boundary line at Tijuana (or Tia Juana—Spanish for Aunt Jane), we had the pleasure, in common, of rediscovering this magnificent plant in a cañon among the foothills, hanging in graceful festoons, or clambering recklessly over the bushes and shrubs beside a running stream.

With hands and pick the first plant encountered was gently disengaged from its support, and root and flower quickly transferred in triumph to my portfolio. From this time on we found it ornamenting the cañon shrubbery and the hillsides and arroyos with its large and showy clusters of deep brilliant rose-red blossoms, which makes its name so appropriate.

On our return to San Diego we found it transplanted from its native wilds and flourishing, furnishing refreshing shade, and covering a porch with its enlivening green, which harmoniously relieved the brilliancy of its flowers.

In April, 1889, I again found it in the mountains of San Diego, where for miles along the roadsides the bushes were heavily loaded with its brilliant blossoms, and where it had won from the people the very appropriate name, the Pride of California, to which it is fairly entitled by its beauty.

With us it blossoms the second season from seed. I should describe it as a hardy perennial, as it is found in regions of frost and snow, as well as in our more salubrious climate. On New Year's day, this year, while crossing our mountain range en route to the Colorado Desert, I found a few stray blossoms along the roadside, and the succeeding week was stormbound, amid ice and snow, where in April, 1889, I had found it in fullest bloom.

One of the brilliant spring beauties that receives the admiration of both the savage and cultivated races is the Californian pink (*Erythræa venusta*), also known under various names like California Century, but best known under its Mexican name, *canchalagua*. Medicinally, it possesses valuable antiseptic and febrifuge properties, and is in high repute as a bitter tonic and stomachic. It is said to form the basis of the "August Flower," so extensively advertised, but this is doubtful. With the Indians and Mexicans it is used extensively in fevers, and hacienda or rancheria is rarely found without a bunch of the dried plant suspended from the roof.

The plant is from three inches to a foot in height, and when favored by sufficient moisture, branches into a bushy form. The delicate green and rather sparse foliage is completely hidden by the mass of brilliant coloring which soon envelops the plant. The large, rotate corolla is a bright purplish pink, and very beautiful, and no one can resist the first temptation to gather a briming handful of the flowers. A bouquet can be gathered, and the flowers will keep bright and fresh without water for weeks—almost everlasting in character.

In 1884, it will be remembered that we had an unusually wet spring, especially in Southern California, and vegetation grew more rank than I had before or have since seen. In May, the usual time for erythræas to bloom, our mesas and valleys near the coast were covered with flowers, and the canchalagua was in its glory. I then detected, not for the first time, however, but in greater numbers than before, a beautiful white flowered form of this species. From the abundance of material which I sent to the late Dr. Asa Gray, he was at first inclined to consider it distinct. In different individuals the flowers passed from pure white into the most delicate shades of lilac, lavender, and purple, and thence, naturally, into deep purplish pink, to a normally lighter shade. This certainly, like many other members of the Gentian family, is well worth a permanent place in American gardens.

Another noteworthy plant of the same family is the Frasera Parryi, a biennial, with light green leaves, margined with white, which produces a tall panicle of curiously marked, showy, apple green and white flowers, spotted with purple.

Eustoma exaltatum is another near relative, growing from a span to a foot or two high, producing showy, light purplish blue flowers; not

rare in moist situations in the Colorado Desert cañons, where it is very conspicuous when other plants are out of bloom.

The California layia (*Layia elegans*) is a beautiful, hardy annual, forming upright, bushy plants six inches to a foot high, and producing in abundance large single lemon yellow flowers, the rays tipped with white. Of easy culture and very showy, this plant has recently attracted the attention of eastern seedsmen. Sometimes the rays are only yellow near the base, the remainder purple or white, three quarters of an inch long. A purple flowered form was found near Todos Santos Bay, Baja California. Again the rays are sometimes entirely yellow. Layia xanti is found on the borders of the Mohave and Colorado Deserts, and has larger, pure white flowers.

I trust that the other flowers of Northern and Central California will not feel slighted at my neglect of them, since it is rather from ignorance than intention. I have been too busy in wooing their, botanically, more youthful sisters in Southern and Baja California to pay attention to the northern members of our "best families."

There are many other magnificent annuals both known and unknown to fame, but I will now mention a few of our shrubs that are more especially worthy of notice.

Solanum xanti is a handsome half-shrubby bush, from a span to several feet in height. Its dark green foliage is well set off by the profusion of brilliant royal purple blossoms which it bears almost throughout the year. It is found from Cape San Lucas, I believe, to San Diego, and northward. Its perennial roots can be easily transplanted, and I doubt not it would grow readily from the seed.

Among our native California shrubs that have already met with the appreciation due them, I will simply mention Carpenteria Californica, Fremontia Californica, the magnificent Romneya Coulteri, Heteromeles arbutifolia, and Leptosyne maritima, all fully worthy of more extended cultivation than they have yet received.

Our California ceanothi—the wild lilacs of the Pacific Coast—do not seem to have yet received the attention they deserve. They are mostly graceful evergreen shrubs, bearing in springtime a profusion of fragrant and beautiful white or delicately tinted blue flowers. The mesas around San Diego are white in early springtime, the foliage and branches of the shrubs almost completely hidden and disguised by the floral wealth displayed by our commoner species. In February, while among our foothills, I found another coast species in bloom, with its clusters of campanula blue flowers, which, as they grow older, fade first into flax-flower, and then into pearl blue.

The Arctostaphylos manzanita is another ill-appreciated flower, perhaps because it does not yield kindly to man's caresses. Yet it would seem as if some one might coax it into the same graceful customs of growing and blooming as it follows in its native mountains, and it would surely repay, in that case, for all the care and time that might be given it.

The lovely sprays of snow-white flowers, blushing at the attentions of the fast falling snowflakes of February, would have won for it the vote of any beholder for our national flower. It would certainly be an appropriate flower for our State emblem, if each State is to choose its own flower, as some one has suggested, and in that case its near relative—the trailing arbutus—might be allowed to carry off the national honors.

Abutilon aurantiacum is a low, compact shrub, found near the southern borders of our State, and as yet known by a few botanists alone. Its large, velvety, glaucous green leaves render the plant in itself highly ornamental, and, in size, admirably adapted for pot growing. The delicate golden flowers are a fitting crown for its beauty, and lasting, as they do in its native haunts, nearly the whole year through, should prove a welcome addition to this favorite group of plants.

Along the borders of the Colorado Desert there are to be found several exceedingly handsome shrubs which occasionally become small trees. Whether they would take kindly to cultivation I cannot say, but certainly we would not begrudge them any trouble if successful in the attempt. First are the daleas—the embodyment of grace—the several species blending harmoniously with each other in color and form. The airily pendant branches, often leafless and yet not appearing in need of foliage, are beautiful at all times. They are the height of perfection, however, when turned to a brilliant mass of deep indigo blue and purple flowers, laden with sweetness, attracting the bees from far and near. Perhaps the desolateness around them, the dreary expanse of white, shining sands along the arroyos where they grow, add somewhat to their beauty.

Parkinsonia Torreyana, the *Palo Verde* of the Mexicans, is another of these both curious and beautiful desert shrubs or trees. Green, bright, vivid green, from the roots to the tip of each graceful branch and twig, leafless at times, and, like the daleas, appearing to need no foliage, they would be admired above the great majority of the ornamental shrubbery that is planted. At this season they are clothed in delicately divided leaves which lend an added grace to the tree. In summer the foliage disappears and is followed by curious, yellow flowers, which do not detract from the beauty of the whole.

Another shrub which invariably attracts a stranger's attention is the *Hocotillo*, or *Palo Adan* ("Adam's tree"), better known to Americans as the candlewood (*Fouquiera splendens*). It, too, is leafless, except at certain seasons. Like most desert shrubs it is provided with spines, or thorns. It branches out from a short trunk into from a few to one or two hundred stems, which stand out at a slight angle on every side. It is an odd looking thing, not very ornamental at first glance, and is often mistaken for a cactus. It has evidently followed the old maxim: "If you can't be pretty, pray be odd." Cut off one of these curious stems, take it home, put it in the garret right side up with care. Some rainy day, six months afterwards, you may wish to make it into a cane and will hunt it up. The chances are you may find it with a flowering cluster of scarlet blossoms growing out of its top. It has served others in this fashion. You may cut slips and plant them and make them grow. You can transplant young roots with difficulty. Still I do not know of its yet yielding gracefully to cultivation, but I have not myself given it a fair trial, I feel, since I allowed my plants to die.

I believe our Adenostoma fasciculatum is already known in cultivation—in Europe if not in California. Of course so common a shrub as this is with us is not worthy of attention, according to the usual verdict. A near relative, Adenostoma sparsifolium, is found in our mountains, is equally desirable for cultivation, and as yet, I believe, unknown to horticulturists in general. Its delicate, light green foliage is in sharp contrast with its congener, which has very dark green foliage. Both are

evergreens, and of a very high order as ornamental shrubs. By studying the natural blending and contrasting of our wild shrubs and trees in their native haunts, the landscape artist could gather some useful hints, and both of these species of adenostoma would be very useful in his work.

I had intended to review in this paper our beautiful liliaceæ, but time prevents me from doing so. But there is one, which I have recently met—the magnificent Hesperocallis undulata, of our desert regions—that must not escape notice. This fragrant day lily is found in clear sand in the Mojave and Colorado Deserts, and has recently been reported from near Cape San Lucás. It has a large edible bulb, which produces a stalk from a few inches to two feet high, bearing often as many as thirty fragrant white blossoms. The blossom is large, with a green midrib on each sepal, which adds materially to its beauty. The bulbs are one to three inches in diameter, nearly globose, and furnish the traveler in those regions with both food and water if he is so fortunate as to know how to find them. They can be eaten raw, or cooked like other vegetables.

In closing, I wish to call attention to certain native and naturalized fruits—the several varieties of tunas, which have been introduced around our old missions, and are growing wild on our hills. The common tuna produces an abundance of a sweet, luscious fruit, greenish in color, and is what I suppose to be the Opuntia tuna, a native of Mexico. The Tuna Colorado differs but little, except in color of fruit, which is of a rich maroon purple. This, I infer, is the Opuntia ficus-indicus, or Indian fig. The fruit is rather insipid and mealy.

The third variety is very distinct from either of the preceding, and is, I believe, a good species, as yet undescribed by any botanist, so far as I know. Its Mexican name may be adopted for its specific, if it has not been already christened by some Mexican explorer. In that case, we will call it the Opuntia tuna-manse. The fruit is more nearly globose, of a mottled "orange-bloodshot" color.

The flowers of these three vary in color to correspond with the color of the fruit. Our native wild tunas vary greatly in size, color, and taste, some bearing exceedingly sweet, delicious fruits, while others are very sour.

The three photo-engraving cuts accompanying this illustrate the beauty of these fruits, which are useful for making delicate jellies or syrups.

I scarcely need to call attention to the ornamental features of this cacti, as the plant is doubtless familiar to all; but the beauty of fruit and flower in the different varieties is probably not so well known.

OPUNTIA FRUIT AS AN ARTICLE OF FOOD.*

One of the most attractive fruits in the markets of Mexico, and one that is always in demand, is the fruit of the opuntia, or tuna, as it is known to the Mexicans. Both the foreign and native inhabitants consume it, and with many it forms the principal article of food for months in the year.

* Dr. Edward Palmer, in "West American Scientist."

The seeds of some of the choicest varieties sold in the markets of Mexico were obtained, and are now being grown by the United States Department of Agriculture for distribution in localities suited to their cultivation. The tuna of the Mexicans must not be confounded with the opuntias found in Arizona, New Mexico, and Southern California, the fruit of which is not utilized.

What is known as the cactus belt of Mexico furnishes many very fine species of opuntia adapted to cultivation. When brought together, and each variety receives a name, as other cultivated fruits are distinguished, they will severally be sold and esteemed for their respective merits. Then especial growers of this cactus will appear, and new varieties be produced by cross-fertilization and other means, as in our northern fruits.

The potato and tomato, when first introduced, were little valued, because their qualities were unknown; now the world would not care to do without them. When man utilizes the opuntia, then that fruit will be prized wherever known.

CULTIVATION.

Scarcely a plant known to man requires so little care in its cultivation as the cactus. It will grow in nearly any soil, but best in light sandy or gravelly combinations. The opuntia reaches the greatest perfection on the tablelands of Mexico, where owners of estates have assured me that they have realized, beyond all expenses, $3,000 to $5,000 annually from the sales of this fruit and its products.

The opuntia takes root readily when a piece of a plant is laid on the ground, or a little soil may be thrown on the top of a joint, so easily is it cultivated. It will stand considerable cold, and drought does not affect it beyond causing the plant to wilt at times, from which it quickly recovers. The dryness during the most protracted drought seems to increase the sweetness of the fruit.

Give the opuntia one tenth of the care in its cultivation that the peach requires, and it will repay you with a delicious fruit that lasts for a much longer period for market; one better for shipment; one with good keeping qualities. No insects to molest it, no danger from frost, as it blossoms after the time of frost, and protected from thieves by its spines, you can enjoy its fruits unmolested. There are some who dislike all forms of cactus because of their spines, and consider them useless, but this is a mistake. All cacti are useful to animals and birds, and may be utilized by man; and the spines simply prevent their rapid destruction by animals that would greedily devour these succulent growths were they not protected.

REMOVING THE SPINES.

When the fruit of the opuntia is ripe the fine spines upon their surface are readily removed by taking a bunch of grass, or any other suitable thing, and switching the fruit, thus removing easily the downy spines, which, if not removed, would cause a little pain for a short time in handling the fruit. I have seen persons, born among the tunas, catch the fruit suddenly near the summit and wrench them off with their fingers, apparently without suffering any evil consequences. If the spines are not removed at gathering, the fruit will have to be wiped before the rinds are removed, to prevent pain to the operator.

GATHERING THE FRUIT.

There are three methods resorted to in gathering the opuntia fruit—one, with the hands; second, by wooden tongs; third, with a knife. The first method can only be resorted to when the plants are low, or in gathering from the lower branches of a tall plant. By taking hold of the fruit with the fingers and giving it a sudden twist it is at once detached. This is, no doubt, the best method of gathering for market, as there is less bruising, and, if the spines were previously removed, can be at once packed for market, or the "jackets" removed for immediate use. The second method of gathering the fruit, by means of wooden tongs, is, so far as the writer knows, only resorted to by Indians, who gather for their own consumption.

The knife in the hands of an experienced gatherer can be made to detach a great quantity of fruit in a day. It is much used along the tablelands of Mexico on the great estates where the opuntia grows to perfection, and the fruit, by various means, rendered profitable to the owners. The blade of the knife is made of steel and is inserted into the split end of a long, strong stick, the length of which enables the gatherer of tunas to reach with the knifeblade the joints bearing ripe fruit. The plants are often eight to fifteen feet high. The fruit is arranged around the outer rim of the joints, so, when the gatherer brings the knifeblade to the joint, he separates by a quick turn that part bearing the fruit, and as quickly thrusting the blade into the severed part, brings it to the ground, when the fruit is soon denuded of its fine spines and removed. Plants present an odd appearance after the terminal joints have been thus removed, but suffer no injury, and the fragments readily take root and form new plants.

REMOVING THE SKINS FROM THE FRUIT.

It is surprising what a quantity of fruit can be deprived of skins and prepared for the palate by one pair of experienced hands. A thin slice is removed from each end of the fruit; a slit is then made through the peeling along the length of the fruit. The fingers press downward quickly the separated skin, leaving the pulpy fruit exposed in a tempting manner. Thus prepared, the fruit is one of the sweetest, most nutritious, and refreshing of fruits, mealy and juicy, most agreeable for the warmer seasons of the year in the United States. Especially is this fruit adapted for the breakfast table, when the languid body needs something to aid digestion. If kept as cool as a watermelon, it will prove far more agreeable than that fruit, being of a similar flavor with that of the strawberry added, and it is healthier, more nutritious, and longer in season than the watermelon.

This fruit is to be found in the Mexican markets in abundance, and very cheap five months in the year, and is consumed by all classes and conditions of people. Venders are to be seen along all the roads. Along the Mexican Central Railroad the earliest tuna is ripe in June, and the latest varieties disappear in November, and you are offered them in small dishes, with the epidermis removed, a thorn from the mesquite tree being used to carry the tempting morsels to the mouth.

This fruit is finding its way all along the frontier of the United States, and this winter I saw some fine fruit on a stand in Jacksonville, Florida, for sale.

Americans and foreigners consume this fruit with equal avidity with the Mexican, and praise the flavor. When as well known in this country as in Mexico, it will be utilized to the fullest degree.

NATIONAL REGISTRATION OF PLANTS.

Essay by A. L. Bancroft, San Francisco.

THE NEED OF A COMPLETE AND SYSTEMATIC PLAN OF REGISTRATION.

The generally unsatisfactory condition of the nomenclature and means of identification of fruits, flowers, and plants, is shown by the fact that at nearly every Convention of fruit growers or florists a committee on nomenclature is appointed or has a report to make. Unfortunately, the work of such committees is generally merely local in its influence and is soon forgotten, and but very little or no advance is being made in establishing a general and uniform nomenclature for the entire country.

Those dealing in or having to do with plant life are caused great inconvenience and loss of time and money, for the reason that the names of many plants are not uniform in all parts of the country, and that there is no ready or authoritative way of identifying them. Cases frequently occur where, through duplicate names, ignorance, or dishonesty, purchasers fail to obtain what they expect. The fault may even be their own, but the losses are no less and the situation no less exasperating for that reason. As to the desirability of having one, and but one, permanent and recognized name for an individual plant, all must agree.

If this one accepted name could be decided upon by some central power and be made official for the whole country, it would be the most desirable thing that could possibly be done; but it must be official and final, or it would not be generally accepted and permanent, and would amount to nothing. The names, etc., should, in this connection, be recorded in a series of volumes, to be known as the "American Horticultural Register."

WHAT THE PLAN OF THE REGISTER SHOULD BE.

The register should be planned upon a very broad basis, so as to be permanent and not to require reconstructing at some time in the near future. It should include all plant life, both indigenous and exotic, which grow on the American continent, extending from the north pole to the equator.

By starting separate lists for different classes of plants at the same time, and not attempting any arrangement of the individual plants in the lists, but merely recording them as the names are decided upon and they are ready to be recorded, the lists under each class of plants could be extended indefinitely. The first plant in each list should be No. 1, and the others continue in regular rotation as new ones are added. A system of letters could be used to indicate the class to which the list belongs, and figures to indicate the number of the plant in the list. This

combination of letters and figures would indicate where the record of each particular individual was to be found in the register, and taken in connection with the name would always be the official designation of the individual plant. The register would always afford an official and authoritative way of identifying plants and of settling disputes concerning them.

The register should contain, first, the number; second, official name; third, botanical name; fourth, the popular name and local names; fifth, description; sixth, a short history and a statement of the peculiarities and habitat of each plant recorded; and seventh, in many cases, if not in all cases, a photograph or series of photographic views of the plants. While the reproduction of these views would be too expensive for general circulation or distribution, complete copies of them should be found at least in all of the State Libraries of the country, and in many of the other larger libraries and educational institutions, while a printed copy of the register, without the photographs, should be easily obtainable by all who might be interested in it.

A very desirable feature of this plan would be to have preserved in a collection specimens of all the plants. Where they are small, complete specimens could be accommodated; but, in the case of large trees, a portion of the wood, bark, foliage, and fruit could be preserved. To do this would require considerable room, and a new building, to be devoted to this special use, would soon be required. A very large building is now used for the storing of models of inventions. Should they be considered of more importance, and have a building devoted to their sole use, any more than plant life?

The registration of all known varieties should be commenced at once, and be continued as names are decided upon, and new varieties be registered as they are discovered or originated.

HOW TO ACCOMPLISH IT.

The carrying out of such an undertaking as this, if done upon a sufficiently broad basis, would be too great an undertaking for an individual, a society, or a combination of societies, or even by a State organization. But even if it should be satisfactorily done by them it would then be without official sanction, and would be comparatively ephemeral and valueless. Nothing short of action by the general Government *can* accomplish what is desired. National societies, local societies, and individual societies can render most valuable assistance in this work, but it must be *official* when once done, decided upon, and recorded. There would undoubtedly be active and influential coöperation with any organized and well defined movement in favor of a plan of this kind, by those having a pecuniary, scientific, or general interest in the subject.

Before, however, recording and announcing a name as being decided upon and irrevocably fixed, lists of proposed names with descriptions, etc., should be published from time to time, and sent to societies and others interested, and allow a sufficient time to elapse for consideration, discussion, and to settle all disputed points, before finally determining the name and recording it, and only transfer the names from this list of names proposed to the register when all doubts are removed, and when it can be satisfactorily done.

The natural place for this work to be undertaken is in the Department of Agriculture at Washington. There it could be done, and well done, and neither would it require for its accomplishment very much of the surplus which so troubled the previous administration. Probably an additional officer or two, with a few assistants and some additional room, would in time accomplish it. Each Government on the North American continent should be invited to join in this scheme, and to send a representative to Washington, to reside there for a time and assist in the work, giving particular attention to the plants of their respective countries, to the end that the same work might be made available as an official list for each country represented. In this case all that would be necessary to do to make it as desirable as it could possibly be were it done especially for each country, would be to translate the names of the classes of plants and descriptions, etc., into their respective languages. The classification, system of numbers, etc., would be as satisfactory for one nation as another. The scheme might perhaps be extended to take in South America, and the islands of the sea, or, in order not to lack sufficient breadth, go even still further, and take in other continents as well.

EXCLUSIVE PROPAGATION AND SALE RIGHTS TO ORIGINATORS FOR A LIMITED PERIOD.

In connection with this movement there should be secured, if possible, to the originators of new varieties of fruits, flowers, and plants—but probably by a separate Act of Congress—the exclusive right to propagate and sell them for a limited time. Suppose the originator had the right to enter at a moderate expense his new plant for propagation right any time within three or five years after a tree was fruited or a plant flowered, in order to have sufficient time to test its merits, and then have the exclusive right for twelve years. This would give him two years to prepare stock for market and a full ten years to reap the reward of his laborious research and experimenting. The originator of literature is protected by the copyright laws; the originator of inventive products by the patent laws; and they certainly deserve no greater recognition than the originator of new and valuable varieties of plants deserves to be protected by propagation laws.

No one but an American citizen should have the right to acquire this propagation right in our country; but a citizen should have the right to acquire by purchase from an alien a plant originated within three or five years, and which has not been put upon the American market, and to enter the same for propagation right in his own name, stating in his application or entry how he acquired his title to the new plant.

The purchaser of a *propagate-righted* plant should have the right to propagate it for his own use, but not to sell it except by special arrangement with the originator, nor to give it away. At the time of purchase he should be furnished with a certificate of purchase by the vender, who shall keep an accurate record of the same. At any and all times before the expiration of the propagation right the owner of a propagate-righted variety should be required to prove, by producing his certificate, how he came into possession of it, and that he is lawfully entitled to have one or more of them in his possession, or hold himself responsible for violation of the law. Any one desiring to do so should have the *right* to

purchase any propagate-righted plant at the advertised price, whether he is an orchardist, florist, or amateur.

Protection of this kind would be an incentive to extensive and systematic experimenting, which would, without doubt, result in producing many new and valuable varieties as a blessing to mankind.

RESULTS AIMED AT.

The California State Horticultural Society and the California State Floral Society have each recently elected members of a joint Committee on Horticultural Registration, etc., with power to act and to add to its numbers. This committee is now being organized, and their work is already being planned. If the members of this Convention approve of this movement, I, as a member of the committee referred to, would ask them to discuss the question, and appoint a committee to draft a memorial to Congress in duplicate, asking that this plan be carried out; and that one copy be forwarded to one of our representatives in Congress, and that the other be sent to the committee.

The work of this committee will be neither short nor light, but by keeping at the work assigned them persistently, energetically, and with good judgment, they hope to accomplish results which will justify the time and labor expended upon it. In due time bills will be drafted and sent to our representatives at Washington for introduction into Congress.

ORNAMENTAL TREES AND SHRUBS.

Essay by Byron O. Clark, Pasadena.

In assigning the subject of "Ornamental Trees and Shrubs" a place in the deliberations of this Convention, you give recognition to a branch of the horticultural interests of this State of much importance. Not in the direct line of dollars and cents, as in the great fruit industry, but one that goes far towards making pleasant and beautiful the surroundings of the toiler, be it he who owns acres devoted to fruit growing, or the dweller on a city lot.

In planning the homestead, all the available land should not be planted to fruit trees, merely for the sake of the revenue to be derived therefrom. The temptation for doing so is greater in this southern clime than in most places. As the orange and other citrus fruits, with their unrivaled beauty of foliage, fruit, and flower, are liable to insinuate themselves into our affections, to the exclusion of many other beautiful shrubs and trees, especially when the possible profits of a single well grown orange tree in the front yard will make more clear money for its owner than the best acre of grain ever harvested in this or any other State. However, if I could have but *one* ornamental tree on my lawn, it certainly would be an *orange* tree, and I give it the first place on my list of ornamental trees, as it is one of the *few* trees suitable alike for planting on the extensive lawn of the country home, or the limited area of a city lot; provided, the soil and other conditions are favorable for healthy growth.

In this semi-tropic climate the tendency is to give preference to evergreen trees and shrubs, and, if properly selected in planting, so as to avoid the predominating error of planting too great a proportion of coniferous trees, with their formal habits of growth, I would give them the decided preference, as it is possible, with a good selection of coniferous trees, interspersed with broad-leaved evergreens, such as the Magnolia grandiflora, Rubber, English laurel, California laurel, Madrona, Photinia arbutifolia, etc., with the addition of the graceful pepper with its beautiful foliage and red berries, the tall and majestic eucalyptus in its numerous varieties, many of which have the additional charm of handsome flowers, the Grevillea robusta, and other trees of varied habits and foliage that thrive well in this climate, to *create* a landscape that will be a constant delight to the beholder, be it December or June. I am not unmindful of the fresh and inspiring beauty of the maple, elm, walnut, etc., when they take on their mantle of matchless green in the springtime; but I always feel sorry for these friends, when, from October to March, their bare trunks and leafless branches are alluded to as "dead trees" by the people who come among us to spend the winter season, and do not recognize them as things of life and beauty, when surrounded by the evergreen pepper, orange, etc.

There are many gems of beauty among the deciduous trees and shrubs that should find a suitable place in our landscape plantations, and can be used with good effect if properly arranged. They should not be planted in too conspicuous a place; their beauty is of a modest, unassuming type, that will receive its share of recognition from their friends without being placed in the foreground, to be the object of criticism by the average observer, for it requires one whose thoughts lie close to Nature's God to recognize the beauty of the stately sycamore, or the graceful elm, when shorn of the verdure of spring.

The hardy palms are a very important feature of our landscape, and very charming tropical effects can be had when grouped with dracænas, bananas, yuccas, fourcroyas, etc.

Among the best of this class of plants I would recommend the phœnix, or date palm family, with its many varieties, as very graceful and ornamental, quite hardy and good growers.

Of our native palms, the Washingtonia filifera is more largely planted than all other kinds put together, largely owing to its easy growth and not being so expensive as choicer kinds, and it is especially suited to avenue planting, being the best palm for this purpose. Erythia edulis, from the Guadaloupe Islands, and Erythia armata, the blue palm, are both choice varieties, and will be popular when better known.

The Chamærops excelsa and humilis, and Cycos revoluta, or sago palm, from Japan, are hardy and very handsome palms, and should be in every collection where one has a variety of palms. The Latania borbonica is a beautiful fan-leafed palm, but needs to be planted in a partially shaded situation or its leaves will sunburn. There are many other palms hardy in this section, but most of them are better suited to the amateur who can give the special attention required to meet with satisfactory success.

It is not advisable in this article to give a long list of trees and shrubs which are suitable for our climate. Such a list can be had from the catalogue of any reliable nurseryman on this coast. With the aid of such a catalogue, and a personal study of the trees growing in the grounds of our older improved places, one can obtain a very good idea of what is best suited to his needs. Do not plant too great a variety;

do not expect to make a complete arboretum on a city lot, or a ten-acre homestead. Select a few choice specimens, and give plenty of room for development. Many choice and rare trees are ruined by planting too thickly. When you plant, have in mind the size the tree will be ten or fifteen years hence; do not plant with regard to present size. Do not touch your tree with a knife, unless you are sure you know what you are about. More trees of all kinds are injured by injudicious pruning than by any other one cause. What beauty is there in an evergreen which has the appearance of a "haycock stuck on a pole?" People who plant trees seem to think the next important thing is to prune. To such, I would say, take Mr. Kinney's advice: "Go away from home until the spell leaves you."

FOREST CULTURE.

Essay by Abbot Kinney, Lamanda Park.

We are all socialists or nationalists to the extent of admitting that certain things are of the nature of monopoly. These things we confess can only be properly administered for the whole people by the people's representatives. Of these there are the public defense, taxation, the Post Offices, etc.

Some countries are behind in the control of such monopolies, as Turkey, where the taxes are farmed out to private contractors; while other countries are ahead, as those managing the telegraph or the railroad. So, also, there is the supplying of water, or of gas, in some communities, or the sale of tobacco, as in France, or of alcohol, as in a city of Sweden, that is made a public monopoly. Some communities control education, sanitation, diet, or drink, etc., while others leave all things alone. About the advisability of Government control of all these, except the national defense, taxation, and the Post Office, there is still dispute by competent persons.

There is one interest, however, managed by the people of most civilized countries, but not in this, about which there is no dispute by the competent. All agree that from its nature it must be a Government monopoly. This interest is forestry. Every civilized country, except the United States and England, have nationalized their forests, or placed them under Government control. England is so peculiarly situated, both as to topography and climate, that the importance of forestry has not been forced upon it. England has, however, a fine forestry system for India. We may, therefore, be said to stand alone amongst civilized countries in our neglect of forestry. Even pioneer countries like Canada and Australia have forestry systems, while we have none.

The forest is the farmer's friend. These friends are often far apart, so far, perhaps, that the relation of the one to the other is lost sight of. It is not a self-evident fact that cutting or burning the forest covering of a watershed will be to the injury of farmers fifty or even a thousand miles away, or that such forest destruction may also be the destruction of these distant farms. The study of man's experience is required to demonstrate the interdependence of agriculture and forestry. But the demonstration and proof of the importance of forests to farmers is not enough to utilize the knowledge of forest management in the whole people.

The individual control of landed property deemed useful in other interests can, upon no theory, be accepted as good for forestry. The owner of a forest in the Sierra may find it individually advantageous to denude an entire watershed. We know that extensive denudations of steep watersheds result in floods during heavy rains, destructive to any valley lands within its high-water area. Thus the lumberman may derive a personal profit from a forest destruction that by and by will destroy whole farming districts. The ratio of his profit to the farmers' loss may be as one dollar to a million, and still the individualistic system is incapable of stopping or even blaming him. The realization of the relation of forests to farms has forced foreign Governments to place the forests under public control. This has not been done upon theoretical grounds, but as a sequence of exceedingly expensive experience. Before forestry was adopted as a Government policy, we learn that the fertility of whole countries was diminished or destroyed as forests were cut off. Palestine, or the Land of Canaan, is described as a land flowing in milk and honey. We also read that very fine timber grew in the mountains, including the celebrated Cedar of Lebanon. At the present time there remain of these cedars a few specimens, visited as curiosities.

No forests remain in Palestine, and, excepting a few little nooks and corners, no fertility remains in Palestine.

The granary of the ancient Roman world was North Africa. At the time of its great productiveness, the mountains which back up the plains were forested. From them came the timber for the great fleets of Carthage. The one condition has disappeared with the other. Many countries of the ancient world have had this experience. Once supporting large populations, are now nearly deserted; once fertile, now deserts. One district after another went through the same experience, that is, allowed the destruction of the forests on its watersheds, only to see the production of the valleys diminished.

The old records tell us, for instance, that logging corporations once did a thriving business on the River Durance, in France. Now its mountain watershed is bare, the channel of the stream has broadened so that no boating is possible. Its bed varies between a wild waste of bowlders and sand in the summer and a wilder waste of turbid torrent during rains.

In this valley alone more than two hundred thousand acres of the famously fertile Provence have been totally ruined. Out of these recurring experiences grew the recognition of the relation of forests to farming. Out of the feudal preserves for hunting and pleasure grew the modern forest system for practical purposes. The pleasures of the few maintained certain districts forested. It was noted that the watersheds of such districts were not subject to either the destruction of drought or of flood, as were those of denuded watersheds. It was also observed that after a certain proportion of forests was destroyed, the productive line of plants, such as wheat, and of trees, such as peaches, receded further south. This indicated either greater extremes of heat in winter or spring, allowing premature blossoming, or of cold at the same season, fatal to the productive character of the plant, or else of extremes of moisture and of dryness of the air or soil, equally detrimental, or extremes of wind, or all of these. At last a rule has been formulated, that

a certain proportion of the area of a country must be maintained in forest for the highest productive capacity of a country. That is to say, a given district, which we will call one hundred square miles in area, if all under the plow, will not produce so much as if 25 per cent of it be in forest and only seventy-five under the plow. Besides these economic reasons for forestry, there are still others, to only one of which I will allude. This is the connection of forestry with health. I believe that I am accurate in saying that, other things being equal, a forested district is always healthier than a denuded one. We know, at least, that many districts formerly forested, or partly forested and then healthy, are now bare of trees and unhealthy. In some cases, as in portions of Greece, Macedonia, North Africa, and Italy, such deforested districts, once fertile and populous, are now deserted and desert. We have a reasonable presumption that it was forest destruction that produced these unfavorable effects by the results of replanting trees by the French in Algiers, and by the Italians on the notorious Campania. In both cases the excessive mortality from malignant malarial maladies has diminished or disappeared.

These records of other countries and of other times may seem far off to Americans. If this is the case, they can study the effects of forest destruction in the Eastern States. By such study can be learned the fact that in America forest destruction is followed by diminished springs and summer flow of streams; by increased destructiveness of winds; increased force of frost; increased force of flood, and increased death rate of the people. Accompanying this is a retreat south of the productive limit of many useful plants and trees; a diminished length of life of fruit trees; a general diminution of the productive returns of land per acre, etc. The census shows some of these things in a manner that should attract more attention than it does. Whether these unfavorable accompaniments of forest destruction are in any way due to deforestation is disputed. The weight of testimony to me, however, seems to point to a large, if not exclusive, influence of forest destruction upon these conditions.

In the older States this view is accepted very generally. Nearly all the northern and central States now have forestry societies or commissions; there is a national forestry organization, and a number of periodicals devoted partly or wholly to forestry. The Federal Government has recognized forestry by adding, some years ago, a forestry division to the Department of Agriculture. This is now under the able management of Mr. B. E. Fernow.

This gentleman, together with Commissioner Ensign of Colorado, Sargent of the Arnold Arboretum, Harrison, the Secretary of the National Forestry Association, Messrs. Beaver and Binney of Pennsylvania, Joaquin Miller and Ira G. Hoitt of our State, Mr. Eggleston, and many others, are doing yeomen service in trying and working to create a practical forestry system in this country. No State where the mountain forests belong to the Federal Government can really do much in the protection of such forests, nor in their preservation as forests. The action must come from Washington. As States in this situation, California and Colorado take the lead in forestry matters. Well they may. These States have all the conditions that command a conservative cutting of their forests.

The forests are upon the mountains. The rainfall is practically limited to the winter season; it is heavy in the mountains and light upon the plains. The mountains occupy large areas, and from them flow the streams and springs from which may be derived a permanent and perennial supply of water for domestic or agricultural use. The climatic conditions are such that, to secure large or regular returns from the soil, irrigation is found essential. Hardly a district is free from the danger of torrential floods, should the high mountains be denuded of their trees or brush. None could be free from the increased wind action that would arise from the bare mountain surfaces, nor could any escape the increased extremes of temperature that we must expect with diminished forest area. In the first report of the California State Board of Forestry, an examination was made upon the effects of tree or brush destruction upon watersheds. You will find there detailed accounts of a number of watersheds of this State where extensive denudation, due largely to fires, had occurred. In these instances, the summer flow of water was reduced, while the flood action was increased. In a number of cases, torrents arose from burned watersheds where none had previously existed. Some of these instances were in the San Gabriel Valley, within easy access for such Thomases as may be among you. I can direct any interested person to these new torrent beds, and also to old residents who knew the country before they existed.

It may, perhaps, be well to say that as far as summer flow of streams or springs is concerned, there is still doubt as to whether the deciduous trees usually found near water have a favorable or unfavorable effect upon its summer flow. There is, however, no doubt about the effect of trees and brush upon the watershed itself. In Southern California there is little forest denudation due to cutting, and this is confined to a few localities, such as San Bernardino, San Jacinto, etc. Our forest fiend is fire. In the lime vat it is the flood that makes the fire; in our forests it is the fire that makes the flood. Forest fires produce conditions which must be followed by floods, with even ordinary rainfall.

The increased erosive power of our streams is general; it cannot have escaped the notice of any observant person. The old streams cut their banks more than they used to do, and new gullies and barrancas are appearing in many places. In some localities the damage from this cause is so extensive that diking districts are spoken of, to be operated on the same principle as the Wright irrigation bill provides for the irrigation district, the purpose being to put in piling to confine the streams to their beds and prevent the erosion and destruction of the bottom lands. Whether this increase of erosive power of our streams is altogether due to brush burning or forest destruction upon the mesas and mountains may be doubted, but that it is largely so may be surmised from the following data:

Given a certain area of watershed and a certain rainfall; the delivery of the water will be more rapid as the area is bare of brush or forest, and slower and more continuous in proportion as the area is forested. Thus we will suppose that at the outlet of a given watershed forested, with a given rainfall, there would pass one thousand cubic feet of water per second, requiring thirty days to deliver the rainfall. If we then suppose this watershed to be bare, with the same rainfall we will have ten thousand feet per second passing our given point, delivered in three days. Besides this, from the area where forested, little or no detritus or soil can be carried by the water. but where bare this will be considerable. It amounts in experience here to 20 per cent of detritus in the total volume of flood water, in a grade of one in sixteen, increasing or diminishing with the grade, and also influenced by the nature of the watershed. We must, therefore, add this element to the volume of our flood waters from the bare area. We then have ten thousand cubic feet of water and two thousand cubic feet of mud, or a total of twelve thousand cubic feet of volume passing our given point from the bared area as against one thousand cubic feet of clear water from the forested area.

Water charged with detritus has a greater erosive power than clear water, from two causes:

First—The sand, gravel, and bowlders increase enormously the cutting force of the water charged with them. The effect of such detritus upon the cutting force of the water is similar to that of a blast of air charged with sand. The cutting force of clear air is imperceptible, but when charged with sand it is very great. I have seen the bark of orchard trees destroyed on the windward side by our sand-laden Santa Anas (winds). The eroding power of clear water is equally imperceptible, while when detritus filled it becomes difficult to control.

Second—Because the detritus-carrying power of water depends upon the grade of its flow. Thus, torrents originating upon the steep watersheds of our hills or mountains, and there charged to their full capacity, must drop some of their load when passing to the lower grades of the valleys.

Streams of this character, therefore, fill their channels and have an everlasting tendency to change their beds. The observer will notice them zigzagging across their beds, now feeling for an escape on one side, and now rushing roughly to attack the other. Cutting everywhere, it picks down the bank in one place to deposit its ruins in another. The finer and better parts of the soil are easiest held and transported, and so proceed to the sea, while the sand is dropped in the ever widening bed at the first opportunity. So our bottom lands, rich and fertile, diminish, and the sand wastes widen and send their arid glitter to the sky. Now that we are upon this topic it may be well to say a word or two about palliative measures. Wingdams at frequent intervals have been suggested for protecting the banks of the Santa Clara; for the San Gabriel and Los Angeles Rivers, piling on each side to the sea is spoken of. The first system to be effective would require quite as much piling as the second, on account of the shifting character of all detritus-carrying streams.

The disadvantage of both is the heavy first cost of doing the work well and in a reliable way, and the heavy cost of maintenance, one item of which would be the short life of piling alternately wet and dry in sand. I made a small experiment in protecting bottom lands this year in a cañon. A ditch was dug about two and a half feet deep on the side of the land to be protected and in the bed of the stream. Into this was placed brush and willow cuttings, the whole wired together and fastened to fixed objects or posts. This was done last October. It has formed a perfect protection, while land above, below, and opposite, has been washed off and lost.

The willow cuttings have started to grow, and we expect that when the brush has rotted we will have a live dike, much stronger than the present one. Whether the stream would have cut under my line, had both sides been treated the same through the scouring effect such confinement usually has, I cannot say. We know by the experience of the San Gabriel and Los Angeles, that willows on the bank of a stream will not stop cutting. On a level with the stream, however, they are not cut out. On the contrary, their effect is to arrest or slacken the flow of water amongst them, which results at once in the waters dropping the detritus it carries and filling in.

The vital importance of finding a protection for our bottom land, warrants a trial of this willow dike scheme upon a scale that will show whether it is of value or not.

The thing we should all unite on, is a preservation of the watersheds of our springs and streams, both to insure the perennial supply of water for summer use, and to arrest further devastation by torrents and floods.

It is an inappropriate moment to go into the full detail of forest effects upon rainfall delivery, upon climate, and upon health. The facts are already familiar to most of you.

It will be sufficient to give a summary of what is being done in foresty in California, and of the conditions which make a national foresty system essential.

The two reports of the Forestry Board are valuable. They have been sought from the four quarters of the globe, and applications for them still come in, both directly and through booksellers. In praising these reports, I do not praise my own work, for, with some insignificant exceptions, I was merely the editor for the scientific experts employed by the Board. These engaged in the work more from enthusiasm and love of the subject than from any compensation they received.

The first great work of the Board was the undertaking to stop the fires in the mountains and the illegal cutting of timber from Government and State school lands. In regard to fires, the results have not been satisfactory. The weight of testimony, however, is that these destructive agencies have been diminished, and that the people are much more careful about them than formerly. The illegal cutting of timber has nearly ceased. The Interior Department took this matter up, and our State agents accompanied the Federal agents in their crusade against this abuse. The first results were Government actions to cancel patents for forest lands obtained by fraud, as in the case of the great Scotch corporation in Mendocino County.

This hiring of men to enter lands, nominally for themselves, in reality for syndicates and corporations, and contrary to law, was diminished if not stopped. Other actions were brought to recover lumber illegally cut from Government lands by corporations. In some cases these suits involved hundreds of thousands of dollars, as in that of the Sierra Lumber Company. In all these cases of timber stealing the State school lands were involved as well as the lands of the Government. The State agents took evidence at the same time with those of the Government. Everything was complete, survey of land, timber estimated by stumpage, names of witnesses, etc. The first case was sent to the State authorities at Sacramento to prosecute, as a test, and recover a large sum from solvent parties for the schools. The evidence and the witnesses were the same as those in a Government case against the same parties, in which the Government received a verdict. For reasons which are unknown to me the State authorities refused to prosecute or to allow the Board of Forestry to prosecute in the name of the State. The statute

of limitations has now run against all those claims, and the schools lose forever the money to which they were entitled. The sums in the aggregate, by the report of the State's special agent, would have paid the expenses of the State Board of Forestry from its creation several times over. The general effect of these activities was a rapid and extraordinary increase in the sale of Government forest lands, of State school lands of the same character, and a practical arrest of illegal timber cutting in any large way.

The second principal effort of the Board was to encourage and aid tree planting throughout the State. To this end the Board distributed tree seeds for experiment in the different climatic belts of the State, with such information for their treatment as was available. This entailed an immense and expensive correspondence, that with the Board's division of forces became almost unmanageable, and after all the results were highly unsatisfactory. The record of tree adaptability which it was intended to give to the whole people was not obtained. Some parties never planted the seeds, others failed to make them grow. Still others, growing the trees, lost their names. Some sold out and moved away, and some completely obliterated any record by dying. A different system had to be devised, and forest experimental stations were proposed. Through the public-spirited generosity of General John Bidwell, Senator Caminetti, Judge Widney, Dr. Wills, Hancock Johnson, E. L. Mayberry, Senator John P. Jones, Colonel R. S. Baker, and a number of others, experimental stations were offered to the Board of the aggregate value of from $75,000 to $100,000.

The stations included nearly every climatic belt from Chico to San Diego. For reasons that are doubtless good, the Board did not accept some of these stations, and abandoned others already accepted. They still have the stations at Chico and at Santa Monica. The Chico station was given by General Bidwell, and is a beautiful and valuable piece of land, with a living stream at its side.

The station at Santa Monica, given by Senator Jones and Colonel Baker, is a remarkably valuable one. In the first place, it is a lovely spot. The land is partly rich, alluvial bottom, in the picturesque Old Cañon, at Santa Monica, and partly mesa, under the mountains. Its climate is of the most favorable for propagating. Nothing, I believe, which has grown anywhere in California has, as far as tried, failed at this station. Its natural attractions and mild climate will enable the forest officers to make of it one of the most complete, beautiful, most interesting, and most valuable tree plantations in the world. The tree distribution for experimental purposes proceeds from this station. The information which can be tabulated from experimental tree stations may be made of great use to the people and save years of time and wasted effort in desultory work, while encouraging, by a fair certainty of results, tree planting in localities where it is most needed.

More reliable information, in regard to trees suited to our more arid climates, is required, and it is to be hoped that the Board will enlarge, rather than curtail, its efforts in this line.

The third principal aim of the Board of Forestry was to secure a withdrawal of the Government forest lands in the mountains of California, and the creation of a forestry department to manage them. Under it the ripe timber would be cut, while a new growth of the valuable kinds would be insured and protected. Fires and over pasturage and waste would be stopped, and the watersheds protected.

In this work memorials were circulated and sent to Congress. A forestry bill was gotten up and introduced into Congress by Colonel H. H. Markham, and an extensive correspondence with those interested in forestry throughout the States maintained.

Amongst other things, the State Legislature passed a concurrent resolution requesting the representatives of the State, and instructing the Senators at Washington, to secure the passage of forestry legislation in the line advocated by the Board of Forestry. One rather striking commentary on the representative character of the Federal Senate, which, in theory, is supposed to represent the States in their sovereign capacity, was the fact that neither of the ambassadors of California to that august body paid any attention whatever to the instructions sent them by the State Legislature, whose servants they were supposed to be.

The demand of our age is condensation and brevity. In response to this, allow me to present to you the forestry question reduced to its elements:

Forestry is the science of forming or of utilizing forests, directly for their products, indirectly for agricultural production from unforested lands.

It has been found that in some localities a proportion of land in forest is essential to good sanitary conditions. It has always been found that a certain proportion of land in forest permits a larger agricultural output than where less or no forests exist. This proportion varies, but is, as a rule, about one fourth of the total area.

Undue forest denudation diminishes agricultural returns per acre, and tends to sterility. The causes are forest effects upon rain distribution, rainfall delivery, humidity, temperature, and winds.

In mountainous countries all these effects are increased in intensity. When the seasons are divided into wet and dry, forest destruction increases torrential action during the wet season and drought during the dry one.

A supply of ripe timber may be cut for the use of the people from forests without any diminution to the forest area, or to the utility of the forest as climate and stream-flow regulators.

The new growth of forests may be maintained of useful kinds of trees instead of scrubs, as is often the case, without forest supervision.

Every forestry department controlling national forest lands, as those of France, Germany, Austria, South Australia, India, etc., is a source of revenue to the State, not a source of expense.

The material interests of California, as of all the country west of Colorado, call for an early establishment of a national forestry system.

Individual interest cannot be relied upon, because the forest owner will not manage his forest in the interest of other land holders engaged in agriculture. The time required for securing a forest crop is too long to tempt men to care for a forest area of mountain once cut off.

Government ownership of forests without any system of care produces robbery, waste, fire, over pasturage, and ruin to the forest. This is the present condition over large areas. It should be changed. The policy commended by reason of experience is a withdrawal of all Government forest lands from sale until, by examination, it shall be ascertained what the permanent line of forest should be in any district and

the establishment of that line, then the organization of foresters to protect the forest from fire, etc., and to sell under proper regulation the forest products.

To California forestry is of paramount importance. It is especially so in the portion of the State south of Marysville.

It is time that the farmers roused themselves and made a fight for their forest friends.

No forests, no farms. The pine tree sings in the Sierra a song that is echoed in the rich rustle of the grain on the distant plain.

Let us not forget, then, that, though so far apart, the interests of the plain are entwined with those of the mountain, and that without forests we may also be without farms.

DISCUSSION.

MR. CLARK, of Pasadena: If I may be allowed an explanation, I would like to say one word in defense of the stand I took on plants. I didn't say, unqualifiedly, "No pruning." I abjured the idea of constant pruning. In judicious pruning, I fully agree with Mr. McDonald. This, I think, is right. Constant pruning is what I condemn, and I repeat what I said in my essay, that there are more trees injured in California to-day with the pruning knife than by any other one cause, unless it be the scale bug, and I can prove it by driving around the country. I speak (as my essay shows) of Southern California, as a standard. Speaking from my own experience with regard to the natural growth of trees growing on the hillside in the sun, or the shady side, they all have their branches distinct, and Nature does it. Take the Magnolia grandiflora; if it is constantly tipped with the pruning knife, it will not make a good tree. I can show good trees that are not so pruned. So through all my ornamental trees, I repeat what I said in my essay. What is the beauty of a tall tree with a long, narrow body? It spoils the beauty. It is not Nature's way of growing those trees.

With regard to planting trees about the house. I would not plant an evergreen near the house. But I do repeat that the evergreen should be placed in the background and the deciduous in front. But everything is reversed in California. We have got to start a new rule in landscape gardening, we might say. The deciduous tree in California must be set in the background, where it will not be too conspicuous when bare, but where its beauty can be brought out when it is in foliage. I have heard it said time and again, in the beautiful grounds of Mrs. Jeanne C. Carr, of Pasadena, which is one of the finest in the world, I had people ask me, "What is the matter with those trees from November to March; beautiful elm trees, all in fine, thrifty condition; but what is the matter with those trees?" There are people from the East who come here and expect to see things green in the winter time, who know those trees, and yet ask what is the matter. I say we can place our trees so as to make a beautiful effect the year round on the plan I suggest. The elm is beautiful in the spring, but is it in the winter time, in California? It drops its leaves early in the fall and starts late in the spring. I say those trees should be placed in the background. Taking the whole class of evergreens and deciduous and planting them together is not right, for Southern California at least.

I move that the plan suggested by Mr. Bancroft be adopted.

Seconded and carried.

Adjourned until March 14, 1890, at 9:30 o'clock A. M.

FOURTH DAY'S PROCEEDINGS.

MARCH 14, 1890.

The Convention was called to order at 10 o'clock A. M., Vice-President Buck in the chair.

MR. BLOCK: If I am in order, I would like to bring up a subject spoken of yesterday, which was adopted by a mere motion, with reference to the abolishing of the name of French prune. If you will allow me, I will offer a resolution to take the place of that motion, and that will cover the subject, and I hope it will be adopted now:

WHEREAS, We are Californians, and our fruits are recognized in all the leading markets of the United States as superior to the imported variety, especially in the matter of prunes; therefore, be it

Resolved, That we, the State fruit growers of California, in Convention assembled, urgently recommend that all growers, packers, and others interested in the prune, do drop the name of "French prune" and all other foreign names; and that hereafter they be called "California prune."

Carried unanimously.

TABLE GRAPES.

Essay by R. B. BLOWERS, Woodland.

My subject, "Table Grapes," is a very large one, and in order to trespass as little as possible on your time, I will treat the subject from the standpoint of shipping grapes for the eastern market.

There are several things necessary to consider if we desire success in this line of horticulture. We must grow the particular varieties that have keeping qualities, and have also an attractive appearance sufficient to make them successful as a market fruit. Flavor is the next consideration. After having arrived in the eastern markets in fine condition, and sold on their good looks, their eating quality should be so excellent as to create a demand for more. In order to produce all these results a proper selection of climate, soil, and varieties of grapes must be made, and the grower must keep in view all the conditions necessary to success. A deep, rich, sandy, clayey loam, well underdrained, and a warm, dry climate seem to fill the conditions. Pruning must be in accordance with the habits of the vine. Overbearing must be avoided, as color is *absolutely* required, and is only obtained in perfection when the proper balance is kept between leaves and fruit. Color, keeping quality, and flavor all go together, and the treatment of soil and vine producing one, all things being equal, produces the other. Irrigation in winter when winter rains are light, and June or early July irrigation supplies the proper conditions, because a vigorous growth of vine during the spring and early summer exhausts the moisture rapidly from the soil. This exhaustion is hastened by the moisture receding downward and a constant evaporation from the surface of the soil, as well as from the leaves, there being but little condensation under the cultivated soil, owing to the heated condition of the ground during July and August. But during this period a strong, healthy flow of sap must be maintained to give the fruit a perfect development, because if there is not enough evaporation from the leaf to keep it cool, there will be more or less sun scald. There must also be a surplus of sap, in order that a part of it may return from the leaf, after being eliminated, to the fruit. In case of lack of moisture, from overdry soil, or too many grapes for the vine under its conditions to carry, it will be found that the fruit is undercolored, insipid, and owing to a lack of full development, has *not* the best carrying qualities.

If the grower will carefully go over his Tokays (I speak of them, as they frequently lack color and are the most important variety) after the berries are set and half as large as a shelled pea, and thin out by cutting away bunches likely to interfere with each other, and especially cutting off the lower one third of very large bunches, he will have nearly as many pounds of grapes suitable to ship, and a larger, better colored, and more profitable crop.

VARIETIES.

Several early kinds are used, of which the Chasselas, Fontainebleau, and Sweetwater take the lead. Heavy shipments are not made until Tokays and Muscats are ripe. The Tokay is by far the most popular grape. The Muscat is not much called for east of Chicago. The Cornichon and Black Morocco are in good demand and have good carrying qualities. The latter, like the Emperor, must be pruned long, as the first and second buds rarely produce first crop bunches.

The Emperor, like the Tokay, is a favorite in the market, but does not fruit over as extensive a range as the latter, being a shy bearer in many places, and never as heavy a producer as the Tokay, but is a better keeper than all others except the Almeria. The past season carloads were shipped from Yolo County, after having been exposed to five or six inches of rain, to Chicago and New York, selling in the last named city at auction to average over $6 per double crate. The Almeria is imported in very large quantities from Spain, and is a favorite, on account of its keeping qualities, in all of the eastern markets. It is a shy bearer in Yolo, where I have grown it for twenty-five years. It should be tried in all sections of California, and if the proper location is found where it will produce equal to Almeria, it will be a very fortunate acquisition to that locality.

The proper methods of picking and packing are of the greatest importance. Grapes should be picked after the dew is off the vines. The picker should cut the stem with a sharp knife, holding it with the other hand, and carefully place it in the picking box stem upward, filling the box only about three-fourths full. The grapes should not be exposed to the light or heat of the sun, but hauled as soon and as carefully as possible to the packing-room; there stacked up in such a manner as to give complete ventilation. They should remain there twenty-four hours; then, it will be found that the stems are wilted and flexible, and they can then be handled softly without breaking the skin at its intersection with the stem.

The packing-room should be light; the clippers arranged on one side of a long table or tables, the packers on the other. The clippers take each bunch by the stem, carefully cut off all imperfect or unripe grapes, then carefully lay it on the table. The bunches should be mutilated as little as possible. Then the packer, using a form with movable bottom, places the largest bunches in the form, filling the top, and covers with smaller bunches, then places the basket on the form, pulls the form partially off the table, places the right hand under the form, the left on the basket, raises the movable form until the grapes are in the basket, turns the left hand down and the right hand up, then places the thumbs on the movable bottom, and with a slight pressure removes the form with the fingers. This leaves the grapes properly adjusted in the basket. The attendant places four baskets in the bottom of the double crate, then stacks them (the crates) up as high as convenient, and places in a cool room an equal amount of packed baskets for further curing.

When the shipment is nearly done the crates are filled and nailed. By this time the stems are sufficiently cured to permit enough overweight to equal the evaporation in transit, so that the consumer can have five pounds net per basket. There should be from four to eight ounces overweight in each basket, as forty pounds net is the approved weight in market. If the packer is found sending good full weight, it is remembered by dealers; the reverse is also found true.

As near a uniformity as possible for each market is desirable, and in *no* case send poor fruit to eastern markets. Handle by stem in all cases where possible, and thus retain the bloom, as in this manner alone will the market and keeping quality be retained. Carry to the car in a spring wagon or its equal—a heavy wagon with a foot of straw in the bed. Have a heavy cover over the crates in transit to the cars. Do not pile the crates upon an open platform exposed to the heat of the sun. A disregard of these small points many times forbids success.

PRUNING THE MUSCAT GRAPE.

Essay by Gustav Eisen, Fresno.

It is not my intention to read you a long and exhaustive essay on the pruning of the Muscat vine; my remarks will be few and short. Not that the subject is not one of great importance to the raisin producer, but because my object is to bring out the views of the various raisin producers here, and to call forth a discussion as to their various methods and ideas. Until quite recently, the Muscat vines, even in our principal raisin vineyards, were pruned without any special attention to what was required, and without any great knowledge of what would be the result of long or short spurs, of high or low standards. A great many of our growers either pruned just as their neighbors did or as they happened to do the first time. Others, again, pruned with a view to get a large crop, or thought they did; some, again, had other ideas in view and exceptions of their own, afterwards more or less realized. During the last few years much attention has been paid to the various systems of pruning Muscat vines in the raisin districts of the State, and coupled with our own experience we have that of the Spanish growers, brought

here by a gentleman who lately visited Spain. While it cannot be said that we have at last settled upon the proper way to prune, we have at least made enough progress to realize that pruning is not a child's play, but, on the contrary, of the utmost importance, both as regards the coming crop and the future and continued welfare of the vine. Should we ask ourselves why we prune, we might establish the following points for consideration:

1. To prevent the vine from getting out of shape.
2. To prevent overbearing.
3. To give larger berries.
4. To keep the vines healthy.
5. To produce as sweet grapes as possible.

There may be other points to be considered, but I believe that these are the most important ones which every raisin grower should take into consideration before he puts the shears to the wood, or, as is only too often the case, allows some one else to do it. We all understand the necessity of keeping the vines within proper bounds. If not pruned with this point in view the vines will grow larger every year, until at last the whole space is occupied by branches, which again will not allow the proper cultivation of the soil. Pruning is therefore a necessity from this consideration alone. The Muscat vine, like so many other varieties, has a tendency to throw out branches from the end buds only, no matter how long is the spur left—it is a real climbing vine. For instance, if we leave a certain number of eyes on a spur, out of the whole number of eyes only the two eyes at the end of the spur will sprout and produce canes. The other eyes will remain dormant. This is a very simple fact which every planter should realize at the very first pruning of his vineyard, in order that the vines from the very start may assume the shape that is best adapted to the purpose for which we raise them. Still, there is not a vineyardist in fifty who does not make an error the first time he prunes, not realizing the consequences. The desire to get big vines quickly induces the planter to leave more wood the first season, the effect being that the vines will be too high or too wide. The coming season the same error is repeated, and when the third or fourth year comes, and the error is realized, it is only with difficulty that a change can be made. If, on the contrary, the pruner from the very start had realized what was required, it would have been a very small matter to have so shaped the vines that no severe afterpruning would be necessary to put them in shape. These remarks are not, of course, directed to those growers who have had years of experience, but to those only who are starting in the vineyard business for the first time; and, judging from the reports in the papers and from my own observations this spring, this class of growers is not a small one. Twenty thousand acres of Muscat grapes are being planted this year in the State, at a low estimate. These owners have certainly the opportunity to learn from others who have made mistakes and are now correcting them. The closer the Muscat vine is pruned the easier it is to keep it in shape, as the close pruning causes buds to develop close to the stem and trunk, buds which with longer pruning would have remained entirely dormant. Some of the principal raisin growers of Fresno are this season pruning the vines back severely, in order to decrease the size of the old wood trunk. While I do not pretend to say that this is a great injury to the vine, still I cannot think but that less severe pruning would have done less harm, and under ordinary circumstances given less opportunity for wood-decay and other infirmities of old age. At any rate, it is evident that it is easier to shape the vine by the first season's pruning than afterwards.

To Prevent Overbearing.—If Muscat vines, or any other grapevines, were allowed to carry a larger quantity of old wood, they would overbear to such an extent that the vine would soon be ruined. In all instances of overbearing, whether in fruit trees or vines, an after period of rest is necessary, which may even change to a period of disease if the bearing has greatly over-reached the capacity of the vine. In the Muscat vine especially, the overbearing is closely connected with the quality of the grape, and our object should therefore be to so regulate the pruning that the vine will bear the largest possible quantity of good grapes of a certain standard quality, which, however, cannot be generally defined. In other words, as long as the vine keeps up a high quality of grapes, we can safely experiment in increasing the quantity; while on the other hand, when the quality begins to decay it is certainly a sign that more grapes are produced than the vine can stand. What this quantity is must be considered in every individual instance, as it necessarily depends upon such circumstances as soil, location, and general thriftiness of the vine. Vines on strong soil will bear more and better grapes than vines on poor, sandy soil, and the former class can therefore be left with more spurs and buds than the latter class, which should be pruned so that the minimum yield of grapes will be reached. With vines on very poor soil we need not trouble ourselves, as the best that we can do with them is to dig them up and replace them with something else that requires less heavy ground. As regards vines on strong soil, each locality will require a system of pruning of its own, according to the facility with which the grapes set. The tendency to increase or decrease the number of spurs and buds has been and is fluctuating, and no general conclusion has been arrived at. Most growers leave their spurs too long, and the inner eyes seldom if ever develop. I am satisfied that every vine should be pruned so that even the inner eyes grow into canes, as not only do they facilitate our effort to shape and confine the vines, but they tend to keep the trunk in a healthy condition by the formation of new wood as close to the old wood as possible. As to the number of eyes to be left, I would limit them to two, including the inner eyes at the junction of the trunk and last year's bud. My reason for this is partly stated above, but it is also this: that these inner eyes, if allowed to develop from the very start of the new growth, will produce just as many and just as good grapes as the eyes further out on the canes. But if only allowed to develop later, that is, by pruning the vines after the exterior buds have begun to develop, they will not make as strong canes, nor will they bear as well, as the buds further out on the spur. From this it can be seen that I favor early pruning, as early as possible. I contend that early pruning not only favors the formation of better canes and better bunches, but that it is perfectly proper to prune any deciduous tree or plant when it is dormant. I do not wish to say that bleeding will injure the vine, but the bleeding is certainly a waste, which if preventd will cause the sap to be used for some other more profitable purpose. To cauterize the woods and stop the bleeding is probably worse than to let the sap flow out. The checking of the flow does not necessarily prevent its being formed by the roots, but, on the contrary, the allowing of the sap to flow out will cause new sap to form. It is like cheating the roots to produce sap, making them believe that it is used for the formation of buds, green wood, and leaves. The proper way to prevent bleeding is, therefore, to prune before the sap has started; but if the vines do bleed do not stop it by any exterior application on the wounds. As to the number of spurs to be left, that will necessarily depend on the vine. Generally too many spurs are left on young vines, too few again on older vines. One of our oldest vineyardists holds it as his opinion that every cane should be left, and only shortened to two eyes; in fact, that we never can get too many spurs. But an examination of his vines satisfies me that the soil in his vineyard is not of the best, and that his vines are not as strong as they should be in order to be counted as first class vines.

Our largest raisin grower, A. B. Butler, leaves from five to eight spurs on old vines, and leaves them as close to the old wood as possible. His experience and practice, founded upon observation both at home and abroad, deserves full attention and close duty. He adheres to the idea of pruning for quality in the first place, considering quantity of less importance; to prune so that the vine will bear the best grapes, and that they may last as long as possible. I share this opinion, the more so as I have seen many sickly vines, the disease of which I must attribute to their having been improperly pruned. The nature of the vine is to climb, and I consider any pruning, of whatever kind, as originally foreign to the grape. In the wild woods the grapevines survive to good old age, hundreds of years, perhaps; at any rate, many times the age of cultivated vines. So do our famous old vines, as that in Santa Barbara, the Hampton Court vines in England, and any other vine famous for age and bearing. They all climb over trellises, and carry an enormous quantity of wood. The effect of pruning, and especially of close pruning, is then not to the benefit of the vine. I am satisfied that the diseases of the vine are especially confined to the trunks and branches, and the roots, more especially as a kind of reflex action. Mr. Butler, whom I have quoted before, holds that the trunk becomes diseased after a certain number of years, and requires to be renewed. If this is so, and I am satisfied that it is, the closer the trunk and the branches are to the ground and to the roots, the better and easier it is to renew them from below. But there are other reasons why the crown should be kept very low. Experience shows that the lower the grapes, the larger and sweeter they are. We must, therefore, in order to produce large and sweet grapes, prune short and prune low. I would rest the crown on the very ground, or only a few inches above it, but in no instance raise it a foot or more, as is so commonly seen in any one of our raisin districts. I cannot close without saying a word about the general idea that blackknot is caused by close pruning. It may be sometimes, in part, but that close pruning alone should cause it, is not by any means proven. I have this season seen vineyards which had not been pruned for two years, in which all the Muscats were dying of blackknot, which actually covered the old and new branches along their whole length. Here then, at least, the blackknot was not caused by pruning at all, but evidently by something else.

CULTURE OF SMALL FRUITS.

Essay by D. Edson Smith, Santa Ana.

In responding to the invitation of your Secretary to read a paper before this meeting on the "Culture of Small Fruits," I do so with the understanding that my few remarks are simply to be used as a text to draw out the knowledge of those having greater wisdom and experience on this subject.

Although the fruit treated of in this paper is small, it by no means follows that the industry is a small one in any sense of the word. It is yet in its infancy on this coast, but I believe it is destined to become a large and profitable one. There are no fruits more healthful than the strawberry, the raspberry, and the blackberry; and the last two may be used in a very great variety of ways, both as food and drink for the well and the sick. Of course, I shall treat this subject simply from the standpoint of my experience in the Santa Ana Valley.

On coming to this valley eight years ago I found the Wilson's Albany the predominating strawberry, the Cuthbert the ruling red raspberry, and the Kittatinny and Lawton the prevailing blackberries. I sent to Mr. Purdy, of Palmyra, New York, for some Doolittles, Tylers, Turners, Crimson Beauties, Hansels, and Herstines, for varieties of raspberries, and the Knox and Wilson's Early for blackberries; but I did not make a success with any of these varieties. But with the Kittatinny, Crandall's Everbearing, the Cuthbert, and the New Rochelle I have had very good success. For strawberries, I like the Monarch of the West and the Pineapple. In some parts of this section of the country the Cuthbert is the most profitable raspberry to be grown. In other localities it seems to winter kill, or live at a "poor dying rate," which is not at all satisfactory. It needs a deep, rich soil, and does much better with some kind of protection from the midday sun of summer. I plant mine in my orchard where the trees' foliage shades them.

The most profitable raspberry that I have tried is what is known as the "New Rochelle." It seems to be a cross between the Cuthbert and Doolittle. It passes for a red berry, but propagates from the tip, like a black cap. This berry is exceedingly hardy and vigorous in its growth of cane, and is a very prolific bearer. The fruit is much firmer than most of the red varieties, and will bear shipment well. Its quality is somewhat inferior, but its earliness more than compensates for this. It is the first berry in the market, and for that reason tastes exceedingly fine; still, I have a few customers who prefer this berry to the Cuthbert at any season of the year.

For family use, I would recommend the planting of a few Herstines. Most people think this variety far superior in flavor to any other kind grown in these parts. The great drawback to them is their shyness in bearing. In some parts of Los Angeles County the Scoubegan raspberry is very profitable, but I have had no personal experience with it. As a rule, the black varieties do not do well here.

Of the varieties of blackberries, I am now setting out only the Crandall. Perhaps the flavor of this berry is not so fine as some other varieties, but in all other respects I think it much superior. It is a strong, vigorous, hardy plant, very productive of fine, handsome berries; fruits over a longer season than any other variety I know of, and the

vines will not run all over your place; in fact, you will not get enough suckers or sprouts to set out a new row.

I have a row of raspberries or blackberries between my orchard tree rows, which are twenty-four feet apart. Of course I draw on more plant food, in the shape of fertilizers, than I take off.

If I was setting out a piece of ground entirely to these berries, I would have the rows from ten to twelve feet apart, and the plants four feet apart in the row. It pays to have a good rich soil for these fruits, and then have the soil put in the best condition before setting out the plants. But wait another season rather than set out your plants in soil only half prepared. Plow deeply and harrow thoroughly several times before setting out. Lastly, open a trench with your plow where the row is to be, twenty inches deep. Go along with a basket of plants, a four-foot lath and shovel, and set a plant in this trench every four feet, and pull the dirt around it with the shovel. If the trench is too deep in places for the length of the plant roots, fill in a little dirt. If not quite deep enough in places, scoop out a shovelful. Aim, in preparing the ground with plow and smoother, to leave it dishing each way towards the row of young plants, so that irrigating water turned in at the upper end will run along the row of plants as in a trough. Aim to have the ground around the set plants a few inches below the general level of the land. After the plants are all set in a row, go along with a rake, if there are but a few plants, or with a horse hoe, if there are many. It is a pleasure to set out plants in this way, and such deep, rich, well stirred soil tickles the plant roots so that they kick out their heels rapidly in every direction, and the plants throw up their heads and crow, and grow in a manner entirely satisfactory to all concerned. If the ground is dry, or there is no rain, irrigating water should be turned down the row, or at least a quart or two of water poured around each plant. Then, before the soil hardens, stir it well with cultivator and hoe, and all future care resolves itself into frequent waterings and frequent stirrings of the soil. Allow no weeds to appear, and keep the three inches of surface soil well loosened with the horse and hand hoes. These small fruits require frequent waterings, especially when forming fruit, and during the fruiting season.

When the blackberry and raspberry canes have reached a height of three feet, go along with a sharp butcher knife and clip off the tops. This will cause them to throw out laterals. When these laterals have reached a length of sixteen or eighteen inches, clip off their ends in the same way, and so with every succeeding growth of laterals. In this way you will have a strong, self-supporting tree-vine, which will be a constant source of joy to you in many ways. I keep my berries pretty heavily mulched close to the vines.

Strawberries in this country are usually grown on ridges, the space between the ridges being frequently flooded with irrigating water. The roots of this plant are so near the surface that, in this rainless region, frequent applications of water are necessary for success, during the fruiting season; and it is wonderful how so many months of the year, with our soil, climate, and irrigating facilities, we can have this delicious fruit in all its perfection. I would set out a strawberry bed this winter or spring, and in two years I would plow it up and set out another; that is, I would set out a new field every other season.

I think the strawberry guava might be well included in the list of small fruits for this particular locality. The past unusually cold winter has proven that they will not be injured in the least by our coldest weather. They are prolific bearers of fine fruit, which readily sells for 10 cents per pound and upwards. There is no nicer, no more healthful food than fresh guavas cut up and eaten with sugar like strawberries, and they are noted as being the best jelly-making fruit we have.

They are a little difficult to propagate, and should be obtained rooted from the nurseryman. They should be set out about ten feet apart each way, and cultivated like an orange orchard. I have seen no pests of any kind on my guavas.

The scale which infests some blackberry vines can be killed with the resin wash, as follows: Resin, fifteen pounds; caustic soda, three pounds; linseed oil, three quarts; water, one hundred gallons. Boil the resin, soda, and oil in one third of the water till a perfect emulsion is formed; then add remaining two thirds of the water and spray while the solution is still quite warm.

For the sake of the healthfulness of the family, every one having an acre of ground should raise some small fruits. In my opinion, an almost exclusive diet during the summer months, of brown bread and milk and plenty of raspberries and blackberries, would very largely prevent the many troublesome and frequently fatal diseases so common among children during these months.

But all small fruits to be in the best condition must be fully ripened on the trees or vines, and for this reason are never so good as when freshly picked. Fresh berries should always be eaten the day they are picked, and those who are obliged to eat them the next day after they are picked are unfortunate. Berry picking for market should begin as soon as it is light enough in the morning to distinguish the ripe berries, and the berries got into the hands of the consumers before noon, if the market is near by, or before supper time if shipped by rail. They should not be put in packages larger than one pound, and these pound packages put in ventilated crates.

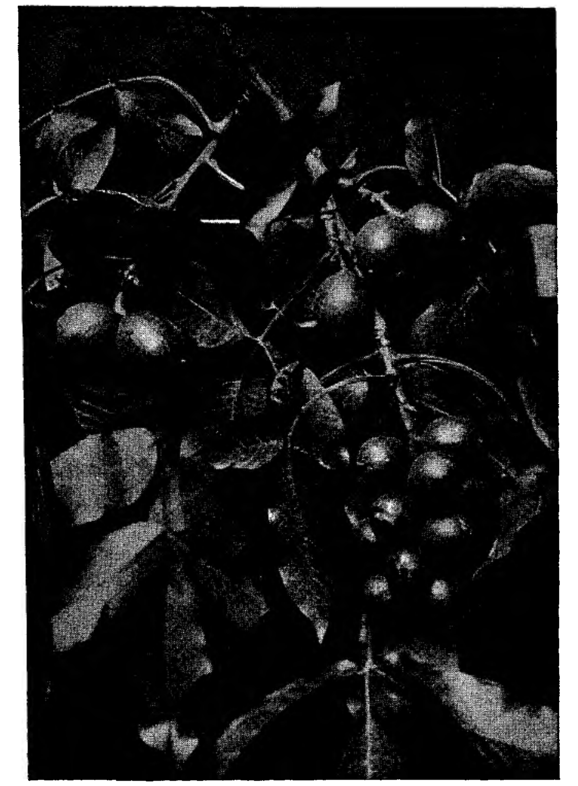
Blackberries can be profitably raised for 6 cents per pound; raspberries for 8 cents per pound. And with our facilities of soil and climate for growing these most healthful of all fruits, and with the large immigration of well-to-do people who will soon create a widespread demand in every village throughout all of our beautiful valleys for this choicest of food, the outlook for the grower of small fruits throughout all of Southern California is of the most hopeful and promising nature.

CULTURE OF THE SOFT-SHELL WALNUT.

Essay by George W. Ford, *Santa Ana.*

The European walnut (*Juglans regia*, Latin; *Noyer*, French; *Noce*, Italian; *Nogal*, Spanish) is one of our finest growing trees, and, after thorough test, has been found to be at home in the State of California, especially in our rich valleys, between the coast and the Coast Range Mountains.

Of this most desirable and profitable nut there are many varieties, some of late introduction from France; two varieties originating in the orchard of Joseph Sexton, Esq., at Santa Barbara, supposed to have



FORD'S IMPROVED SOFT-SHELL WALNUT.

come from seed brought from South America; and besides, the common English (or Madeira) nut, known best of all to us, as it was the first to be propagated and raised in our orchards. The soft-shell walnut (one of Mr. Sexton's varieties) is considered by all who have had experience with it to have all the points essential for a first class walnut, and on suitable land the most profitable orchard to plant.

I have in my orchard eight varieties imported from France, which, in my estimation, are entirely worthless, all being of a dwarfish nature, and, after being planted in orchard for seven years, have not as large a growth as some of my three-year old soft-shells. I first procured my seed from Mr. Sexton, and in examining them I found two varieties, a soft and a paper-shell, or rather a thin and a soft-shell.

This paper-shell, as it is termed, is a finely flavored walnut, but it is not by any means a good grower, and besides the nuts are small and the shell extremely soft, which consequently makes it difficult to ship any distance. For family use, on a small lot, and for close planting, the paper-shell will give satisfaction, and those who plant trees of this variety will certainly not go amiss.

The larger and finer variety is what I term the "Improved Soft-shell Walnut," as by selecting the nuts for planting I pick out the largest nuts, and only those that come from the largest growing trees in my orchard.

My improved soft-shell nuts took the premium at the last Downey Fair. I had about one third of a bushel there, and they averaged twenty-four to the pound. Last year a well known fruit grower at Tustin raised some soft-shells which ran as low as eighteen nuts to the pound.

I plant my walnuts in the nursery rows four feet apart by one foot apart in the row, and do not believe in planting nursery stock of any kind too close. Certainly cheaper trees can be grown by that method, but I have yet to find a stunted tree that ever gave good satisfaction when placed in an orchard.

I want one-year old walnut trees one to three feet; two-year olds, four to six feet; and three-year olds, seven to nine feet, all of the above to be good, stalky trees. The root of a three-year old walnut is but a little longer than a one-year old, though it is certainly larger. Of course, the root will grow in proportion to the top of the tree, for when a walnut commences to branch—which is about four years from the seed—then the root will commence to throw out laterals.

In planting trees in an orchard, first of all plow the ground deep, and then go over it with a harrow or pulverizer.

Forty feet apart, giving twenty-seven trees to the acre, is the best distance to plant the improved soft-shell walnut. Dig large and deep holes; plant two or three inches deeper than the trees grew in the nursery; lean them to the prevailing summer winds, and you will not have to stake your trees to make them grow straight. Press the soil firmly around the roots, and if not very moist, give each tree five or ten gallons of water, which is sufficient to settle the soil firmly around the roots. Cultivate your orchard to the depth of four or five inches. If your soil is moist enough to keep the tree in good growing condition during the summer months, irrigation is not necessary; but to make a first class walnut, in size and in the fullness of kernel, if the ground is not naturally moist enough, artificial means will have to be adopted.

I don't think small grain should be planted in a walnut or any other orchard. If corn is grown, leave eight feet on each side of your trees clear, though I am of the opinion that potatoes, peanuts, or beans are less injurious to the trees.

Pruning the walnut is but little trouble, and can be done by any one. When planting, do not cut the top off, as is done on other deciduous trees, but leave the main trunk for the center. Prune up to three or four feet (not too high), for the bark of a walnut tree is easily sunburned, so it is necessary for the foliage and lower branches to shade the trunk. If the lower limbs extend outward and are in the way of the cultivator, tie them up to the trunk, for by so doing you can train the lower branches upward, so as to cultivate close to the tree, and when the orchard comes into bearing the limbs growing upward will not bend down to the ground with the fruit, so you can't get within twenty feet of them with a cultivator.

My improved soft-shell walnut commences to bear at four years from the seed; at six years old my trees average fifty pounds of nuts to the tree, while some trees went as high as seventy-five pounds; at seven years, they averaged ninety-six pounds, and at eight years old, averaged as high as one hundred and twenty-five pounds, while some of the largest trees bore one hundred and fifty pounds of the finest walnuts I have ever seen.

I have never sold the nuts for less than 10 cents per pound, and from that to 15 cents.

Here are a few figures, which, no doubt, will be of interest to many contemplating planting walnuts:

For instance, take an eight-year old improved soft-shell walnut orchard, which will average at least one hundred pounds to the tree, at 10 cents per pound, which gives $10 to the tree, or $270 to the acre. Even at 5 cents per pound, $135 would be the gross returns, which is good interest on $1,000 per acre after all expenses for cultivating, irrigation, etc., are paid.

The above figures speak for themselves as to the paying qualities of this nut. I have a few English, or Madeira, nut trees on my place, fourteen years from the seed, receiving the same care as my eight-year old improved soft-shell orchard, but they do not bear at the present time one third the quantity of nuts that my soft-shells produce, besides obtaining a smaller market price (about 5 cents or 6 cents a pound), and the trees, though nearly twice the age, are not any larger.

It is a well known fact, not only to the fruit growers, but to our merchants, that the Madeira nut gets rancid if kept a year, though all care possible may be taken of them, but I have kept the improved soft-shell walnut in good condition for two years, while a friend of mine, Judge Bacon, at Capistrano, tells me he has kept them in first class condition for three years.

The above points are of interest to us, as, if we have the soft-shell, we don't have to crowd it off on an overstocked market.

Planting walnut trees forty feet apart only gives twenty-seven trees to the acre, and if a man is not satisfied with this small amount of trees, then let him put oranges in between (budded varieties are preferable for quick returns).

Plant an orange tree in the center of every four walnuts, which gives an equal number of walnuts and oranges; twenty-seven of each kind

to the acre. If three-year old walnuts are planted, an orchard like this will give the owner handsome returns in three years from planting if properly taken care of.

The walnut, being covered with heavy foliage in summer, protects the oranges from the cool coast winds which prevail at that season, and when the cool coast breezes have stopped blowing in the winter, then the foliage is off the walnut tree, which gives the sun full play among the fast ripening oranges. I believe an orchard like this could stand for twenty-five or thirty years without having to remove any of the trees, and am of the opinion that orange trees will produce more and better fruit if planted in this way, if near the coast, for the cool coast wind in summer is not at all beneficial to the orange.

The only good oranges I have seen grown near the coast were well protected with wind breaks, and oranges grown in this way will compare favorably with the inland fruit.

Now, gentlemen, in making the above remarks, I would say, before you plant a walnut orchard, see that you have good, rich, deep valley soil, with first class water facilities, or do not expect such promising returns as I or my neighbors in Orange County have had. I don't recommend planting a walnut orchard if you have poor soil, but something that will come off the ground early in the season.

Certainly, your land need not be anything extra, but I say that on almost any land where corn can be grown without irrigation in this State, especially in the southern part, a good quality of walnut can be raised without artificial means of watering.

In winding up this short paper on the "Culture of the Soft-shell Walnut," I will say, if any fruit or walnut grower doubts my words, I extend to him an invitation to come down to our thriving little capital of the new-born county, and I will show him there an orchard which will satisfy the most skeptical that a soft-shell walnut orchard is a paying investment.

WALNUT CULTURE.

Essay by A. Dorman, Rivera.

The soil best adapted to the growth of the English (Madeira) walnut is a deep, rich loam or sediment, where there is no hardpan to prevent the roots from running down deep, and where the water level is from twelve to fifteen feet below the surface.

The usual custom is to set two-year old trees forty feet apart, and plant corn among them as long as it will make a paying crop. This mode of culture usually includes irrigation.

I think that if the corn and irrigation were left out after the first three years, and the land given clean and thorough cultivation, it would be more profitable for the owners. Shallow cultivation is advocated by the most successful walnut growers in the valley.

The old orchards are nearly all planted too close together, and it is reasonable to expect that they will fail to produce good crops sooner than they would if they had have been given more room. Trees twenty years old often have a spread of branches fifty feet across, and I think it safe to say that the roots extend further than the limbs. I have broken roots as large as a pipestem in plowing twenty-five feet from a tree that had been set seven years.

In setting out young trees, they should be inclined towards the coast or prevailing winds, and in trimming, always try to keep them in that position. By using these precautions and insisting on having the tap-root left at least three feet long when the trees are dug in the nursery, you will be likely to have your orchard in good shape when it is grown. No limbs should be allowed to grow within at least six feet of the ground, as they would interfere with the cultivation of the orchard.

The walnut crop shipped from Rivera in 1888 was about seventeen cars; of this amount sixteen cars were hard-shells, bringing 7 cents per pound; the other car was soft-shells, bringing 9 cents per pound.

In 1889, thirty-four cars were shipped, bringing about $45,000. Of this amount thirty-two cars were hard-shells, at 7½ cents per pound, and two cars soft-shells, at 8½ cents per pound.

The experience of the past season has had a strong tendency to increase the popularity of the hard-shell walnut among the growers in Ranchito and the Los Nietos Valley. Some of them intend to provide racks or trays of a suitable size for two men to carry, and rank them up in a building erected for the purpose where they will be safe from storms, fogs, or dews.

I believe the practice of sulphuring is injurious to the flavor of the nut, and hope it will soon be discontinued with the hard-shell as has already been done with the soft-shell.

FOREIGN WALNUTS AND THEIR CULTURE.

Essay by FELIX GILLET, Nevada City.

Of all branches of horticulture so far experimented upon in California, I do not think there is one so little understood and so much under a cloud as walnut culture. This is due to several causes. Chief among them has been the undiscriminating propagation, all over the Pacific Coast for forty years, of the most delicate variety of walnuts to be found anywhere, and known here under the name of the "Los Angeles" walnut, first started in the old mission of that name. Another cause that has had the effect of retarding the progress and spread of walnut culture throughout the State has been the stand taken by eminent walnut growers of Southern California, and their erroneous statements in papers read before horticultural societies and conventions, and the false impression made by them on the public mind, that walnut culture could not successfully be carried on except in a very small section of the State bordering the sea, in the counties of Los Angeles, Ventura, and Santa Barbara, and where to this day most of the walnut crop is grown. Now, there is as much truth in that as there is in the idea entertained by many people in Southern California, that no oranges can be grown profitably for market north of San Bernardino County. Indeed, some of the best oranges I ever ate came from Smartsville, in the foothills of Yuba County, a few miles from Marysville, and right in the heart of Northern California.

In discussing the adaptability of our State to the successful growing of this or that class of fruit or nuts, we should always bear in mind the

great diversity of soil and climate to be found in a State like California, extending, as it does, from the burning deserts of Arizona to the snowy peaks of Siskiyou, and that in nine tenths of this vast extent of country the walnut is liable to be injured by late frosts in the spring; hence, the advisability of planting none but hardy kinds.

The idea that walnut culture in California is possible only in those little valleys bordering the sea in Southern California, is, I must say, a preposterous and erroneous one. "The area of land suitable for successful walnut growing is very limited," said a well known nut grower in an essay on the English (Madeira) walnut, before a former Fruit Growers' Convention. "It requires well drained, deep, sandy, *bottom* land, well protected, and where no 'live oak' trees have grown within the last century." Now, I do strongly object, in the presence of facts to the contrary, to the above banishing of walnut culture from nine tenths of the area of the State of California; and I do not care, either, what Pliny said two thousand years ago on that subject, but will cite an instance in the course of this essay that will set at naught the theory that walnuts will not do well "where an oak forest has recently existed." That walnuts will grow more luxuriantly and bear larger crops at comparatively earlier age in deep and rich bottom land, well drained, well protected, and with plenty of moisture, is an obvious fact; though there arises another question: whether it is advisable to plant walnuts—a class of trees requiring so much space and with so little regard to the nature of the soil—in our richest land, so well adapted to the growing of other valuable crops that have *absolutely* to be raised in *rich land*. My experience in walnut culture, and for twenty years I have imported, propagated, and fruited all the leading varieties of Europe, besides having collected a large amount of data on that subject from nut-growing countries, warrants me to say that walnut culture can be successfully carried on on the whole Pacific Coast, provided we plant none but *hardy* kinds; in fact, the success of walnut culture in California lies exclusively in the hardiness of the kinds to be planted.

The Los Angeles (English) walnut, which, by the way, has been constantly propagated from the seed for the last forty years, without any regard to the degeneration of the species, has three big defects that should make every one reject this variety as worthless, except where it is known to do well. First, it puts forth too early, from two to eight weeks before the foreign kinds, and is injured by late frosts in the spring three years out of four; second, it does not mature its wood well in the fall, and is nipped again by early frosts at that time; third, it blooms very irregularly, as the owners of such trees all over the State can very well ascertain in the spring at blooming time, the male flowers, or catkins, all dropping off before the female flowers, or nuts, had a chance to show themselves; consequently, the nuts, not being fertilized by the pollen or yellow dust secreted by the catkins, drop off after attaining the size of a large pea. In this way does that variety keep barren, or at least so unproductive that it has already induced many people throughout this State and Oregon to cut down their trees, some of them over thirty years old, they having come to the conclusion that the country was not adapted to the walnut, while it is that worthless kind, the Los Angeles (English) walnut, that is not adapted to our climate and that of Oregon.

Here is a good illustration of the case under discussion. A short distance from this town is a large Los Angeles walnut tree, measuring two and one half feet in diameter at the base, having been planted when four years old in 1860. That tree yielded in twenty-one years seventeen nuts—eleven in one year. In 1881 it was grafted into a Præparturiens, and in 1884 bore for a start four hundred to five hundred nuts, and last year, though the hailstorm on the twenty-seventh of April did considerable damage to the nuts then partly out in bloom, five bushels of nuts were gathered from that tree, and lots were carried away to the woods by bluejays, birds very fond of acorns and soft-shell nuts of all kinds. This very tree stands seventy-five feet below a huge oak tree, which has been permitted to stand there on the right hand side of the entrance gate on account of its beauty. That oak tree measures four feet in diameter, with a top from sixty to seventy feet in height; though its branches do not meet those of the walnut, it towers up above the latter. In the vicinity and on the hillsides are many other oak trees, but much smaller, and that grew back after the cutting down of large oaks years ago. Well, this close proximity to oaks does not seem to hinder in the least the growth, development, and bearing qualities of the walnut, as should be the case if there was anything true in the assertion, that "walnuts would not do well where an oak forest had recently existed."

The irregularity of bloom of the Los Angeles walnut, and its consequent unreliability as a bearer, also its tenderness, first drew my attention to walnut culture in California and induced me to introduce into this country the best and most hardy foreign kinds known. In that way did I experiment these last twenty years on the following foreign varieties: Præparturiens, Cluster, Mayette, Franguette, Parisienne, Grenoble, Serstina, Chaberte, Gant, Mesange, or Paper-shell, Vourey, Meylan, Culong, and also fancy kinds like Weeping walnut, Ash-leaved walnut, Mammoth walnut, and others.

Those foreign varieties differ widely from each other, all having special characteristics; some being recommended either for the extraordinary size and fine shape of the nuts, or for their surprising fertility and precocity; others for their lateness in budding, which enables them to withstand, uninjured, late frosts, so common in the spring, that hardly one tenth of the whole area of this State may be said to be exempt from them. A question, however, has been often asked, Which among this large collection of foreign walnuts may be considered the best to plant for family use, and which the best for market? A question of much import, so that no mistake should possibly be made.

As the size, shape, even color of the shell, is not precisely an object whenever a walnut tree is planted in the family garden, but rather the quality of the kernel, thinness of the shell, precocity and fertility of the kind, no variety recommends itself better for the family garden than the Præparturiens, or Fertile walnut. Surely, there are varieties more late in budding out, such as Mayette, Vourey, Parisienne, and Franguette, that might be preferred wherever late frosts in the spring are the rule; but, on the average, the Præparturiens will do in almost all parts of California as the walnut *par excellence* for the family garden. The Præparturiens is not precisely a large walnut, though "second generation" trees bear nuts of a fair size, some of them quite large, but it is so fertile and bears such good crops from the very start, and when quite young, that it is very valuable. I have found the Præparturiens to give good crops where the Los Angeles walnut was barren, in Dutch Flat, high up in the Sierra, in the foothills of Butte County, in Marin

County, close to the sea, in Stockton, in Nevada, two thousand six hundred and two thousand eight hundred feet in the mountains, and in many other places.

Now, as to what varieties of walnuts to plant for market: It is a fact that the best marketable walnuts are those that are the largest, fairly shaped, thin shell (not paper-shell, a kind that should never be planted for market), light colored, and with a fine, fat, sweet kernel. This is independent of other characteristics, such as fertility, hardiness, and lateness in budding out. Whenever a variety combines all the above characteristics, it might very well be called the "boss" variety to plant for market.

For size and beauty of the nuts, I find that no varieties can surpass the Mayette, Parisienne, and Franguette, which I have fruited in California. But size and beauty of the nuts are not the only advantages of these three fine kinds over all others, for they are, besides, hardy, putting forth late, and seldom, if ever, injured by frost in the spring. (They never were on my place at an altitude of two thousand six hundred feet.) As to the kernel of these three kinds, it is very fine, corresponding fully to the size of the shell, with a sweet and nutty flavor.

As to their fertility in California, I cannot tell much yet, for my bearing trees are rather young; but the way they bear is encouraging. The Præparturiens, Chaberte, Vourey, Cluster, and others, have more or less claims as nuts for market.

Walnut growing is an industry that ranks very high in France, and which can be developed on the same scale in a State like California, if only we are wise enough to study the French method a little and do as they do, planting none but *hardy* kinds, and planting them on plateaux, hillsides, rolling land, alongside roadways, around large fields and vineyards, in cordons and avenues, on soils not well adapted to other crops, and where the walnut in the course of time will grow to gigantic dimensions. But keep your deep and rich bottom land for the growing of other crops, and remember that walnuts require much space, and that in rich and valuable land walnut growing might, after all, prove unprofitable, if you take into consideration the extra value of the land.

The walnut belt in France comprises two thirds of the whole area of that country, extending from the ocean to the Alps and Jura Mountains, and from the Pyrenees Mountains to the Loire, a belt where exists a similar diversity of soil and climate as is found in California from one end of the State to the other, and up to two thousand five hundred to three thousand feet in the Sierras. The finest walnuts in that immense belt come from the Department of Isere in the southeast, and are exclusively grown on grafted trees; the kinds most generally propagated, on account of their hardiness and beauty of the nuts, are the Mayette, Franguette, and Parisienne; the latter is found to do better in light soil, while the Mayette and Franguette prefer a rocky soil, but rather deep and rich. The Chaberte, less particular as to the nature of the soil, but very rich in oil, is much grown for the oil mills. To give an idea of the extent of the walnut industry in France, I will say that the Department of Isere alone exports annually to the capital of Russia, $100,000 worth of Mayette walnuts. Most of the walnut crop of that and adjoining Departments is carried down the River Rhone to Marseilles on pine log rafts, at which port nuts and lumber are better delivered for market. The walnuts of the Isere bring the best price of any walnuts in France—5 to 8 cents per pound, according to years—in fact, Isere walnuts sell with a premium, which is another illustration of that truth, that fine fruit will always bring better prices anywhere. In that part of France the walnuts are planted a little everywhere, especially on rolling land and hillsides. By the way, whenever having level or rolling land on your place, always plant the walnuts on rolling land. In the Department of Dordogne, from which comes the bulk of the walnuts exported to the United States from France, statistics show six hundred thousand walnut trees. The walnut crop of that Department, in nuts for market and oil, amounts annually to $1,000,000. The nuts are exported to the north of France, Switzerland, and the United States. To the latter country, on account of the tariff, are exported only the common kinds. In the Department of the Loire, fifteen thousand acres are planted in walnuts, the trees being planted as high as two thousand three hundred feet in the mountains; and so on in the whole walnut district.

Walnut picking costs 5 cents a bushel in France, and prices for walnuts vary from half a cent to 8 cents per pound. The cheap nuts are sold to the oil mills, the finer ones shipped to market. Paris alone consumes fifteen million pounds of dried walnuts and ten millions of fresh nuts. Half of the oil used in France is walnut oil, or three times as much as olive oil. One hundred pounds of walnuts average eighteen pounds of oil.

My advice in regard to those foreign varieties of walnuts is that where the Los Angeles, or common walnut of California, does badly, people should not hesitate a moment to plant them, as being so much superior and more hardy; and where that same Los Angeles walnut does well, to give at least those foreign kinds a fair trial, and see if they would not prove more profitable than the common kind. It is as easy to grow fine nuts as poor ones, and certainly more profitable.

As to the "culture" of those foreign kinds, since they are but mere varieties of the Juglans regia, or common European walnut, or English walnut, so called by the colonists of Virginia when that tree was first imported to America from England, and to distinguish it from our native black walnut; and as Mr. A. Dorman, of Rivera, and Mr. G. W. Ford, of Santa Ana, have papers on "Walnut Culture," and not desiring to take up any more of the time of the Convention, I will say nothing more, trusting that these gentlemen will ably and fully dispose of that subject.

DISCUSSION.

Mr. J. Hobart, of Nordhoff: I would say, if you would visit Ventura, there are, in the center of the town, quite a number of walnut trees grafted on the native walnut. They are twelve and fifteen feet high. I live eighteen miles back in the Ojai Valley, where there are a great many native walnuts, and I have one tree which I grafted onto the native walnut, and it is growing very well. What Felix Gillett, of Nevada City, says in regard to the growing of the walnuts in our valley is correct. He could not have described it better if he had visited our place. I claim, if you get the right variety where they fertilized, we can raise them. I see no reason why the English walnut should not grow in that section where the native walnut abounds and flourishes; but as to grafting these

trees, it can be seen in Ventura. They are large trees, and, I presume, were grafted twelve or fifteen years ago.

Mr. Buck: Mr. Lelong has told me that he had grafted the English walnut onto the wild black walnut. I cannot give you any definite instances, although I know of a few cases in which they are growing nicely, but they are not old enough to bear.

Mr. Kinney: I saw them only three years ago. I was surprised at the size of the tree, but it established the fact that they would grow on this root, and I don't see any reason why not. There is a great deal of difference in the formation of the valley, where the experiment was made—La Puente. The south of the mountain side, where I live, carries the oak to the top of the mountain; on the other side, nothing—perfectly bare. There is a great deal of difference in the soil. The wild walnut is limited to the south of the mountain side, or the south side of the valley, where the soil is very deep and rich.

Mr. Dorman, of Rivera: We claim our crop of walnuts is fairly profitable; from some individual trees over three hundred pounds are returned. Last year we got 7½ cents per pound. Take trees set about forty feet apart—twenty-seven to an acre—it would make a fair return, but nothing equal to oranges; because, in that same neighborhood we have orange orchards that have given a return of considerably over $600 per acre; not every year, but occasionally.

Mr. Paine: As to the bearing of walnuts in San Bernardino County on the mesa lands, even where they are well irrigated, the crop of English walnuts is only about one third as much as it is in the bottom or naturally moist lands of the country, while the trees on those mesa lands will grow to as large size as they do in the low land.

Mr. Kellom: I don't think Mr. Ford wanted to be understood that the soft-shell would become rancid while the other would not. I didn't so understand. We have no rancid walnuts down there, unless they become so by extreme sulphuring and not drying. Colonel Heath, of Santa Barbara, is authority on the walnut, and he has a dry range where he dries his walnuts, and he does not sulphur them. In Tustin we have a very old walnut orchard, and some of the trees in that orchard have yielded from $27 to $30 a year in fruit. Those trees are about eighteen years old. In the oldest settlements of San Bernardino and Los Angeles Counties the Mormons planted the walnut trees. They were probably Englishmen from the southern part of England, and they brought the walnuts with them and planted them. There was no system of irrigation, and of course there was neglect in their culture. The probability is this story has got out from that, that the walnut tree does not require one fourth of the amount of irrigation that the orange tree does. I think it is a great mistake, for I have noticed that where walnut trees happen to be set along our irrigation ditches they produce walnuts, and of fairer size and more of them. So that we have come to the opinion that it pays to irrigate the walnut trees, and we regard the walnut crop in our county (Orange) next in value to the orange crop. At San Juan, twenty-two miles below Santa Ana, it did me good years ago to see the wagons piled to the top with those great sacks of walnuts—hay stacks, as it were—with four and six-horse teams. And they all come from an orchard planted years ago, and within half a mile of the ocean.

Mr. O. N. Caldwell, of Carpenteria: We do not irrigate the walnut where we live. I live adjoining Mr. Heath. He is quoted as authority upon the walnut. He does not irrigate. He has a great many trees, nearly two hundred acres, I judge. Some places it is thirty feet to water on his ranch, some seventy-five before you will find water, and in other places not more than fifteen feet, according to the formation. The nearer the creek we get in many places, the further we have to go to water, because it is rocky. For our annual rainfall we want twenty inches, but we oftentimes don't get it. We had thirty this season, and a little more. We have some fogs there, and they are not only beneficial to our walnuts, but help us out on the bean question. Beans are very profitable there on proper ground. Mr. Gillett says the walnut will grow on any soil where good corn will grow. The English walnut will not do it, according to my experience. I have mesa land which will raise good grain of almost any kind, and will raise almost anything, but it will not raise Los Angeles English walnuts. If the French varieties will grow on our mesa land, we will have a fine thing of it.

Mr. Thomas: H. K. Snow, of Tustin, says that four years ago he put away some soft-shell walnuts, and this winter they tried them, and none of them were at all rancid. Coming from the source it did, I was very much surprised, because I know that the old English walnuts here do become rancid after the first year.

Mr. Higgins: Mr. Thorpe, of Ventura County, told me that he had seen two rows of English walnuts and native wild walnut grafted on English walnut. He told me the native wild walnut grafted bore fully twice as many nuts.

Recess until 2 o'clock P. M.

AFTERNOON SESSION.

Friday, March 14th, 2 o'clock P. M.

(President Cooper in the chair.)

REPORTS FROM COMMITTEES.

Judge Aiken: Having served on the Committee on the Monument of Matthew Cooke, Mr. Johnson, the President, who resides at Sacramento, and not having attended our meetings lately, I do not know what he has done. I can hardly report progress, and at the next meeting of the Convention we will endeavor to present a report.

Mr. Block: I move that the committee be given further time, and that the Secretary be instructed to notify the Chairman of the committee to do something in the matter.

Seconded and carried.

The report of the Committee on Railroad Freights being called for, Judge Aiken, the Chairman of the committee, said: I will report progress, and that we have not been able to ascertain exactly from the railroad authorities the rates that will be charged the coming year. However, the committee will continue its efforts, and be able to report at its next meeting. Very little can be done in this way until about

the first of April, when we will probably reach the railroad authorities and use the best endeavors to obtain better rates for the coming year.

The President: I would state to those members who heard the suggestion for the appointment of a committee to memoralize Congress for an appropriation to send an entomologist to Australia and adjacent islands to look for parasitic insects, that there has been no action taken on that proposition. If it is the desire of the Convention to take such action, it will be necessary to have a committee appointed to draft the memorial.

Judge Aiken: That is a very important step. I would move that a committee of three be appointed to report later in the session to-day a memorial to Congress.

Seconded and carried.

The regular programme for the afternoon was here taken up.

THE MYSTERIOUS VINE DISEASE.

Essay by N. B. Pierce, Washington.

On November 8, 1884, we find recorded in the Anaheim "Gazette," under the head of "A New Winery," the following: "The large increase in the production of grapes this year, caused by the fact that hundreds of acres of new vineyards contributed their first crop, taxed the wineries beyond their capacity. They were unable to work up the grapes as fast as offered, and as a consequence the growers, especially those whose first experience it was, grumbled deeply and loud, and prated of overproduction."

On January 17, 1885, the same journal says: "The vineyard area will be largely extended in the vicinity of Anaheim this year."

This, then, is the apparent prosperity of the grape industry at Anaheim during the close of the season of 1884. But later developments clearly show that an unsuspected force was even then at work undermining this profitable industry.

In the summer of 1884, a few vines of the Mission variety, in one of the vineyards situated in the southwestern portion of Anaheim, became unhealthy. In the spring of 1885, in each of several contiguous vineyards in the same portion of the town, a few vines failed to produce a healthy growth, several vines not starting at all. But the following, from the "Gazette" of April 4, 1885, will clearly show that no serious trouble was then suspected; it says: "Many vineyards are far enough advanced to give an idea as to the probable crop, and those who know are of the opinion that the crop will be a very large one, barring accidents. The vines are showing up wonderfully well under the stimulating and warm weather." On the eighteenth of the same month we find the following: "A rare instance of vinous fecundity is the Burger vineyard of J. J. Dryer, which at three years from planting yielded close on to three tons to the acre." April 25, 1885, we find: "The grape crop here is likely to be very fair. Such are the present indications."

As the summer of 1885 advanced, the old Mission vines in the southwestern portion of Anaheim, in that region where some had failed to produce growth in the spring, quite generally showed a yellowish cast of the foliage; and as the heat of the season came on this appearance extended to most of the Mission vineyards of Anaheim and vicinity. Still the people at large did not fully comprehend the situation. The crop of Mission grapes from the older vineyards was noticeably deficient; but owing to the young vineyards, just coming into bearing, the total yield for the season was quite satisfactory. At this time the Muscat vines were still in full bearing in all parts of the Santa Ana Valley. The "Gazette," of October 10, 1885, says: "Many paragraphs have been printed this season regarding heavy yields of grapes, but we are gratified to be able to cap the climax by recording the phenomenal yield of the Muscat vineyard of Mr. John J. Duff, situated about one mile north of town. This vineyard yielded twelve tons to the acre, and there is about a ton to the acre, second crop, left on the vines. Two vines gave three trays of grapes, each weighing seventy pounds, making the yield of each vine one hundred and five pounds." This record could probably have been equaled or surpassed in other vineyards of the valley at that time. McPherson Bros., of McPherson, who were making raisins in the foothills, it is also recorded, "have already covered one hundred and sixty acres of land (with drying grapes), and are still enlarging their yard."

It became generally remarked, about the heat of this season, that something was wrong with the old Mission vines; and for the purpose of briefly following the early history of this trouble, we quote again from the same journal, of October 24, 1885: "The sound of the crusher is yet heard in the land, but very faintly. The vintage is in its last stages. It has been much more satisfactory than was anticipated, though it must be confessed that while some growers have cause for satisfaction, others cannot greatly felicitate themselves. Although this was an off year for Mission grapes, there are many instances of large yields."

In the fall of 1885, we then have nearly all the old Mission vineyards of Anaheim and vicinity showing a decidedly lowered vitality. In the spring of 1886, after the winter months of rest, the vines again put forth, and we have, on March 20, 1886, the following record: "The vineyards of Anaheim are putting forth leaves. In the warmer soils the vines show an unusual forwardness. The season thus far has been favorable for planting new vineyards and for the growth of the old vines. But little, if any, irrigation has been required. The outlook is auspicious." But this condition of things was not general, and large numbers of the old vines have failed to produce more than a short growth, and many even failed to start. By July this vine trouble had become serious, and we find the people of Anaheim becoming anxious. On July 24, 1886, a meeting of vine growers was called and a discussion held, the result of which was the appointment of a committee to set on foot an investigation into the nature of the trouble.

From this time forward the destruction of the Mission vines was rapid and relentless. The crop of 1886 in the old Mission vineyards was not more than 10 per cent of the usual crop; while the loss in 1885 had probably not averaged more than 30 per cent in these vineyards. The grapes dried on the vines; the canes died back from the ends; and when the pruning season came it was found that but a small amount of vitality remained in a great majority of these vines. The pruner could tell a diseased vine as soon as his instrument entered the wood. It may be fairly claimed that these great, and for more than twenty years most productive, vineyards were dead or worthless at the close of

the year 1886. This was not all. The foreign varieties, most numerous on the south side of the Santa Ana River, where the great Muscat vineyards stretched along the foothills as far as the eye could reach, were also beginning to show spotted leaves, poorly ripened canes, and other signs of a reduced vitality. It is true that the output of grapes and raisins for that season was large in the valley; but those of an observing habit could see that the vines were not in perfect health. At the close of 1886 the trouble was beginning to show itself in many places miles distant from the point of first appearance.

In 1887 there was a failure of a great percentage of the Muscat vineyards of the Santa Ana Valley, especially those located in the higher, drier, and consequently warmer situations. Many of the vineyards located in the river bottom, where the soil was a rich sedimentary deposit, or of a sandy and cooler nature, were still preserved and bore good crops. It was in the summer of 1887, after the death of thousands of acres of vines in the Santa Ana Valley, that the same trouble was seen to crop out in distant vineyards; many old vines, especially of the Mission variety, becoming badly diseased or dying in San Bernardino and Los Angeles Counties. From that time to the present, vineyard after vineyard has been giving up to this scourge, usually at greater and greater distances from the point where the first deadly effects appeared. Although vines of certain ages and varieties, or in certain sandy, cool, low, or favorable soils, still hold out in the midst of the dying vineyards of older, less resistant, or less favorably located vines, yet it is evident to one who has worked over the entire field, that the trouble has extended out progressively, year by year, since 1884, from a common center. This work is still going on. It must be understood that local or special conditions are not here considered. In speaking of the general spread or more distant development of this trouble, we intend investigating it, but only where other conditions are equal. There are vines within a few miles of Anaheim that have yielded abundantly up to the past summer, but this has been due to special conditions of temperature, moisture, soil, variety, age, etc., and which conditions cannot easily be explained except after a most thorough and general canvass and study of the infected district.

Of all the vine affections known to science, we have here one which, in the deadliness of its nature, the universality of its attack in a vineyard, and the obscurity of its workings, is nowhere surpassed. In a vineyard showing this trouble more or less generally, it may be said that every vine will die from its effects. There are in the longest affected districts few exceptions to this rule. This feature of the trouble is one which should not be lost sight of in our search for cause and cure. It is in fact *the* feature of this affection; every vine thus attacked dies from the effects, be it sooner or later; and, so far as the longest affected district has shown, no vine in the affected vineyards will remain for any great length of time exempt from the trouble. As a certain writer on this disease has said, "The salient facts are the important ones to be first considered." Of all the features forcing themselves upon us, those of virulence of nature and eventual completeness of attack in the vineyards affected, are the most prominent. One other related feature, but perhaps of equal importance, is that of the almost or quite universal death of vines started from cuttings taken from diseased stock; thus pointing, with much force, to the disease as being inherent in every portion of the infected vine. A cane may be well ripened and stored with starch, yet produce a vine early showing signs of disease, and soon dying. Vines weakened through the action of downy mildew (*Peronospora viticola*) will furnish cuttings of an unhealthy nature. A considerable percentage of cuttings from such vines will fail to start, or will soon die; but when they have once formed sufficient foliage and root to carry them the first season, the number that will die the second season is immaterial. With the present trouble this will not hold good. Many cuttings fail to start; others make but a short growth; while those continuing to grow through the season will mostly die the second year.

After several months of thorough and careful field work, extending over most of Southern California, we have brought together many facts of importance and interest bearing on the effects, distribution, and nature of this trouble; but which, of necessity, can only be presented in a full report to the Department at Washington. The following facts, however, have been clearly established. The death of the vine is not due to any of the commonly known parasites of Europe or America, such as phylloxera, downy mildew (*Peronospora viticola*), anthracnose (*Sphaceloma ampelinum*), powdery mildew (*Uncinula ampelopsidis*, or *Oidium Tuckeri*), to any of the rots, or to any of the well known root fungi, as *Dematophora necatrix* or *Agaricus mellius*. It is also true that it is not due to pruning, to cultivation, to irrigation, or to want of irrigation; to too dry soils, or to too wet soils, when considered as normal conditions; to too poor soils or to too rich soils, or to the want of any required constituent of the soil; to the effects or to the want of sulphur; to the prevailing winds, to what are locally known as "northern" or "Santa Ana" winds. This last statement will appear well founded, when it is known that vineyards lying miles outside of the course of these winds have died, while in other regions, in the direct track of the most severe of these winds, the Mission vine has prospered for thirty years or more.

We are then led to exclude all the better known causes of vine disease, and to classify our trouble with that considerable group of illy defined affections, which in Europe have been the occasion of much investigation, with often quite diverse results, or to consider that we have an affection of the vine wholly new to science. Although the latter is by no means impossible, it would be hasty to consider it probable till a thorough canvass of known affections had been made.

What of the possible relationship of this trouble as indicated by its observed characteristics? There are a few matters that stand out clearly defined in this connection. There has never before been in California such a complete, such a widespread, or such a continuous death of vines. The vine in California which dies first with this trouble is the Mission vine. The Mission vine has been successfully grown in this same region for from thirty to one hundred years. I think it may then be fairly said that we have a new or exceptional case in hand. If we have an exceptional case, to what date shall we look for the inauguration of these exceptional conditions? This, we feel confident, can be placed during or about the year 1884, as already indicated. From that time on the death of the vines has been steady, progressive, relentless, and complete.

In Europe there are several long known but illy defined or poorly understood affections of the vine, which result in its death. One of

these is known as folletage, or apoplexy; while another, long known in Sicily and throughout Italy, is designated as *mal nero*. It is to these two affections that our trouble bears most points of resemblance. It is unfortunate that the nature of both of these troubles is quite imperfectly understood.

Folletage, or apoplexy, has been considered as a physiological accident, which occasionally occurs to scattering vines in a vineyard, and which it is claimed almost invariably results in the death of the vine. Professor Viala tells us that "there is sometimes observed during the period of full vegetation, particularly in July or August, some vines in the midst of a plantation that suddenly die. The leaves fade, become stained and dry; the branches and even the stem suffer the same way; in a few minutes the vines may die." Viala states that this trouble "never manifests itself over a continuous surface." He also says that "folletage is produced in all mediums, but most frequently in deep soils, cold or humid; as in wet, sandy soils, or rich alluvial, on the borders of rivers. It is after great rains, and during great heats, when hot winds blow in damp years that it is to be feared. In Algeria the sirocco sometimes causes a quick and entire desiccation of the exterior organs." The general claim of European writers on this affection is, that it is rarely known to affect more than a few vines in a vineyard; that the death of the vine ensues—often immediately; and that the vine rarely sends forth new growth when cut back. There are some features here, as well as in the appearance of the foliage, which remind us of our disorder. The leaves of vines affected by folletage are often stripped much as in the present case; the vines remaining green. However, our affection disagrees with the diagnoses of folletage given by Europeans in the following not unimportant features: The California affection rarely produces sudden and complete death of the vine. Many vines live two, three, four, five, or even more years before they die, making their death often very gradual from the time when the affection is first noticed in the vineyard. The trouble, unlike folletage, spreads over a continuous surface, eventually taking every vine in the vineyard, and every vineyard in the region. Again, our affection is seemingly progressive; it kills the same variety of vine in like soils in later and later years, as we pass to greater and greater distances from the point where like vines first died. I feel that at present we can hardly be justified in saying that the effects of a case of sunstroke (folletage), occurring in the season of 1884, could still be cropping out and killing vineyards which have borne as high as twelve tons of Muscat grapes to the acre as late as the season of 1888, and which last season dropped to six tons, and began to show disease. The case I refer to is near Florence. On the other hand, if we assume that there is now a constantly recurring series of sunstrokes, we are looked to to explain why these special conditions had not destroyed the most susceptible Mission vine during its century of growth at San Gabriel, its quarter century at Anaheim, and its four score years at Los Angeles.

Although we find many difficult points to explain under the view that our trouble is identical with folletage—or what is really sunstroke—it should still be borne in mind that the season of 1884 was in some respects an exceptional one. The rainfall of that year was nearly three times as great as the usual rainfall of Southern California.

The second affection of vines, with which it is well to compare our disease, is *mal nero*—a disease which has worked great destruction in the vineyards of Sicily, throughout Italy, and in adjoining regions.

A large number of Italian students have devoted themselves at various times to the elucidation of the characteristics, nature, and workings of *mal nero*. It is not best to enter here into any extended review of the literature of this malady, but a few extracts are required to properly place before us the more or less generally accepted views respecting the nature of this disease. It is quite generally agreed that *mal nero* is of ancient origin, but the attention of scientists has been especially called to it within the last twenty years. It has existed since 1868–9 in Sicily, where it raged in 1877, ravaging a large section of country. It is stated that it "exists in a black-brown putrefaction of the wood, and exhibits itself on the outside by brown spots on the branches, the buds, and the petiole of the leaves, and also on the footstalk of the cluster, which dries up and leaves only a few healthy berries. The buds are weak, the leaves shriveled and withered, with parched and burnt-looking patches on the outer edge. The diseased vines die after a period of from three to five years." Dr. Gregori says: "The spring buds in the infected vines appear pale and feeble, then yellowish spots appear on the leaves, other spots of a black color succeed each other upon the branches, followed by a withering, mortification, and laceration of the tissues." We find it recorded that, "The disease manifests itself first upon the upper part of the plant, and descends little by little, encroaching by degrees on the underground part, which dies; but it does not attack the roots until from three to five years." It is also said that, "By a kind of compensation for the ravages caused by the disease, the plant puts forth many very vigorous shoots from the main body of the vine, near the ground, or even from the roots. We must not, however, deceive ourselves; these shoots will also become infected and die the following year." I regret to say that up to the present time I have been unable to obtain any careful records of the behavior of cuttings taken from vines infected by *mal nero;* but from the preceding statement, that healthy shoots will take the disease by transmission from diseased roots, I think it not unfair to suppose that cuttings would inherit the disease with *mal nero*, as seemingly they do with our own affection.

Professor Comes, who has probably given more study to this disease than any other European scientist, assigns it the following characteristics: "Palor, shriveling, mutilation, and dryness of the leaves; dryness and blackening of the branches and stalks; dropping of the fruit, unequal and interrupted growth of the berries in the same bunch; blackening and decortication of the bark of the branches and stub; drooping, partial blackening descending from the upper part of the plant; afterwards the putting forth of shoots, more or less vigorous, from the foot of the stem. At last, after a longer or shorter period (from three to five years), weakness, enfeebled vegetation, great wasting and death of the plant takes place, slowly during the winter, suddenly during the summer."

An anatomical study of vines diseased by *mal nero* has led to about the following diagnosis:

Mori states that in transverse sections of the cane there are seen "little clots of gum, which are produced especially in the lumen of the vessels," and he thinks that "this emission of gum is the cause of the pathological condition of the plant."

Others have attributed the trouble to "a vicious function of the organs of nutrition and an imperfect performance of the physiological function." It is claimed by Garovaglio and Cataneo that "in infected plants, many of the vessels, especially the rays, are found to be filled with a substance that obstructs the inner cavity after the manner of a bung;" and that the bladder-like vesicles, so commonly seen in the vessels, are "filled within and covered without with thousands upon thousands of 'bacteria.'" These scientists claim that "it is precisely in this alteration of the juices contained in the organic elements of the wood that we must look for the cause of the disease, which undoubtedly arises from a faulty assimulation."

Garovaglio also states that "the wood of the stem is spotted with hazel brown as far as the root, and clusters of bacteria are found in the vessels." Sommer tells us that in the south of France a similar disease has been known for ten years; that it acts upon the pith and wood of the entire vine as far as the root, killing the plant. It is known by the yellow color of the leaves in spring, as well as by the blackness of the wood, and, that "by the continued injury done the plant, it perishes." The views of various scientists, although not harmonizing in all features of this disease, are very similar as to one fact of observation, viz.: the presence of a substance in an abnormal condition, filling many of the cells of the wood and bark of the diseased vines. The nature of this substance has been in question for many years, but perhaps the balance of the evidence rests with those who consider it of a gummy nature. It is claimed that much of this amorphous deposit within the lumen of the cells is due to an abnormal degeneration of the cell contents—mainly starch. It is also held that this degeneration is caused by an active ferment within the cells themselves. Views as to the nature of this ferment vary, some holding that it is due to the presence of micro-organisms (bacteria), which are seen in immense numbers within the altered substance and throughout the vine; others affirm that it is a zymotic ferment of the diastasis class. It may at least be said that the mass of evidence points to a pathologic condition of the sap of the vines affected, the abnormal degeneration of the cell contents and the infection of healthy shoots springing from below the ground being a portion of the evidence advanced.

Professor Targinoni-Tozzetti has kindly furnished me with material affected by *mal nero*, of which a partial study has already been made.

After having given the preceding review of folletage and *mal nero*, the two European affections of the vine with which our disease can, with the most reason, be compared, I think that the California disease appears to be more nearly related to *mal nero* than to folletage. Of our disease and *mal nero* we may give the following characteristics: They die back from the top, and the canes turn black; the green bark of the diseased cane is usually covered, more or less thickly, with minute, often protuberant, pustules of gum which fill the cells at these points; the leaves turn yellow or red in spots, and dry up about the edge; there are seen minute drops of gum upon the yellow spots on the leaves; the vines do not die suddenly, but survive for from two to five years or more; they send out healthy "suckers," which become infected and die the following season. The characteristics of the anatomical elements are closely related. There is good reason to think that the sap of vines affected by either disease has assumed a pathologic or zymotic condition, the cuttings inheriting the disorder (?). These diseases are not confined to a few vines in a vineyard, but affect every vine, extending over a continuous surface. They are both progressive and capable of denuding an entire region. Neither, so far as an investigation has extended, presents any obvious cause for the trouble in the form of higher fungi; and at the present time most Italian workers have discarded the idea that parasitic fungi bear any casual relation to their disease. After asking the pardon of our scientific friends, perhaps we may be allowed the liberty of using a negative character, by saying that we almost feel that the absence of any apparent cause in these two diseases indicates a generic, if not a specific, relationship.

I will now briefly indicate some of the lines of study thus far pursued in our investigations of the California disease.

During, perhaps, two thirds of the time since my arrival in the State, I have occupied myself with active field work. This is always an essential feature in arriving at true results. One of the most faulty features of the work of nearly or quite all the European students of *mal nero* has been the want of facts gathered personally in the field. For instance, they leave us almost entirely in the dark as to whether vines will again grow successfully in a region once denuded by *mal nero*.

During the field work the matters of the origin, spread, distribution, and workings of the disease in various regions were among the leading features of study; but much of the field work has been upon the effect of the disease seen in the individual vine. Much attention has been paid to the growth of cuttings, presumably healthy, brought from various sections of the State and from the East. The result has been to show that the trouble has not yet passed away, but continues to infect vineyards set from cuttings and rooted vines, and some seedlings have died apparently from the same cause. The host of observations made and of theories considered cannot here be touched upon.

The laboratory portion of the work has included a thorough microscopical study of the affected vines, including the foliage, canes, body, and roots of the same. During this examination numerous fungi have been observed and given the study they appeared to require. Up to date I cannot say that any forms have been found upon the upper portions of the vine which it appeared possible could bear any casual relation to this disease. I find, however, some two or three forms upon the roots, the mycelium of which works within the cortical parenchyma. These forms are now being experimented with, to determine if healthy vine roots can be infected by means of their spores. I cannot at present say that I think such will be the case.

During the microscopical examination, certain parts of the vine were found more or less infected by bacteria, and in deference to the views held by some European students, we have considered it advisable to inaugurate a series of inoculation experiments with these germs. The matter was taken up here, but afterwards transferred to Washington, owing to the all-pervading nature of the disease in this region, and the difficulty of keeping plants free from it. These experiments and numerous grafting experiments are now under way at the department, and it is yet too early to say what will be the ultimate result.

As to remedies and preventives, I will say that numerous tests have been conducted with various substances, and under many conditions; but the whole may be summed up by saying that what may be properly

termed a remedy or preventive is not yet known. The Bordeaux mixture is a great stimulant, and may be properly used as such, but it does not fill the place of a preventive or cure.

I have recently received some letters from the department where they have been carrying on experiments. The first letter says: "Two more of our inoculated vines are beginning to show signs of disease." Also another letter of March third: "Three of the vines inoculated above ground two months ago are beginning to send out very peculiar shoots. In some cases the leaves are covered with purplish brown spots or blotches, while in other instances they are streaked with yellow, which shades off to a green toward the principal veins."

Of course, it is my intention to go to Washington within two or three weeks, and I will be able to tell then, probably, whether it is the same trouble or not.

VOTE OF THANKS.

Mr. Eisen: I move that a vote of thanks be tendered to the Department of Agriculture in Washington for what it has already done and for what it proposes to do for this disease, which all of us know is of such great importance to us in this country.

Mr. Paine: In seconding that motion I want to congratulate ourselves upon having a man among us (Mr. Pierce) who is making such a careful and thorough study.

A Member: And to thank him for the efficient way in which he has said this, and for his kindness in coming here and telling us.

Motion carried.

Mr. Pierce: Gentlemen, I thank you all. I try to do my best; that is all I can say.

Mr. Eisen: I think the seriousness of the case warrants us to go out of order and take up this matter of importance. I understand the department in Washington has not all the means at its command to carry on this as it should be. For instance, I think it is of great importance that an expert should be sent to Europe to study the disease there and see if it is the same thing we have got, and to find out what remedies have been used, and anything else that belongs to the disease. I beg to offer the following resolution:

Be it resolved by the fruit growers of California, convened under the auspices of the State Board of Horticulture, that

Whereas, An undetermined and deathly disease of the grapevine has already destroyed many thousand acres of our formerly most fertile and productive vineyards in the State of California; and whereas, this disease shows no abatement in destructiveness, but is constantly spreading over new territory; and whereas, the Division of Vegetable Pathology of the United States Department of Agriculture, which is now engaged in the investigation of this disease, feels the need of more liberal appropriations of funds to enable it to continue and properly maintain its work now well advanced; be it, therefore,

Resolved, By the fruit growers of California, in Convention assembled, that the Secretary of the State Board of Horticulture shall at once place these facts, in the form here presented, before each of our representatives in Congress, with the request that they will take united action in presenting and urging the great necessities of the case before the Committee on Agriculture of the Congress at Washington, D. C.

Adopted unanimously.

TARIFF ON FRUITS.

Essay by F. A. Kercheval, Los Angeles.

Closely cordoned about by tropical and semi-tropical lands, east, west, and south, "where every prospect pleases, and only man is vile," and his labor very cheap, when required at all, to gather what Mother Earth almost spontaneously produces in the greatest profusion, is it not just and proper that we should demand ample protection against the blight of competition by ignorant and semi-barbarous coolies, South Sea Islanders, peons, and slaves, in the surrounding lands? Governments, like heads of families, must, first of all, cherish and look after the happiness and material welfare of their own children as against the rest of the world, else they cannot long expect love, reverence, and obedience, and are doomed to perish. We could not, as freeborn American citizens, take kindly to a costume of fig leaves or breech-clout, a sombrero and poncho, a gunny or flour sack about the loins; or to a diet of rice, poi, or taro, or tortillas and frijoles, and the munificent compensation of 10 or 15 cents per diem. Patriotism would perish were we compelled to live in wretched thatched huts or miserable jacals with earthen floors, in order that we might be able to compete with degenerate races, in whose breasts centuries of oppression have extinguished all high and noble aspirations. Nor yet should the products of overflowing pauper labor from the lands bordering upon the Mediterranean and other teeming regions of the old world be permitted to be dumped upon us, smothering in its infancy an industry that, with proper protection, would soon make us the glory and pride of our own continent and the envy of the world.

But let us calmly look at the circumstances by which we are surrounded, and the dangers by which we are threatened, and act accordingly. It is already plainly apparent that the present almost nominal duty upon citrus fruits, raisins, walnuts, almonds, figs, currants, prunes, olives, and oil, is entirely insufficient, as a means of protection to us against cheap capital, cheap transportation, and starved labor, that will confront us with ever deadlier menace, year by year, with their and our own ever increasing production. But a few days since the telegraph announced that in one week the amount of oranges received at our eastern ports from the Mediterranean was equal to the entire crop of California for this year, completely demoralizing, for the time being, the markets for our California and Florida productions. And the temptation to those countries will always be irresistible to flood our markets with their surplus, so long as the duty and ocean freight combined amounts to little more than one half the rate our own producers are compelled to pay for transportation to the same points, or even to reach the Mississippi Valley. From the tropical islands, laved by the torpid waters of the gulf stream and the Caribbean Sea, from the coral-guarded isles that gem the broad expanse of the South Pacific, from the broad curving palm-shaded coast lines of our own continent, stretching away through the equatorial regions down to Brazil on the east and Chili on the west, where fruits grow spontaneously, and man's wants are few and simple, where he "rests" for regular occupation and labors for pastime, will pour an ever increasing tide of competition, as the facilities for transportation and preservation in transit are cheapened and perfected.

But it is to our own immediate neighbor in the south, whose territorial line is coincident with our own for fifteen hundred miles, that we may look in the future for the deadliest menace to all our varied horticultural and pomological interests.

There, in the future, will be produced, in the greatest profusion, every fruit and every product of the temperate, semi-tropic, and tropic zones that is known and prized by the commercial world. There, right upon our border, from San Diego on the west, to the mouth of the Rio Grande on the east, lie almost limitless areas, stretching away down to the southward, much of it as near, or nearer to our great centers of population than California. Into every portion of this immensely rich domain, railroads connecting directly with our own great interior system are rapidly penetrating, giving Mexico quite as good and cheap facilities for transportation as California enjoys. Already, from Hermosillo and Guaymas, in the State of Sonora, and other points, considerable quantities of oranges, lemons, and limes of the finest quality reach us, both by sea and land. Millions of grape cuttings are being planted upon lands worth 25 or 50 cents per acre, by the aid of wretched peon labor, at the rate of 1 real per diem; and an income of $5 per acre, or even one half that amount, will be a princely income to the great land barons produced under such conditions. Think of it, ye raisin growers of Riverside and Fresno, with lands worth from $100 to $300 per acre, and labor from $1 to $1 50 per diem, and calculate the duration of your prosperity when forced into such deadly competition as you will surely be in the near future. Think of competition with such cheap lands and labor, Oh! brethren of the "Northern" and "Southern Citrus Belts," where orchards are worth $1,000 per acre, and let all foolish jealousy and bickering cease in the presence of the threat of common and overwhelming calamity.

The duty at present upon oranges is but 25 cents per box, or $1 60 per thousand, loose. In box, duty paid, the Mexican can place his oranges or lemons upon the cars at a price as low or lower than 50 cents, and realize what to him would be a good profit on his investment; but by shipping loose, in bulk, and but the choicest and largest fruit, the duty can be reduced as low as 10 to 15 cents per box, thus enabling him to place them upon the cars free, at a rate of 25 and 30 cents. Already the Mexican and State Governments of that republic are offering extraordinary inducements in the way of subsidies and exemption from taxation for a term of years, to those planting orange orchards and fruit trees of any kind.

Let our growers of figs, prunes, peaches, apricots, and olives look well to the land of the Montezumas, for the "cloud no bigger than the hand" will by and by assume portentious proportions.

Let us note some of our specialties of production requiring patient and careful manipulation in preparation for market, the present duty thereon, and find what the Mexican, with his almost valueless lands and labor, can afford to sell them for when he shall have produced them in sufficient quantities to enter into serious competition with us. Beginning with oranges, duty as now from 10 to 25 cents per box, he can sell them at from 25 to 50 cents; lemons, 5 to 10 cents higher; raisins, duty, 2 to 3¼ cents; figs, duty, 2 to 4 cents; plums, dried, 1 to 2 cents; prunes, duty, 1 to 2 cents; peaches, pears, apples, and apricots, which pay no duty, he can place upon the cars, fresh and dried, at 1 to 2 cents per pound.

It must be apparent, then, to every one, that to protect our most promising industries in the future against the cheap capital, transportation, and pauper labor of the old world, and the cheap lands and peon labor of the new, a material increase in the tariff rates—at least double—should be imposed upon all fruits now taxed, and those now classed as free, including olives, should be placed upon the protected list, and made dutiable accordingly. Notably, upon oranges and lemons, which are soon perishable and cannot be preserved by drying, the rate should be increased to at least $5 per thousand, loose, or 75 cents per box. Before the close of the present century the production of oranges and lemons upon this coast will be enormous, probably twenty-five million boxes, perhaps much more, and with proper protection all our other fruit industries will increase proportionately.

To produce, handle, and move these vast aggregates will require the labor of one million men, women, and children, for which they should receive such compensation as will give them good homes and insure their comfort and happiness. And of not less magnitude and importance are the fruit industries of Florida and the Gulf States of the Union. In conjunction, we shall soon flood the United States and all the continent northward with the "fruits of the Hesperides," and none shall be so poor that they may not partake freely thereof. Only let our Government protect her children against the insidious encroachments of foreign capital and pauper labor, and peace, plenty, and prosperity shall be our lot, and strength enduring, and glory eternal, hers forever.

DISCUSSION.

JUDGE AIKEN: To bring the tariff question before the house and limit the same, somewhat, to the articles that probably will be recommended by the Finance Committee of the house for an increase of duty, I beg to offer the following memorial:

To the honorable the Senate and the House of Representatives of the United States, in Congress assembled:

Your memorialists, the fruit growers of the State of California, assembled at Los Angeles, this fourteenth day of March, 1890, most respectfully represent:

That they are engaged in raising fruit in California for consumption in the United States in competition with foreign fruits.

The soil and climate of this State are adapted to the successful production and preparation for market of green and dried fruits of excellent quality and in quantities sufficient in amount to supply, at an early day, the demand for such fruits in the United States.

The competition, however, with foreign fruits, raised and prepared with cheap foreign labor, has become so close that the present duties of 25 cents per box upon oranges, and 1 cent per pound upon prunes, have, in reality, ceased to protect these great industries from such disastrous competition.

Your memorialists, therefore, respectfully and earnestly request that the duty upon oranges be increased to 25 cents per cubic foot, or $4 per thousand, and the duty upon prunes to at least 3 cents per pound, and that all other duties on fruits and nuts be increased in a like proportion.

JUDGE AIKEN (continuing): Mr. President, I move its adoption.

Motion seconded.

MR. ROWLEY: Before that motion is put I would like to read an extract from a letter I have just received from New York. It is in reference to the dispatch that was received by the Foreign Fruit Exchange from the President of the Italian Chamber of Commerce. He urges, in his dispatch, that the foreign importers of New York use their best endeavors to defeat the following action, which, he says, is sure to take place through the recommendation of the Committee on Ways and Means: "The duty will be increased on a box of oranges to 25 cents per cubic foot. The ordinary box which comes from Valencia and elsewhere contains two and a half cubic feet, which makes 62½ cents duty. The case of Valencia oranges contains double the quantity of a box, which is five cubic feet, making the duty on that $1 25." So that in the face of this news I would suggest that Mr. Aiken make his recommendations in accordance with what they are about to do, and not lessen that amount—62½ cents a box in place of 50 cents.

JUDGE AIKEN: I am very happy to receive that information. I had made inquiries about that, but could not ascertain the exact amount, and I am happy to receive it.

The motion to adopt the memorial as offered by Judge Aiken was put to a vote and adopted unanimously.

LEGISLATION.

JUDGE AIKEN: Mr. Chairman, there is a committee to report at this meeting, appointed early in the session, and it is very brief, as follows:

Your Committee on Legislation respectfully report: That it is most desirable that further legislation may be had, but that owing to the importance of the subject no consideration or action can be had at this meeting, and therefore ask to be discharged. Your committee would recommend an appointment by the President of a standing committee of five to act as an advisory legislative committee to the State Board of Horticulture.

Mr. Buck moved that the committee be discharged, which was seconded and carried.

JUDGE AIKEN: I move the President appoint a standing committee of five to act as an advisory legislative committee to the State Board of Horticulture.

Seconded and carried.

THE PRESIDENT: I have named as a committee to draw a memorial to the United States Congress, with reference to procuring an appropriation for sending an entomologist to Australia and adjacent islands, William H. Aiken, George Rice, and I. H. Thomas.

NEXT PLACE OF MEETING.

THE PRESIDENT: It will now be in order to take up the discussion relative to the place of holding the next Convention. And before I take my seat I will state that I was delegated by the delegate from Santa Rosa, who was requested by the County Board of Horticultural Commissioners of Sonoma County, as well as by the State Board of Trade of San Francisco, to present the name of Santa Rosa as the proper place to hold the next Convention.

JUDGE AIKEN: I wish to present the name of Santa Cruz, and offer this resolution:

Resolved, That the State Board of Horticulture be requested to arrange for the fall meeting of the State Fruit Growers' Convention this year at Santa Cruz.

MR. E. W. MASLIN: At the request of the citizens of Marysville, Yuba City, and the counties of Yuba and Sutter in particular, and of the north in general, I present their request to this Convention asking that the next State Fruit Growers' Convention be held at Marysville.

The merits of the various places for holding the next Convention were presented by the delegates from the various localities so requesting it. The final vote resulted in a unanimous request of the Convention that the State Board of Horticulture be requested to call the next Convention to be held at Santa Cruz.

MEMORIAL TO CONGRESS.

The committee appointed to prepare a memorial to Congress, as to parasites, presented the following memorial, which was adopted unanimously:

To the honorable the Senate and the House of Representatives of the United States, in Congress assembled:

Your memorialists, the fruit growers of the State of California, in their annual Convention assembled, at Los Angeles, this fourteenth day of March, 1890, most respectfully represent:

That the climate and soil of this State are adapted to the growth and preparation of fruits of good quality and in quantities sufficient eventually to supply the demand for such products in the United States, especially prunes, raisins, figs, olives, and olive oil.

The success of this enterprise is of the greatest importance to the State and nation.

That the spread of scale insects from foreign countries in California threatens the continued successful cultivation of fruit trees subject to their ravages. Parasites have been found in foreign countries—especially Australia—that live upon and destroy the scale.

Your memorialists, therefore, respectfully and earnestly request an appropriation that will enable the Department of Agriculture to import to this country parasites for scale insects.

FINAL RESOLUTIONS ADOPTED.

Resolved, That a vote of thanks of this Convention be tendered to its President and the officers of the State Board of Horticulture for their fairness and ability in presiding over this Convention.

Resolved, That this Convention return its thanks to Fred. C. Miles for his kind attendance in seating this audience during the session of the Convention.

Resolved, That all persons who desire to contribute towards the Koebele fund be requested to send their subscriptions to the Secretary of the State Board of Horticulture, No. 220 Sutter Street, San Francisco.

Resolved, That the thanks of this Convention be tendered to the railroad companies for reduction in rates and extension of time on expiring tickets.

Resolved, That the thanks of this Convention be given to the citizens of Los Angeles for the hearty welcome and courtesies extended. That we thank the Chamber of Commerce for the active, enthusiastic reception accorded us. That we thank the Cross Railroad Company for an excursion to Pasadena, and also the citizens of that place for their cordial reception.

The Convention then adjourned *sine die*.

B. M. LELONG,
Secretary.

SUPPLEMENT

TO THE

REPORT OF B. M. LELONG,

Secretary of the State Board of Horticulture.

EX OFFICIO HORTICULTURAL OFFICER.

THE MISSION OLIVE.

A TREE OF GREAT LONGEVITY—ITS EARLY INTRODUCTION INTO CALIFORNIA, AND NOTES.

The Mission olive is among the first of trees that were introduced into California; and from the authorities at hand it appears that prior to the introduction of this tree but few fruits were known. Most of the fruits then consisted of seedling peaches, apples, pears, quinces, pomegranates, and grapes.* They were so inferior in quality that the "prickly pear" (*Tuna opuntia*) ranked first in favoritism among the people.

"I remember the time when there was no fruit raised in California, except at the old missions. Some attempts were made on the ranches to raise a few grapes, and perhaps a few pear trees, but they were invariably failures, so far as I know." †

The Mission olive is supposed to have been introduced into California from seeds brought from San Blas, Mexico, by Don Joseph de Galvez, during an expedition to rediscover the port of Monterey.‡ On the suppression of the Jesuit order in Mexico, in 1767, and its consequent expulsion from all the Spanish dominions, it was decided to send a body of Franciscans to take charge of the Jesuit missions in California. These were all in Lower (Southern) California, no attempt at settlement having yet been made in Upper (Northern) California. The band of missionaries numbered sixteen. Father Junipero Serra § was put in charge of it, and was appointed President of all the California missions.‖

It appears that the purpose of the Spanish Government was to proceed as soon as possible to the colonization of Upper (Northern) California. Among those representing the King of Spain in inspecting the the work of the Government in every province of the Spanish Empire, was Don Joseph de Galvez, who held the office of "Visitor-General" and "Commander." Upon him rested the responsibility of the practical organization of the first expedition into Upper (Northern) California. It was he who ordered the carrying of all sorts of seeds of vegetables, grains, and flowers; and everything that would grow in old Spain he ordered to be planted in the new.¶ From this expedition resulted the establishment of the San Diego Mission, the parent of those of San Gabriel, Santa Barbara, San Luis Obispo, and others, to all of which the fruits which Galvez had introduced were carried, and there throve abundantly.

The first seeds of the olive are said to have been planted at the Mission San Diego in 1769, and those seeds which Galvez had been so provident in sending took root and prospered. The fathers built new missions, and among the first fruit trees planted was the olive. The

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*Known as the "Mission" grape, and the only variety then grown.

† General John Bidwell, in an address before Fruit Growers' Convention, 1884.

‡ Bancroft's History.

§ His baptismal name was Joseph Michael, which he changed to Junipero on becoming a monk.

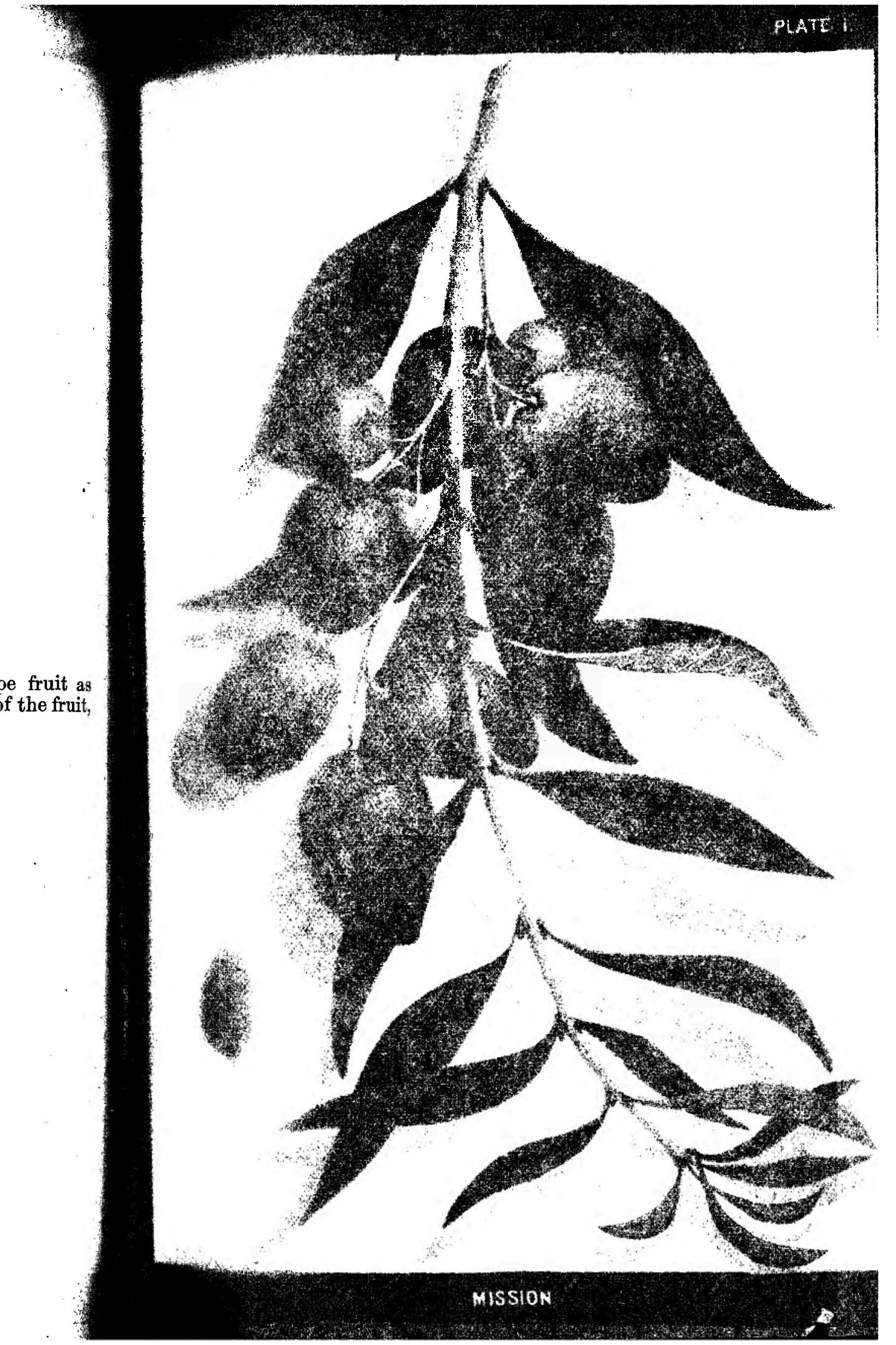
‖ History (imperfect) of Franciscan Missions in California.

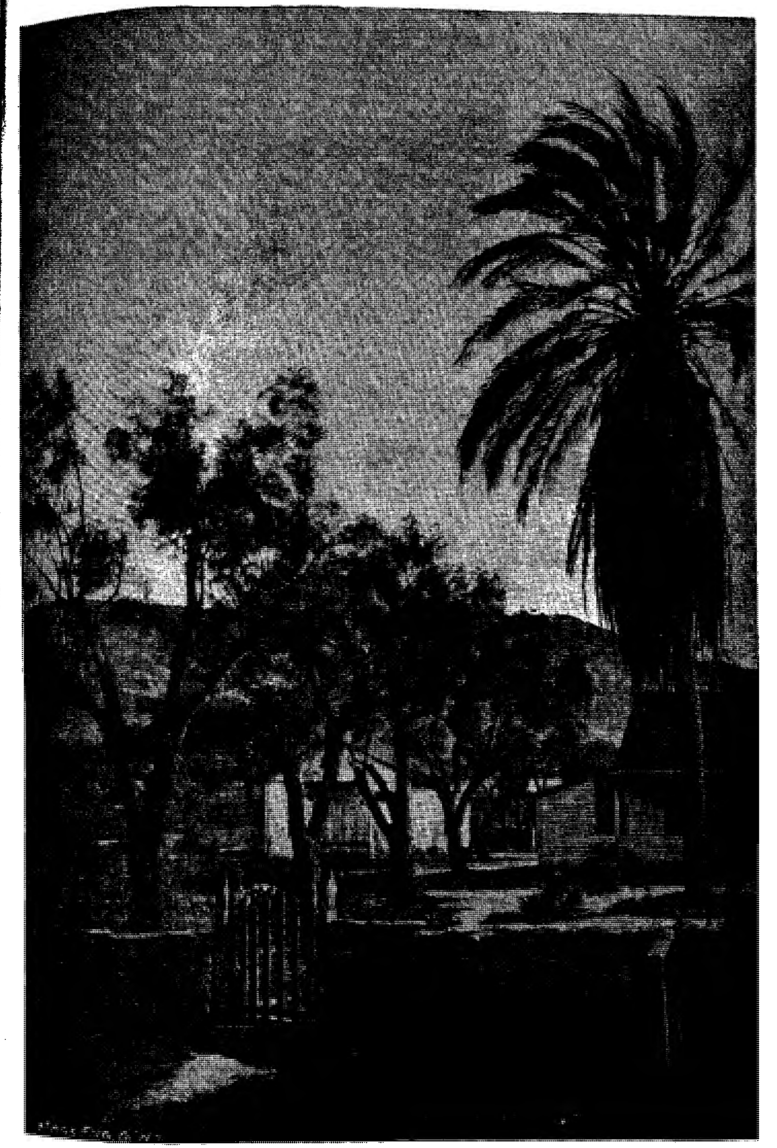
¶ "Records of the Founding of Missions."

EXPLANATION OF PLATE I.

THE OLIVE.

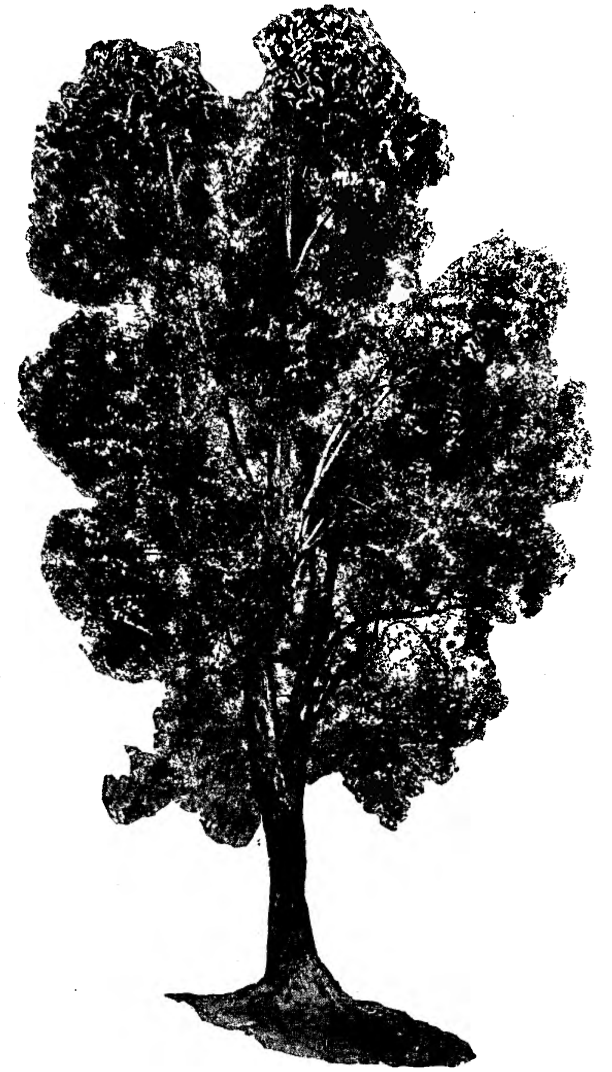
Figure No. 1. Branch of Mission olive, showing the ripe fruit as borne upon the branches in clusters; also the characteristics of the fruit, leaf, and pit; natural size and color, when mature.





Olive Trees at Mission San Diego, Over a Century Old, Being the First Planted in this State, and Still Doing Well.

THE MISSION OLIVE.



One of the gigantic olive trees at the various Missions, over one hundred years old, producing good crops yearly. Stands fifty feet high; its trunk measures five and three quarters feet in circumference at about two feet from the ground.

olives planted at the various missions were from the San Diego Mission, and the trees that were afterwards transplanted to various places throughout the State are from the San Diego and other missions.

The dates of the missions founded are as follows: San Diego, July 16, 1769; San Carlos de Monterey, June 3, 1770; San Antonio de Padua, July 14, 1771; San Gabriel, September 8, 1771; San Luis Obispo, September 1, 1772; San Francisco (Dolores), October 9, 1776; San Juan Capistrano, November 1, 1776; Santa Clara, January 18, 1777; San Buenaventura, March 31, 1782.*

The Mission olive is a tree of great longevity, and the trees above referred to are still fruiting at the various missions throughout the State. At these various missions the trees receive but little care, and notwithstanding the rough usage they receive from neglect still continue to bear fruit. In many of the missions olive trees are seen that have not received any cultivation whatever for many years, and while they do not bear fruit of much value, they do not perish under such treatment.

Of the first olive oil made in this State, the late General M. G. Vallejo, in an address before the Eighth State Fruit Growers' Convention, held at Santa Rosa, November, 1887, said: "In 1822 I visited Santa Barbara and San Buenaventura, and found that olive oil had been made at those missions." I have been unable to get the exact date when olive oil was first made in this State, as the information obtained from the imperfect records at hand is, indeed, scant.

"I understood that a small quantity of olive oil was expressed at San Diego as early as 1780, from conversations which I had with the old fathers, Jimeno, Gonzales, Muro, and Sanchez, whom I knew personally." †

"In 1838 considerable soap was made from the oil extracted from the olives grown at San Juan Capistrano—it could not be put to any other use, as there was no demand for it. In the making of the soap from the olive oil produced, four large copper kettles were used, which would turn out four tons of soap. About fifteen tons of soap were made that year (1838), and I superintended the making of it." ‡

The first olive oil made in the State outside of the missions was made by the late Don Ygnacio Del Valle, at Camulos, Ventura County, in 1871.

Pliny says that "the olive grown under favorable conditions of climate and soil is one of the most vigorous of plants, and can even compete with the oak." He also says that "there were at Luiterno, in the Roman Campania, some olive trees planted by Scipio, the African, two hundred years before."

Extraordinary for age and height are the Saracen olive trees of Sicily, some of which, says Pasquale, "have produced as high as fifty bushels of olives;" although Professor Aloi says that "the highest production of the largest olive trees of Sicily never exceeds two hundred and sixty-four gallons of olives, and that even this quantity is but seldom reached."

The trunk of a tree near Girgenti § measured twenty-six feet four inches in circumference, at five feet nine inches from the ground. In the Province of Cosenza there are still some very old trees, which are

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* "Records of the Founding of Missions."

† From a letter by Joseph J. O'Keefe, O. S. F., Santa Barbara Mission, 1890.

‡ Hon. A. F. Coronel, Los Angeles, September 10, 1890.

§ Raffaello Pecori, "La Cultura dell' Olive in Italia."

said to belong to the times of Louis d'Angio, Governor of Calabria. Some of them have trunks of extraordinary size, empty inside, in which many persons can stand. Thiebaut de Bernaud describes an olive tree situated between Villefranche and Nice, which was already known in 1850 to be exceedingly old, whose trunk, at three feet from the ground, measured twenty feet six inches in circumference. One near Marseilles is mentioned by Ceyreste, which is thought to be nine hundred to one thousand years old, and so gigantic that it can harbor in its interior twenty persons; and another at Tarascon, on the top of a hill, with branches seventy feet long. It is asserted by Gasparini that he has seen, near Rogliano, in Corsica, olive trees fifty feet in height. Very beautiful and fruitful wild olive trees are admired at Mount Amiata.

Repetti, writing of Magliano, Tuscan Maremma, mentions the gigantic olive trees spoken of by the naturalist Giorgio Sauti, in volume two of his "A Trip in the Province of Siena." The stem of this tree measures thirty feet in circumference. It is yet standing.

In 1853, at the Fair of Paris, there was exposed the trunk of a wild olive tree of Algeria, thought to be one thousand years old.

On Tianosa Island (Tuscan Archipelago) there are olive trees of such immense size that they must have been in existence before the cession of the island, that is, before 1600.

It is related by Targioni that on the hills of Fiesole there was an olive tree as large as an oak, and known under the name of Michael Angelo; in fact, that property belonged to the Buonarroti family, and, according to the tradition, that tree was planted by Buonarroti himself. The same writer speaks of another olive tree, on the hills of Bagno a Ripoli, off Candela, supposed to have been planted by St. Antonius, Archbishop of Florence, who died in the year 1445.

Tgnazio Lavaggi advised in one of his letters to visit the celebrated groves of olive trees near Tivoli, one of which, and very likely it is there still, could not be embraced by three persons, and had branded on its trunk the design of a sword, which seemed very old.

Professor Caruso writes: "The most remarkable olive trees I have seen are situated at some maritime places of Sicily (plain of Palermo and Milazzo), in the forest of Pertinicio, on the coast of Ætna, in the plains of Syracuse, in Calabria (plain of Palmi), and in Puglia (Terra d'Otranto). Their majestic appearance is justly attributed to the general practice of the ancient cultivators of those regions of multiplying the olive trees with the wild species gathered in the woods and grafting them very high from the ground. The enormous height is the effect of the olden order of pruning the trees very little or none at all, so that they grew thick and confusedly, as in a thick wood, forcing the branches to stretch up continually in search of air and light. This is the reason why the old groves of the plain of Calabria, at about one mile from Palmi, have the appearance of long poles, dressed on top with a scarce foliage and a quantity of dried leaves, which make a striking contrast with the vigor of the trees, the mildness of the climate, and the fertility of the soil."

As Bianchedi writes: "We are not permitted to-day to see the celebrated forests of olive trees, under which rode, in 1482, Marin Sannto; nor can we see the town of Salo, at Gargano, full of olive trees, which, as is related by Roga, were extolled, in 1558, by Leandro Alberti. Of that large and luxuriant surface there remains no trace to-day. The

last one, said to have been planted by St. Francis, at the beginning of the thirteenth century (Canevari: Agricola Italiana, 1883), was admired by many some twenty years ago, on Lechio Island, or Frati Island."

At the various missions throughout the State may be seen olive trees that were planted, according to history, over a century ago. These trees yet bear good and regular crops with but little attention.

Notably among the largest olive trees are those at the Mission San Fernando, but those at San Juan Capistrano, Orange County, have much thicker bodies. A tree at the Mission San José, Alameda County, supposed to have been planted there about fifty years after the introduction of this tree, is perhaps the largest olive tree in the State. Its trunk measures five feet eight and one half inches in circumference, at about two feet from the ground, and stands erect, and is about forty feet high. The fruits borne by this tree are large, and it bears a regular crop yearly, although larger in one year than in another; this is, however, the same, or nearly so, in the other places where these gigantic trees abound, and especially when they receive proper attention and care.

OLIVE OIL MANUFACTURE.*

SEASON AND MEANS FOR HARVESTING OLIVES.

It is of the utmost importance for the manufacture of olive oil to determine the time and manner in which the olives shall be gathered.

There is a great diversity of opinion as to the proper time for picking the fruit from the tree. A few horticulturists, modern ones even, prescribe that the olives be gathered late in the season, because, in their judgment, they then yield more oil in proportion to their weight.

It is owing to such a conviction that in the greater part of Italy the olive is harvested rather late, and, in fact, when it falls of itself from the tree on account of its excessive ripeness; and it is also due to such a practice that the greater part of the Italian oil-producing regions give oils that are little or not at all appreciated.

Such a practice ought to be stopped absolutely, since it carries with it grave and many evils. First of all, one must bear in mind that the greater quantity of oil which seems to be obtained from late-gathered olives is but apparent, as the fruits lose the water of vegetation during their prolonged stay on the tree, and hence yield, necessarily, more oil with less weight. Thus, a given quantity of olives, if gathered in November, for instance, will weigh less if gathered two or three months later, and the amount of oil obtained from it will appear larger when compared to the reduced weight of the fruit.

Besides, the oil extracted from olives gathered late is very much inferior to that yielded by early picked ones.

In order to get good oil the olives must be picked as soon as they begin to turn black, and pressed immediately. Many modern authors, Caruso among others, condemn the delay in harvesting the olives as injurious to the quality of the oil.

To demonstrate by facts the truth of these assertions, I take pleasure in pointing out the results of an experiment I made on this subject in the course of the year 1880.

On the first of November of that year I had some olives of a very small species picked from a tree; they were nearly ripe, as was evidenced by the vinous tint assumed by the fruit, and the ease with which it parted with its skin. I measured one quart of these olives, and found they weighed 1 pound 13 ounces. I next counted them and ascertained there were four hundred and ninety-five; so that the average weight of each olive amounted to $25\frac{81}{100}$ grains. I then extracted the oil from this quart of olives and secured about $5\frac{1}{25}$ ounces of an exceedingly fine quality, or 17.25 per cent.

On January 30, 1881, I had another quart of olives picked from the same tree. They numbered this time five hundred and eighteen, or twenty-three more than on the first of November, three months previous. This showed that the fruit had diminished in size. I took four hundred and ninety-five of these olives, and ascertained their weight to be 1 pound 11 ounces, an average of $24\frac{14}{25}$ grains for each olive, instead of $25\frac{81}{100}$ grains as before; hence, there had been a diminution not only in the volume, but also in the weight; a decrease, in fact, of 4.64 per cent in the former, and of 4.84 per cent in the latter.

From the four hundred and ninety-five olives I extracted 5 ounces of oil, and about $\frac{1}{4}$ ounce from the other twenty-three, but it was of a quality much inferior to that obtained the first time.

Now, if these 5 ounces of oil be compared with the 1 pound 11 ounces weight of the four hundred and ninety-five olives, the production of oil in that case was 18.07 per cent, and therefore 0.82 per cent more was obtained from the olives gathered on the first of November, which gave 17.25 per cent. But if we make the comparison with the 1 pound 13 ounces weight which the same four hundred and ninety-five olives would have had on the latter date, the rate falls to 17.20 per cent; consequently the greater amount of oil which late-gathered olives seem to yield is only apparent.

If we compare the production of oil to the size of the olives used, the apparent difference in favor of the olives gathered late is still more marked. Indeed, the four hundred and ninety-five olives picked on the first of November, 1880, and which amounted precisely to one quart, gave only $5\frac{1}{25}$ ounces of oil; whereas, the quart of olives gathered on the thirtieth of January, 1881, and composed of the four hundred and ninety-five olives which yielded 5 ounces of oil, and of the twenty-three which gave $\frac{1}{4}$ of an ounce, produced in all about $5\frac{1}{4}$ ounces of oil, that is to say, 6.18 grams more, or 4.32 per cent.

From this experiment, and from what has been said before, one may well infer *that the prevalent belief, that olives yield more oil when harvested late, is one of those errors which it is absolutely necessary to correct.*

Besides giving rise to the fallacious belief just referred to, a delayed harvest still brings forth many inconveniences.

Above all, late-gathered olives give an oil of poorer quality. This fact was noted even by Columella, who, despite his opinion that very ripe olives yield more oil, could not help but acknowledge that its quality was impaired. Indeed, he says on this subjeet: "The riper the fruit, the harsher and less agreeable the juice."

Besides, by remaining a long time on the tree the olives weaken the plant very much and hinder the formation and growth of new buds; consequently, the next crop is always light.

Also, the longer the fruits are left on the tree the more are eaten by the birds, which are fond of them. The olives, moreover, are then subjected to rough weather and frost, and large quantities are carried away by the rains, while the oil obtained from the remainder is less abundant and of lower grade.

That the olives harvested in freezing weather give less and a poorer quality of oil, has been proved by the experiments of Professor Bechi. Here is how he expresses himself on the subject: "But, in delaying the harvest until the olives are perfectly ripe, it frequently happens that they are caught by a sudden frost, and then, as is well known, they yield a lesser quantity and an inferior quality of oil. Wishing to observe this phenomenon more closely, we took a certain quantity of olives and produced their congealment artificially by means of ice and salts, just

* By Professor A. Aloi, Professor of Agriculture for Italy. Being the latest information published on the subject.

as is done by Nature herself, when the lowering of the temperature causes the water to freeze. The olives were penetrated by the cold, and a few days after we put them into the press and extracted the oil. A little clear oil flowed at first, but there soon began to come out a mass of paste, from which the oil could be separated only through the use of a great deal of boiling water. It is true that if we reckon the total amount of oil obtained from the frozen olives, none of it was lost, though it was full of dregs, and upon a close examination it was found to be as abundant as in the sound olives. We may say this, however, in regard to the congealing of olives: It is known that when the oil is exposed to the cold, its components become separated; that is to say, the stearine and margarine from the oleine. The fluid part exudes freely from the tissue of the olive, while the solid part remains firm within the cells. But the tissue of the frozen olives is torn by congelation, and is, therefore, easily modified by the mingling of the albuminoid matters. The unpleasant and harsh taste acquired by the oil emanates precisely from the alteration of the substances which form the food of the olive, and the oil mixed with that being richer in solid matters, does not become fluid and flow out, except with hot water and by means of heat. The admixture of the azotous matters, which is brought about by the rupture of the cells, is the cause of an incipient fermentation, and of that peculiar odor and taste which the oil so readily attracts and appropriates."*

After all that has been said, it is to be hoped that no one will any longer contend "that delay in the harvesting of olives is injurious to both the quality and quantity of the oil," and that it should, therefore, be avoided.

On the other hand, the premature gathering of the olives is injurious to the quantity of the oil, but not to its quality.

If the olives be taken off the tree very early, they give a palatable and delicate oil, and one which tastes of the fruit, but the quantity will be rather small.

Professor Bechi, whom we have just cited, came, after some experiments, to the following conclusions:

"That early-picked olives give the best quality of oil, but a little of it is lost, especially by remaining mixed with the dregs; that well-ripe olives yield a little more oil."

The olives should, therefore, be gathered when they have reached that degree of maturity which would insure the greatest quantity of oil of good quality.

The olive is ripe when it assumes a deep violet color, tending to a rather clear black, and the pulp is easily detached from the stone. Then it contains:

Pulp	51.26
Water	14.38
Stone	20.16
Residue	8.38
Oil of the kernel	0.06

He, therefore, who wishes the finest oil must not wait until the olive has reached complete maturity, but it is necessary for him to anticipate somewhat the harvest. It is not to be inferred from this that ripe olives give oil of inferior quality. One has to make a distinction between fine oil and that which is very fine. Ripe olives give fine oil and a larger quantity. Olives that are a little unripe yield the finest oil, but the quantity is somewhat smaller. It is well to state, however, that in some regions the oil thickens very much in the pulp cells of the olive that has turned black, and becomes charged with coloring matter. It is advisable in that case to gather the olives a little before they have attained true maturity if fine oils are desired.

* Bechi, "Saggi di Esperienze agrarie," No. 14, Florence, 1874.

The following deductions may be drawn in consequence in regard to the season in which olives should be harvested:

First—Olives picked a little before maturity give the finest oil, but some of it is lost.

Second—Olives gathered when just ripe furnish the greatest quantity of oil, and it is of good quality.

Third—Olives harvested late yield an oil of inferior grade.

Fourth—In southern climes the formation of the oil within the pulp of the olives is perfected a little before the fruits have reached complete maturity.

The season for harvesting the olives having been determined, it is now time to consider the second question pertaining to this chapter; that is, the manner in which the olives have to be gathered.

The evils resulting from the natural fall of the olives are about as follows:

First—By prolonging the olive harvest one has to incur larger expenditures, and encroaches upon time which should be devoted to other occupations no less important.

Second—Late-gathered olives always give an oil of inferior quality.

Third—The birds and animals fond of olives have an opportunity to devour a large quantity, and hence the production is smaller.

Fourth—The rains and the winds are given more time to bring destruction and make more serious ravages.

Fifth—To lengthen the stay of the olives upon the tree does harm to the fructification of the following year.

The harvest based upon the natural fall of the olives should be, therefore, absolutely proscribed.

The harvest made by beating the fruit down with poles is no less to be proscribed, or rather, forbidden. This illy advised mode of gathering the olives, so much in vogue, should be abandoned absolutely and forever. Knocking down the olives, as is done for nuts, is most injurious to the plants. Striking the trees in this way ruins the product of the subsequent year, because the olive bears fruit on the two-year old wood, and in beating down the olives with sticks there occurs a great destruction of shoots upon which the future crop depends. This inconsiderate practice has given rise to the false belief that the olive is a plant which fructifies every other year. If we destroy the shoots which would fructify in the next year it is but natural that the plant would not give fruit in that year.

One cannot have an idea of the damage caused by beating down the fruit. A plantation of olives that have been struck with poles looks as if it had been visited by a severe storm. The ground is literally covered with broken shoots and the trees can no longer be recognized, from rough usage, their heads being in disorder and shorn of their more tender parts, or presenting bent shoots partly fractured and hanging. With a little attention, one may readily perceive that the tender shoots are almost totally destroyed, part having fallen on the ground, part being broken and pending from the tree, part being bruised. A storm could not produce like damage.

These are not the only evils brought by the use of the stick. The plant is injured in its bark at several points, a considerable number of buds, which fill an important function in vegetable life, are torn and ruined, and finally the olives undergo lacerations and contusions, either directly in being hit by the pole or on account of being dashed against the ground, which excites an early fermentation, while part of the fruit is lost by being hurled far away from the tree.

The ancients knew better how to appreciate the olive; they forbade, by law, the beating of the precious tree of Minerva. So great was their veneration for it that they respected, religiously, the famous precept which formed part of their code: "Do not cut or strike the olive."

I understand that sometimes the tallness of a tree and its peculiar position compel the olive growers to use a stick to gather the olives; but there is a great difference between a general use of the pole and its employment in a special circumstance. In the first case it is considerable; in the second, it is barely excusable. I say excusable, because, instead of striking the big trees, it would be better to shake them, as this would produce the same effect with regard to the gathering of the olives, and not be subject to the disadvantages already enumerated. But if one be so obstinate as to persist in beating instead of shaking the fruit off the big trees, he should at least be cautious enough to use canes instead of poles, and take care not to break and knock down the tender shoots upon which the future fructification is dependent.

The best and most commendable way to gather the olives is to do it by hand, since thus are avoided the evils produced by beating down the fruit or by its natural fall. When the olives are picked by hand the tree is not injured in any part; the shoots destined to bear fruit are not broken or bruised; the olives can be taken off the plant in due season, and hence, not only is the future production not curtailed, but healthier and nicer fruits are obtained, and in greater quantity; thus producing more and a better quality of oil.

The olives that are picked by hand produce the finest oils, and are most esteemed in trade. It will be sufficient to cite the Province of Bari, in support of this assertion. The Province of Bari, which, prior to 1830, according to De Cesare,* was behind Kabylia, Greece, and Turkey, in the matter of oil production, and furnished most fetid and blackish oils, fit only to make soap or to burn, is to-day the model district of southern Italy, not only for the fabrication of oil, but also for the culture of the olive; in fact, it is the most progressive region after Tuscany. Now, in that province the olive harvest is done by hand, because the owners of plantations are sensible, and know what effect the manner of picking the olives has upon the quality of the oil. In the neighboring district, on the contrary, the Province of Lecce, which is the chief oil-producing region of Italy, and where are produced the worst oils, used only for burning, making soap, lubricating machinery, etc., the olives are not gathered until falling from the tree.

In Tuscany, that classical region of the olive oil, and especially in the Province of Lucca, where is produced that liquid which surpasses

*Relazione sugli oil commestibile alla Esposizione Universale di Vienna dell anno 1873, of R. De Cesare.

the most famous oils of all countries in fineness and delicacy, the olives are gathered mostly by hand. When the picking is done by hand, one should clear up the ground beneath the trees a long time before the fruit is ripe, in order to facilitate the gathering of such olives as the wind, a prolonged drought, or injurious insects might cause to fall. These olives are to be put aside after being gathered, and kept by themselves when expressing their oil, which is of inferior quality; and in no case should they be mixed with those picked by hand from the tree.

The proper time for harvesting having arrived, the tree is surrounded with large pieces of canvas, held rather tight. The pickers rub by hand the small branches loaded with olives and let the fruit fall upon the canvas. As soon as the stretched cloth is sufficiently covered, the ends are brought together and the olives dumped into baskets close by, which are then carried to the oil factory. The branches that are too high or too far away to be reached, may be stripped of their fruit by shaking, but never by striking. The shaking of the branches is done by means of an iron hook set at the end of a long pole (Fig. 1), or by a hook wholly made of wood (Fig. 2), both well padded at the curved end with cotton, to prevent injuring or tearing the bark, and consequently the buds. To use the hook, it is simply necessary to pass it over the branches and shake them repeatedly, thus forcing the olives to fall.

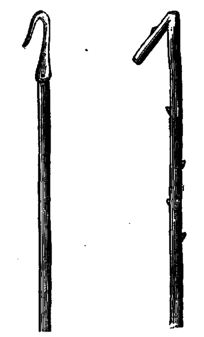


Fig. 1. Fig. 2.

It would seem at first sight that the gathering of olives by hand, as just described, must entail a larger expense than their beating down, but such is not the case; hand-picking is the most economical.

It is important also to have in mind the state of the atmosphere during the picking season. The olives should preferably be gathered on dry and sunny days. But if, owing to circumstances quite independent from the will of the grower, they have to be gathered in damp or wet weather, they should then be dried in the grove itself before being sent to the crushing-rooms. This may be easily done by spreading them over canvas or boards exposed to the sun and sheltered from the dust. Whatever be the mode followed in gathering the olives, it frequently happens that foreign matters get accidentally mixed with them, and the olives themselves are covered with dirt; it is advisable in that case to clean or wash them in the field. The washing of olives that are covered with dirt is easily effected by putting them into sieves pro with handles, and dipping them repeatedly into a basin full of w They are then dried in the sun.

The olives, having been gathered and cleaned, it is now necessa carry them over to the oil factory and pass them through the cru and press. The transportation may be accomplished immediately the harvest, or a certain time after. If, owing to either of the circ stances mentioned, the olives have to be kept in the field for a protra time, it is necessary then to place them upon cloth or boards, in o that they may be kept clean and uninjured. One must also avoid ting them in heaps, but spread them out as much as possible, the la not to exceed six inches in thickness, so as to prevent fermentation setting in in the mass, which would ruin the oil, as will be shown fur on. The olives should always be carried in baskets and never in sa as is practiced in a few places, because the olives in sacks are ea bruised, and even broken, and, consequently, they ferment if kept any length of time at the factory, and the oil is spoiled. For the s reason one must avoid throwing the olives with violence into the re tacles.

It would be proper to speak now of the way to keep the olives in oil factory, but I deem it useful to give first the description of the pl where the oils are manipulated, and of the tools and machines requi in their handling, and to this will be devoted the next chapter.

MACHINES AND IMPLEMENTS PERTAINING TO THE FABRICATION OF OLIVE

The machines and other implements necessary for the fabricatio oils begins with the crusher, which represents the first and most imp tant machine of the factory.

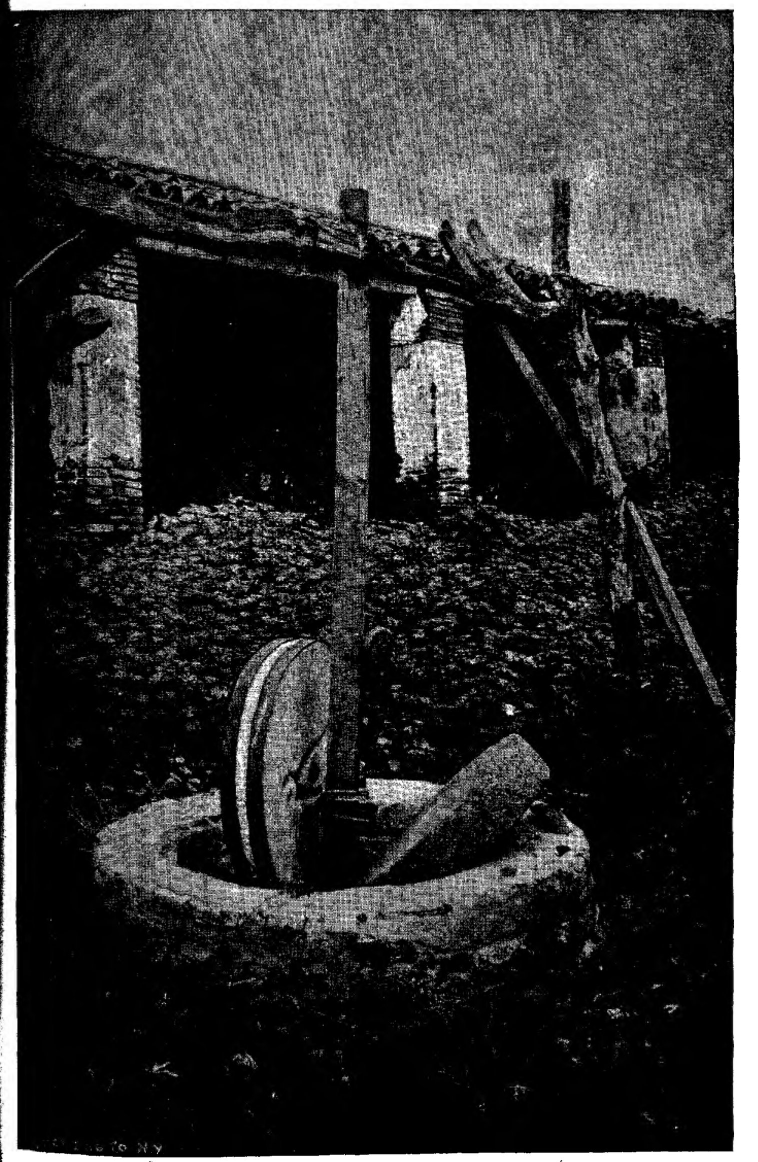
We call the machine destined to crush the olives, preparatory to th being pressed for extracting the oil, a "mill," or "crusher."

The oil is contained in certain cells which form part of the oliv and it cannot come out unless they be broken; hence, one can read understand the importance of crushing the olives. The best olive is that extracted from the pulp of the fruit, without cracking the sto which also contains oil, but of inferior quality, and therefore the b crusher would be the one which could mash the pulp of the olive a yet leave the stone intact. But the science of mechanics, it must confessed, has not been able so far to devise crushers of this descripti There exist, it is true, a few machines designed with the view of direc separating the pulp of the olives by working it apart, but these do n answer the purpose well.

I have seen some authors* praise a mill answering the purpose grinding the pulp of the olives without cracking the stone. In ma of those in use a movable upper stone of the form of a truncated co is imbedded in and surmounts a fixed lower stone of similar shape. differs from them chiefly in having a special mechanism to increase decrease the space between the two stones.

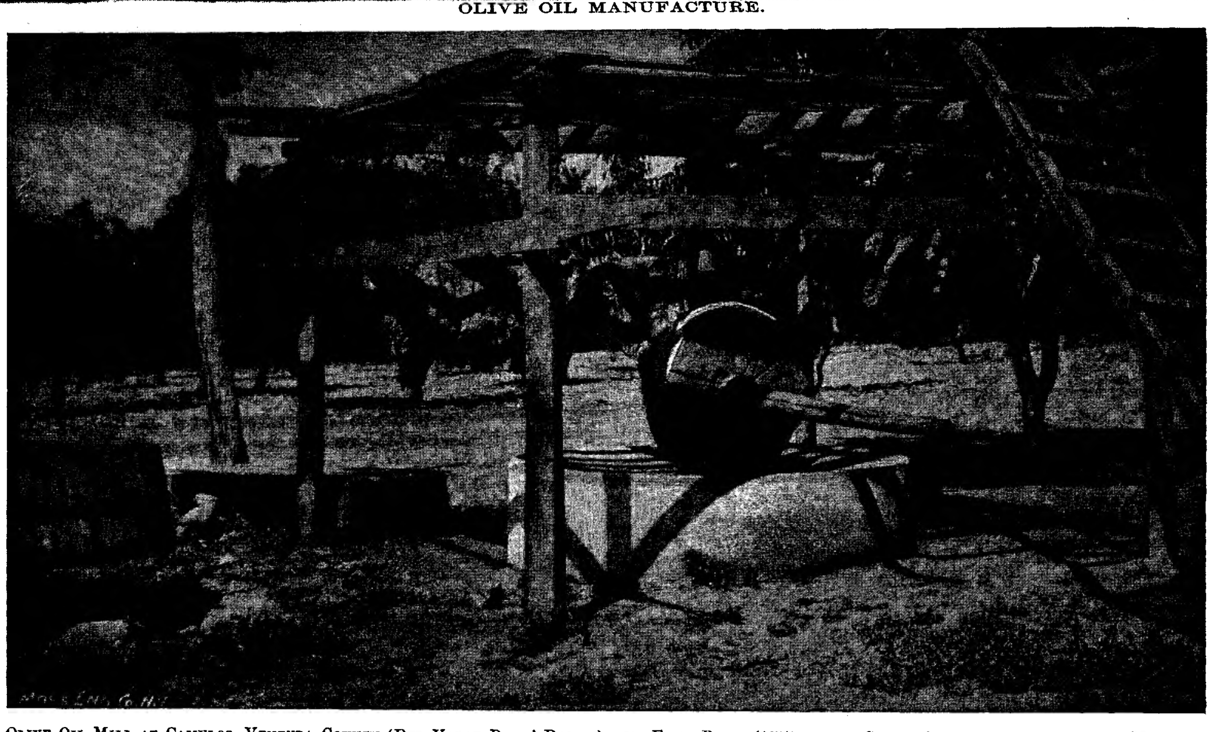
A sufficient space can be left between the two stones so that the pu of the olives alone will be crushed, and not the pits; and the paste fro this first grinding being put under the press will give virgin oil, and the residue of the pression be passed again through the mill, keepin

* "Enciclopedia Agraria" of Professor Cantoni, Vol. IV, 7th part.



OLIVE OIL MILL AT MISSION SAN DIEGO, THE FIRST BUILT IN THE STATE (DATE UNKNOWN). SUPPOSED TO BE OVER A CENTURY OLD.

OLIVE OIL MANUFACTURE.



OLIVE OIL MILL AT CAMULOS, VENTURA COUNTY (DEL VALLE BROS.' RANCH), THE FIRST BUILT (1871) IN THE STATE, OUTSIDE OF THOSE AT THE MISSIONS.

the stones closer, the pits also will be crushed, and one will be able, with this second paste, to draw new oil, though of lower grade; thus is rendered possible that segregation of the oil which is so useful and so desirable for the advantage of the industry.

I may observe, in the first place, that the olives fed to a mill cannot all be of the same size, and consequently the pits cannot all be equal; if, therefore, the millstones be set apart so as to crush only the pulp, it will always happen that many olives will have their pits crushed and many others will not be stripped of their pulp.

In the second place, a great deal of time is consumed in operating a mill in this way, as only a very small quantity of olives can be put under the stone at one time, which is contrary to economy.

Lastly, the working of the horizontal stone must be very rapid, in order to produce the desired result, and consequently the paste becomes heated to excess and the oil thus loses in quality. It must be admitted, therefore, that the best machine for crushing the olives known to-day is still the crusher with vertical stones. When working the olives in small quantity one may use the hand-crushers, or better, the crushing cylinders. The crusher is a very simple machine formed of two cylinders of cast-iron, fluted, horizontal, and turning in opposite directions with equal speed, but rather slowly. Motion is imparted to one of the two cylinders by means of a crank, and it is transmitted to the other by cogs. Above the two cylinders is set a hopper, into which the olives are put, and under them is placed a receptacle to receive the crushed fruit. The hopper is provided at the bottom with a small grooved cylinder, which, by turning more or less rapidly, regulates the descent of the olives so as to supply the cylinders with just the quantity strictly necessary to their proper feeding. The crushing cylinders may also be driven by means of horses, or even by steam; but in that case the cylinders are very large.

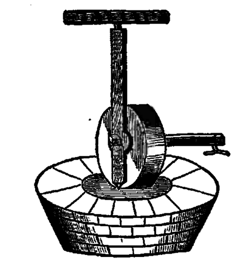


Fig. 3.

The machine with crushing cylinders is good merely for the smaller establishments.

The crusher that is mostly used is composed of two disks of granite, or sandstone, or compact limestone (see Fig. 3), horizontally upon a strong support, and has sides somewhat raised and inclined towards the center, presenting the appearance of a mortar formed of a nearly spherical segment. The other disk revolves in a vertical plane, being attached to an upright board, or post, in the middle of the mortar, by means of an arbor passing through its center, and which is fixed by one end to the board, and bears at the other a whiffletree for a horse.

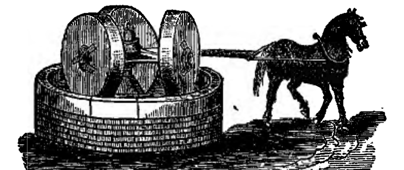


Fig. 4.

The mortar consists of a circular well, the bottom or bed of which is made of hard granite, and surrounded by a wall lined with stone slabs united with good cement to prevent the escape of oil. In the well turns the stone, which is set in motion either directly or through gearing. There are, besides, two iron arms; one attached to the tree and the other to the axle which guides and drives the stone, and they serve to stir up the paste.

Many other crushers in use are similar to the one just described, differing only in that they have two stones instead of one.

Crushers can be made with two, three, or even four stones, moved by animals, either directly or indirectly, through gearing, or else by inanimate force, such as steam or hydraulic power. Instead of minutely describing these crushers, which would require much space, without giving a really complete notion of them, I deem it more useful to illustrate them by figures, so that the readers may form a much more exact idea of their construction.

In Fig. 4 is represented a crusher with three stones moved by animal power. The stones are sustained at different distances from the center by a cast-iron arbor provided with pivots, upon which they revolve.

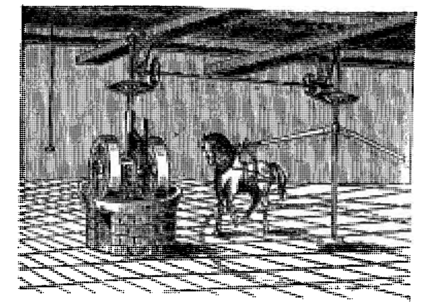
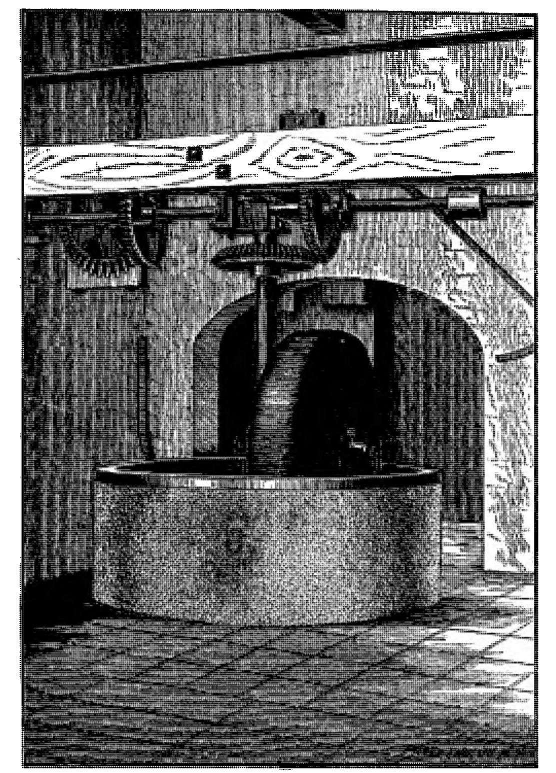


Fig. 5.

To the arbor is also secured a bar, to which is attached the animal which puts the stones in motion by dragging it.

The crushers, with two or four stones moved directly by animal power, are also built in the same way.

OLIVE OIL MANUFACTURE.



Samuel Rae & Co., Boston.

OLIVE OIL MILL, WORKED BY STEAM OR HORSE POWER.

Fig. 5 shows the application of horse-power to a two-stone crusher through the medium of gears.

The same type answers when the crusher has to be worked by inanimate force, such as hydraulic power or steam, it being only necessary then to suppress the vertical tree to which the horse is attached, and to provide the horizontal shaft with a pulley, as may be seen in Fig. 6.

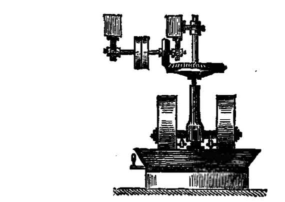


Fig. 6.

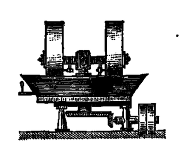


Fig. 7.

In Fig. 7 is shown a crusher with two stones operated indirectly from underneath, and which may be moved either by horses through gearing, or by a hydraulic motive force, or by steam. In large works, where inanimate power is used, these crushers driven from underneath are to be preferred, as occasioning less inconvenience and requiring no upper beam to support the shafting.

If one were to be governed by the famous old saying, "haste slowly," the palm would belong to the ordinary crusher, since it is held that the more slowly the millstone is turned, the better is the oil obtained. But customs change with the times; the sciences progress, the mechanical arts make gigantic strides, and hence some of the old maxims cannot and must not be followed any longer.

Olive growers who have devoted much time to the manufacture of oils oppose the crushers with two or three stones. They consider that no good oil can be obtained unless the millstone be moved slowly, that is, at the rate of six to eight turns a minute. A faster movement would cause the paste to heat and the oil to acquire that unpleasant taste called "heated." That an increase in the number of revolutions of the stone per minute causes the paste to become somewhat heated is beyond doubt, but that such a light heating causes the oil to lose in quality is not sufficiently proved, and therefore there is no great reason to depreciate the crushers possessed of two or three stones and moving a little faster than six to eight turns a minute. With such crushers the work can be doubled and trebled, and still the stones be moved with that slowness of speed which one may consider as the most apt to produce good oil. For these reasons the crushers with several stones must not be undervalued, but on the contrary, appreciated and adopted, because effecting a great economy in the expense of working the olives.

To grind the olives with the ordinary crushers is a long and painful task, and requires a great expenditure of time and labor, not to mention that it calls for the continuous employment of a rather skillful workman to watch the crushing of the olives, push them with a shovel under the stone, and draw them back after they have been ground; the operation, in consequence, is not only long and expensive, but also imperfect.

Much more serviceable are the crushers with troughs, which, according Caruso,* present the following advantages:

First—The olives do not escape from the basin.

Second—The attachments with which the crusher is provided take the place of the workman, and hence there is a saving of labor.

Third—Less motive force is required.

Fourth—It crushes the largest quantities of olives in the shortest possible time, thus saving much expense.

Now, if crushers present such advantages, the three-stone and four-stone crushers must present them in a greater degree. Indeed, the quantity of olives which can be put at each time into the different crushers, and which constitutes what is called a charge, is the following, to wit:

In one-stone crushers	264 to 352 pounds.
In two-stone crushers	352 to 484 pounds.
In three-stone crushers	484 to 660 pounds.
In four-stone crushers	660 to 880 pounds.

One easily understands that the advantage lies with the crushers having the most stones, not only because they grind at each operation a larger quantity of olives, but also because the latter are sooner subjected to the press. The importance of the establishment then shall determine whether it be expedient to adopt a crusher with two, three, or else four stones.

It is expedient, at any rate, to always give the preference to a single crusher with a double number of stones over two crushers with half the number, since the same work is performed with the first in a shorter time and with greater economy. Thus, a crusher with four stones is to be preferred to two crushers with two stones, because it accomplishes about the same amount of work, occupies less space, and requires a motive force of much smaller intensity.

As previously stated, the motive forces applicable to the crushers provided with one or more stones are the muscular power of animals and the inanimate power of hydraulic machinery and steam. It is impossible to lay down precise rules on this subject, since they are better determined by the nature of the establishment and its topographical position. I only say that for oil factories of minor importance it is expedient to use crushers moved by animals, and that for the large works preference must be given to those actuated by steam or hydraulic power. As regards economy, the motive force which should be preferred is the hydraulic, since it does not require the expense of fuel as the steam system, nor the feeding of animals, as the horse method, but it cannot be had only under certain peculiar local circumstances.

The steam system has the advantage over the horse system for quick work and the saving of labor, but it can be applied only in large oil factories, as otherwise it would not be profitable.

The application of hydraulic or steam power to the crushing of olives is condemned by some people on account of the heating of the oil already mentioned. It is contended that as the two forces cause the millstones to revolve more than six to eight times a minute, the paste becomes heated and the oil loses its quality. These assertions are, nevertheless, contradicted by facts. Many oil establishments crush the olives with crushers run by steam, and yet they obtain oils of the very

* "Trattato sulla coltivazione degli olivi e la manifattura dell olio," Palermo, 1870.

best quality, much sought for in trade. Likewise, there are some oil houses where steam is used.

These facts serve to prove also that there is exaggeration in contending that with the increase in the number of revolutions per minute of the crusher-stone the oil loses in quality. It is not a light momentary heating undergone by the paste beneath the stones which can ruin the oil, although a prolonged and rather strong heating would spoil the precious liquid, as it would cause the fermentation of the olives, and hence of the oil. The crushers with several stones moved by the inanimate force of either hydraulic or steam machinery may, therefore, be adopted without danger of not receiving an immense advantage from their use.

Some one has attempted to apply the hydraulic press to the extraction of oil, making it perform the office of crusher and press at the same time, but the result did not correspond to the expectation. In order that the oil may come out of the olives, it is necessary to break the cells in which it is contained, and this is effected by crushing and triturating. Hydraulic presses, however, merely squash the olives, and consequently the whole of their oil cannot be drawn out, whatever be the pressure. These presses do not, therefore, answer the purpose.

After the crusher, the most important machine of the oil factory is the press.

One of the roughest presses, which is still used in many factories, is the press called the Calabrian (Fig. 8).

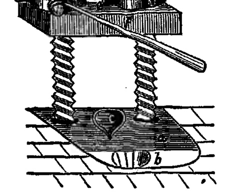


Fig. 8.

It is composed of a big block of wood, *a*, fixed horizontally upon the floor, close to a basin, *b*, containing a tub destined to receive the oil. In the middle of this block there is a disk, *c*, upon which are placed the bags filled with paste, and which is surrounded by a small channel destined to receive the oil and lead it to the tub. From the ends of the block rise two big wooden screws, *d d*, secured to the base and provided with inwardly-threaded disks, which by going up or down raise or lower another block, *f*, which expresses the oil on being brought down upon the bags filled with paste. It is this second block, therefore, which performs the function of a press.

The small ladder, *g*, which is placed upon the internally-threaded disks, is furnished with a big iron hook engaged by a ring, *t*, secured to the upper block, and as it goes up and down with these disks, it consequently forces the block to follow its movements.

The first downward movement of the threaded disks, and hence of the block, when the bags filled with paste have been stood up in place, is accomplished by hand, but afterwards recourse is had to a lever or strong bar of wood, *x*, the point of which is introduced between a corner of the threaded disks and a twist of stout rope, *z*. The bar is pushed by two, three, and even four persons.

More effective than the Calabrian, but still imperfect, is the Genoese press, which has been substituted for the former in many factories of the Calabrias, Sicily, and other southern districts of Italy. The Genoese oil press is nothing more than the percussion press, and it is represented by Fig. 9.

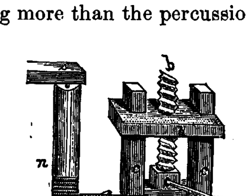


Fig. 9.

It also consists of two wooden blocks, *a* and *b*, set horizontally one above the other, and both fixed and kept in position at a certain distance apart by two pillars of wood vertically set up. In the middle of the upper block are formed internal threads, into which runs a screw, *d*, provided at its head with a solid disk of wood, which is lowered as the screw comes down and presses the paste bags stacked up on the disk, *s*, of the lower block and squeezes out the oil, which is received in a small vat underneath. In the head of the screw are bored four ball-shaped holes, set in the form of a cross, and into which is inserted the end of the operating lever. When the pressure increases, and the lever no longer answers, the latter is replaced by a bar, which is inserted at one end into the holes of the screwhead and attached by the other to a rope fastened to a capstan or windlass, *n*, composed of a vertical post moving on its own axis, and of a lever, *r*, set in the shape of a cross, and to which hand force is applied.

To the Genoese presses, as formerly constructed, have been made some modifications, consisting of the substitution of iron screws and threaded disks for the wooden ones. With these modifications the work is rendered easier. To-day, however, the presses made entirely of wood, or partly of wood and partly of iron, give place to the presses wholly made of iron, as the latter afford more commodity, greater solidity, and exercise a much stronger pressure.

Among other presses there are those with a simple lever, and those with a compound lever. The simple-lever press, shown in Fig. 10, is made wholly of soft and hard iron. The columns are of hard iron turned in the parts, which are set in the base and top, and they are only three in number, so as to leave a wider space within which to handle the lever. These presses were once built with four columns, but to-day

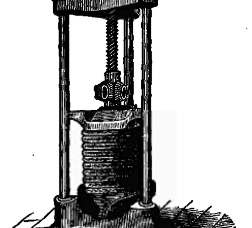


Fig. 10.

they are discarded, and those with three columns preferred for the advantage mentioned, that is, handling of the lever. The head and base are of soft iron. The screw is of hard iron turned on the lathe, and consequently these presses can exercise strong pressures. They are made in various sizes, and the pression they exercise varies from about fifty-two to one hundred and thirty-two tons.

Preferable to the one just described is the press with compound lever and continous movement, represented by Fig. 11, because it not only presents the simplicity and solidity of the simple-lever press, but exercises a much greater pressure.

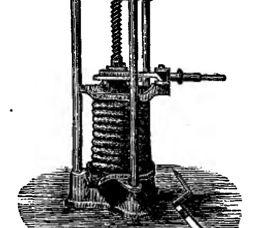


Fig. 11.

One man alone, with a simple backward and forward movement, which he imparts to the lever, can exercise as much as one hundred and ten tons of pressure. Moreover, the pressure of these presses is even, slow, and continuous, conditions which are favorable to the extraction of the oil from the olives.

Although the advantages of the compound-lever press over the simple-lever press cannot be disputed, I will state here the results of an experiment I made on this subject in November, 1880.

I took about twenty-one and one quarter gallons of olives, had them crushed, and afterwards pressed twice with a simple-lever press, as much as could be done, and in this way obtained four and one quarter gallons of oil. I then had the residue, which the laborers said could not contain a single drop of oil, subjected to a compound-lever press, and to the great astonishment of these same laborers it still yielded over two pints of oil.

Instead of having a disk in the lower part for receiving the paste bags, as the Calabrian and Genoese presses, the iron presses are generally provided with a metal plate having a high rim and a spout for conducting away the oil, like that shown in Figs. 10 and 11.

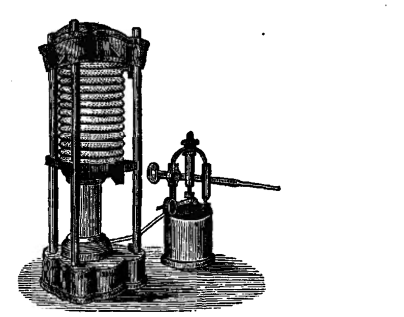


Fig. 12.

A greater pressure than that secured by any of the presses previously described, may be obtained with the hydraulic press. Of such presses, there are some built for the extraction of oil which can give as much as four hundred and forty tons of pressure. In Fig. 12 we have a type of the hydraulic press. Hydraulic presses, however, are not very suitable for the extraction of oil.

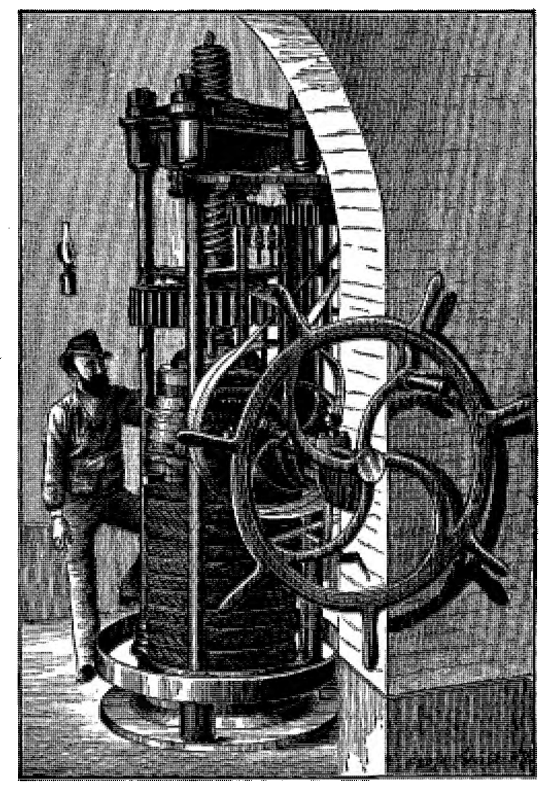
"Some oil makers," says Caruso, "have thought they could substitute the hydraulic presses for those mentioned (percussion presses). There is no doubt that they are more expeditious, and can be applied with great success to the extraction of oil from the seed of flax, spurge-olive, rape, ground-nut, etc., but it is well to repeat that the nature of the fruit of the olive is quite different from that of the other oleaginous plants, inasmuch as it requires both time and a prolonged trituration to liberate all the oil.

"The hydraulic press compresses with violence and force, and cannot produce any other result but that of compacting the grounds into a tenacious mass; the oil therefore remains imprisoned, and is lost in the oil-bearing cells which are not broken and disruptured.

"The oil does not flow out quickly, but it takes some time before it leaves the paste and comes to the surface of the bags. If the pressing be done hastily, as with hydraulic presses, the mass contracts instantaneously and the oil remains inclosed.

"It requires a strong but slow pressure to draw out all the oil from the olive; *strong*, to drive it out and free it from the albumen which

OLIVE OIL MANUFACTURE.



Samuel Rae & Co., Boston.

OLIVE OIL PRESS, WORKED BY STEAM PRESSURE OR HAND POWER.

retains it; *slow*, to give it the time necessary to go through the crumbs and leave the albumen."

Hydraulic presses, therefore, may be used at pleasure and to much advantage for the extraction of oil from the dregs, when they fill the office of presses of last compression, but never for the first or second extraction.

The other utensils belonging to the oil factory are the bench, the tub, the paste recipients, the vats, the bottles, the barrels, the jars or pots, etc.

The bench serves to receive the paste produced by the crusher, and to fill the paste bags. It is generally made of wood, and located in the same room with the crusher. It must be of such a size as to be able to contain all the paste from a whole charge or crushing, and allow besides for the filling of the paste receptacles. To prevent the wood, of which the surface of the bench is formed, from becoming saturated with oil, it is expedient and very useful to cover it with a sheet of tin, which not only prevents the absorption of oil on the part of the wood, but can be cleaned with great ease.

The tub is a recipient formed of wooden or iron staves; into it is put the paste as soon as it comes out of the crusher, whenever it is wanted to draw off the virgin oil. As the wood composing the tub presents the same inconvenience indicated for the bench, and in a much greater degree, since the paste remains in it for a longer time, it is useful to line it also with tin on the inside, so as to avoid the trouble and expense of changing tubs every time one wants to secure the virgin oil, or else subjecting it to repeated washings with lye and rinsings with vinegar.

In many places the tub is put into a reservoir located near the press, and used to receive directly the oil flowing therefrom. Whether or not the paste be subjected to the extraction of virgin oil, it is always put into the bench and thence into the paste recipients, to be afterwards subjected to the pressure of the oil press.

Of all the paste bags in use, the best ones are those made of rush, because the rush absorbs little or none of the oil and does not communicate any flavor to the liquid. But bags of this description are easily stopped up, on account of their peculiar texture, and last but a short time.

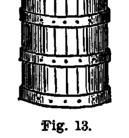


Fig. 13.

The most desirable paste recipients are the modern ones which accompany especially the iron presses. These recipients (see Fig. 13) are composed of perforated iron plates or of iron bands, set up at small intervals from each other, and kept in place by stout metal hoops, like those used in the pressing of wine.

The flowing out of the oil from the metal recipients is facilitated by inserting perforated boards or disks of rushes at short intervals throughout the paste. To the metal recipients is imputed the defect of getting stopped easily, and hence preventing the escape of the oil if the holes in the plates are small, and of letting out the paste if these are too large. This defect is easily overcome by lining them with sackcloth on the inside. Thus arranged the metal recipients are to be preferred to all the others, for the reason that they cost less, are destroyed with much difficulty, need less repairs, and do not require during the pressing all the cares necessitated by the other paste receptacles. The oil flowing from the paste recipients is collected either in the tub or in the vats.

OIL VATS.

The vats may be likened to common, large-sized buckets, provided with two opposite prolonged staves having a hole in the upper end for the insertion of the index and middle finger, so as to facilitate their transportation. For the reasons mentioned above, iron recipients are to be preferred, or else wooden vats lined with tin on the inside. To avoid the repetition of the same things, I may say, once for all, that in the fabrication of oil one should avoid as much as possible the contact of either the paste or the oil with wood. Wood (excepting oak), owing to its porosity, becomes saturated with oil, and as the latter is sometimes of bad quality, it spoils the oils with which it subsequently comes into contact.

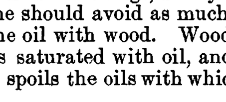


Fig. 14.

After the oil has been secured it is set at rest so as to make it clarify, and to this end are used glazed earthen vases or tin pans, rather wide and low. (See Fig. 14.) Their size is determined by the quantity of oil handled in the factory. The oil is taken out of the tub or of the vats with a small bowl or cup of wood, or better, of tin. A small bowl made of a gourd is also used. But besides the natural clarifying vessels, so to speak, the oil factory needs other clarifying utensils, called *filters*. Of filters there are many, but I will only mention the principal ones.

FILTERS

The filter most commonly used is formed of a vat with a double bottom, very large, and provided with conical holes, filled with carded cotton. The cotton is placed evenly, and not too compactly, as otherwise the oil could not go through. In order to prevent the filter from getting clogged up, it is usual to cover the bottom with a layer of tow, or else with several layers of straw. The apparatus for filtering, and which is mostly used, is constructed as follows:

A wooden box thirty-nine and one half inches long, and nearly two feet wide, and twenty-seven and one half inches deep, set upon four legs, and lined with tin both on the inside and outside. From the bottom of the box hang either six, eight, or twelve cylindrical tubes of tin, which are perforated. In these tubes is placed some carded cotton, to a thickness of two and three quarters to three and one eighth inches, which is kept in place by a perforated disk, also of tin. Under the tubes there is a second recipient, likewise made of tin, destined to receive the oil flowing from the filter.

Another valuable filter is the one composed of a barrel carbonized inside and divided into two compartments by means of a diaphragm; in the upper compartment, and precisely on the diaphragm, is placed a layer of very coarse sand one finger in thickness; over this a layer of animal or vegetable charcoal about two feet high, and finally a third layer of coarse sand. In other words, the two feet of charcoal have to be inclosed between two layers of coarse sand. The oil is poured into the upper compartment, and comes out limpid into the lower compartment, from which it is drawn by means of some faucets, which may be located at different heights.

A good substitute for cotton in the filters is a layer of dried mosses, two to two and three eighths inches thick, placed under another layer of tow three quarters of an inch in depth.* A filter containing three layers, one of fine sand, one of charcoal, and another of chalk, is also used. It is asserted that such a filter purifies the oil well, because the sand retains the matters that are in suspension, the charcoal lightly discolors the oil, and the chalk absorbs the water it contains.

I have found very efficacious for the purification of the oil, a filter composed of two layers, one of animal charcoal in grain, washed, and the other of carded cotton.

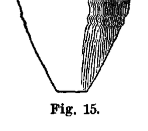


Fig. 15.

It is well to note that the cotton to be used in the filters should be soaked for twenty-four hours in water containing a solution of 1 per cent of caustic soda, and afterwards washed with pure water and dried. This precaution is necessary to prevent the cotton from imparting a bad taste to the oil.

VESSELS FOR PRESERVING THE OIL.

The oil having been purified, it has to be put away for preservation, and for this purpose are usually employed glazed earthen vessels, oval in form, somewhat distended in the body, more or less broad and high, of the capacity of about thirteen to one hundred and five gallons (Fig. 15). It sometimes happens that these jars break, and the oil contained therein is lost. To avoid this, many oil makers have them made of zinc or tin. Jars of this description are also preferable to the others, on account of being less porous and easier to close with padlocks, so as to prevent fraud on the part of the domestics. Some

* "L'olio di oliva," by Doctor Alessandro Bizzarri, Milan, 1875.

people use walled reservoirs, covered inside with slate. Reservoirs thus made are solid, but they are subject to the inconvenience of presenting too large a surface of contact to the air. Much better, therefore, is the system followed by some, which consists of inclosing the jars with a solid wall, so as to avoid breaking. Many tradesmen preserve their oils in cisterns or underground reservoirs made of stone, with inner walls of brick covered with cement plaster, or with sheets of lead or slate. The lead lining must be proscribed, for the reason that fresh oils easily attack and dissolve the lead oxides, which render them poisonous, and produce in the consumers that peculiar disease known under the name of "painters' colic," or *saturnina*. However, cisterns should never be used for the preservation of fine oils. In the cisterns may be placed the ordinary oils used in the manufacture of soap, for lubricating machinery, etc. The fine edible oils are to be preserved in rather small recipients of glazed clay, or better, of zinc or tin.

I believe it unnecessary to speak of the other utensils pertaining to the oil factory, such as the picks, shovels, lamps, etc., as they are all too well known. I will only remark that all the machines and tools used in oil making must be kept perfectly clean, as this has a marked influence upon the goodness of the oil. It is indispensable, therefore, that all the implements of the establishment be subjected to frequent washings with water containing 5 per cent of soda. Let frequent and copious washings be lavished upon the crushers, the presses, the mats, the tubs, the vats, etc., since their cleanliness contributes toward making the oil keep. All these practices are conformable to the assertion that any defects which may be disclosed in the oil a few months after its extraction are to be ascribed to the want of cleanliness.

The barrels and casks used for the transportation of the oil, which I have deemed superfluous to describe, as they are very well known, must also be kept clean, and they should be washed with a little vinegar, and then emptied before filling them with oil.

PRESERVATION OF THE OLIVES.

There is an old proverb which says: "Whoever mashes the olive fresh, mashes rightly;" which means that if the fruit from the tree be mashed as soon as picked, it brings more profit. Granting that some proverbs no longer apply after the lapse of a few centuries, the one just quoted will hold good forever, because fresh olives will always, and at all times, yield finer oils than preserved olives, whatever be the means of preservation employed. That the olives mashed fresh give the finest oil is beyond doubt; the ancients *knew* it, the moderns *know* it.

Cato* and Columella prescribed that the olives be pressed as soon as gathered in order to obtain good oil, and Palladius laid down as a rule, not to gather any more olives in one day than can be pressed during the following night.† Presta also advised to mash the olives immediately, and finally Caruso, Bechi, Basile, Cappi, Caponi, and others, to-day, agree in saying that olives put into the crusher as soon as taken off the tree furnish an oil of better quality.

With all this, however, it is painful to see how, in the greater part of the Italian oil-producing regions, is preserved always that most pernicious practice, acquired from time immemorial, of keeping the gathered olives piled up for a greater or lesser time, and afterwards putting them into the crusher to extract the oil.

*Olea ubi lecta siet, oleam fiat continuo. Cato. (Let the oil be made as soon as the olive is picked.)

† Tantum legendum esse olivæ, quantum nocte ventente possimus esprimere. Pall.

The olives kept in a heap ferment and, as will be seen later on, the oil is spoiled, and is no longer fit for table use. It is hardly credible, but still it is true, that in some districts of southern Italy and Sicily the fermentation of the olives is protracted as much as four months, and when they are taken out of the respository to be subjected to the crusher, it is necessary to have recourse to the pick, because the olives lose their primitive form, and are reduced to an almost homogeneous mass, like manure. In certain regions of Sicily it is customary to add salt to the piled olives to purge them, as the Sicilians say, and in others, besides the salt, they place big stones on top of the mass in order that the effects of the purgation may be more pronounced.

Where the olives are heaped the mass of the olives have often been found almost filled with mold, which showed itself even on the surface, and emitted a fetid smell.

In the pernicious practice of having the olives ferment, or, as some people say, *heat* or *effervesce*, is to be found the reason why, in the greater part of the Italian oil-producing regions, and especially in the southern provinces and Sicily, the oil produced is of a greenish color, loathsome odor, and strong flavor, so much so that it cannot be used on the table.

In the Province of Bari, in Tuscany, and in Liguria, regions where fine oils are made, the fermentation of the olives is not practiced.

Before examining the causes for which the oil deteriorates in quality with the *heating* of the olives, I believe it necessary to search into the reasons which have induced the growers to subject the olives to such a heating.

Many are the reasons set forth to excuse this inconsiderate practice, but the principal ones are three in number, namely: the *feudal* system, the *farming* system, and the *false* belief that the fermented olives yield more oil than the fresh ones. The first cause has disappeared with the abolition of the feudal system, but for all that the practice engendered by it continues to subsist. In times gone by the Barons were the sole owners of the lands, and exercised over them the power of high lordship, and as they were invested with the right to condemn, absolve, set a price on one's head, they thus obliged their own vassals to have their olives mashed at the baronial mills by paying a certain compensation, usually in oil. The number of mills, therefore, was too limited and wholly insufficient for the oil industry, and hence was felt the need of resorting to the system of fermentation. In one of these baronial mills still in existence, I have found about twenty cellars for the preservation of olives, each of which is divided into various compartments so as to hold divers lots of olives. But if the obligation under which the horticulturists were to mash their olives at the baronial mill has fallen with the abolishment of the feudal system, the inconvenience of the restricted number of mills as compared with the yield of olives has not disappeared, and consequently the pernicious habit of having the fruit of the olive tree ferment has continued and still continues to subsist. However, this inconvenience may be easily overcome, and with a single effort of good will, since to-day, as we have seen, mills may be built for the small as well as for the large producers, the trade affording nowadays small, middling, and large crushers, small, middling, and large presses.

The second cause, that is to say, the farming system, has not only maintained, as Caruso asserts, but rather increased the practice of fermentation. In all the regions where the farming system exists, and especially in the districts of Messina and Milazzo, it is customary to consign to the lessee the olives hanging to the tree after having estimated their quantity by empirical rules. The farmer has to make the harvest, express the oil at his own expense, and remit to the owner the quantity fixed by the estimator; what is left over belongs to him. And as the metayer does not possess a mill, and is obliged to pay the expenses incident to the extraction of the oil, just referred to—expenses which are estimated according to the grinding—and as the grinding is charged for in proportion to the volume of olives, and not to the amount of oil, he naturally prefers the method of making the olives ferment, because by reducing the volume to two thirds, or down to one half, he succeeds in saving from one third to one half the expense.

The abolition of the farming system on the part of the proprietors would bring with it the abolishment of the fermentation, since it has been proved that the countryman is always anxious to turn his products into cash, he going so far as to gather some yet unripe.

But the principal and most powerful cause which makes the fermentation practice still rule, is the false belief that fermented olives give a larger proportion of oil. That this is the principal and most powerful cause is proved by the fact that the fermenting of the olives continues to subsist in spite of the disappearance of feudalism, and is still practiced to-day in the districts where the farming system is not in use. It is therefore necessary to instruct the oil makers concerning this error, so as to make them abandon a practice which is so injurious and so absurd.

Even the ancient writers on rural subjects have acknowledged that no increase of oil takes place in the fermented olives. Cato wrote that "one must not believe that the oil increases upon the floor; but that on the contrary, it diminishes, and becomes bad."* And Columella afterwards called this belief mendacious (*mendacium*), and wrote that "it is false that the oil increases on the floor, as much as it is false that grain increases on the thrashing floor." Presta, in his valuable treatise on the olives, relates new experiments made on this subject, and thinks he can infer that in the olives the oil increases a very little by means of fermentation and heat. Meloni, in his valuable articles on oil making, comes to the same conclusions as Presta. Caruso, on the other hand, shows clearly that the oil diminishes rather than increases in the fermented olives.

Two grave evils therefore arise from this treatment, the deteriorated quality and the lessened quantity of the oil.†

Filippo Bacile, in a valuable treatise,‡ related rather at length the various opinions entertained in regard to the proportion of oil in the fermented olives, and concludes that the latter do not yield a larger quantity of oil. He also adds that from the results of his own experiments he had to be convinced that the oil from unfermented olives set at rest deposits very little sediment; whereas, the oil from fermented olives drop and abandon nearly one half of sediment, and, moreover, becomes in time detestable. Bacile notes further that if the oil extracted from fermented olives be sold before it is clarified, to avoid part of the loss due to the heavy deposit it makes, it brings a much lower price. Admitting now, what is not true, that fermented olives give a little more oil, what price can it command?

* Cato de re rusrica.
† Caruso. Work cited, p. 119.
‡ Baron Filippo Bacile, Lecce, 1873.

Professor Bechi, of Florence, made, a few years since, some experiments upon fermented olives, which are worth relating in full: "Upon the return of the Agricultural Association of Florence" (it is Bechi who speaks), "Mr. Taruffi raised the question as to whether the quantity of oil increased or diminished in the olives that are kept in store for some time, as compared with the quantity of oil yielded by fresh gathered olives. The question appeared of great importance to me, and I therefore undertook a series of experiments, the results of which I now deem it my duty to make known.

"The first experiments were begun on the eighteenth of December, 1875. The olives were at that time gathered from the tree. The mean density of each olive was $16\frac{1}{20}$ grains, the mean weight $26\frac{3}{4}$ grains, and they gave 19 per cent of oil. Olives kept until the eighteenth of February, 1876, and treated in the same manner, gave four and two thirds more oil as compared with the fresh ones.

"On the thirteenth of December, 1876, I again picked olives from a tree, and mashed part of them fresh, while the rest were put away to be tried later on. It must be said that the mean density of each olive was $15\frac{37}{50}$ grains, and the mean weight $43\frac{1}{2}$ grains; and I secured 18.036 per cent of oil.

"On the twenty-first of February, 1877, I extracted the oil from the olives that had been kept over, and comparing the oil obtained with that yielded by the fresh olives, there would have been a loss of about $4\frac{1}{2}$ grains per hundred grams.

"On the twenty-fourth of October, 1877, I repeated the experiments, and gathered the olives from an olive tree. They were invariably green, hardly beginning to turn black. The mean density of each olive was $33\frac{1}{3}$ grains and the mean weight $28\frac{6}{25}$ grains. These olives gave 17 per cent of oil. Part of them, however, were preserved until the twenty-third of November; they then had all become black and seemed well ripe. Being mashed they gave me three and one third more than what I had secured on the twenty-fourth of October.

"On the eighteenth of December I had gathered the olives which had been left on the same tree, and which were quite black and very ripe. Each olive weighed on the average $25\frac{11}{25}$ grains, and had a density of twenty grains. From these olives I got 24.32 per cent of oil.

"On the third of January, 1878, I pressed a portion of the olives which had been kept over, and having compared the oil with that given me by the fresh olives, I found an increase of 1 per cent.

"On the twenty-second of January another portion of these same olives that had been kept over was pressed. They were exceedingly withered. From such olives I received 6 per cent less oil than from the fresh ones.

"From the results of these experiments, it seems to me that one may conclude that olives gathered green gain in oil by keeping them over for a few days before putting them into the crusher; that olives already ripe do not lose oil if left on the floor for some days, but rather increase their yield a very small quantity; but that a great loss of oil ensues from their being left to wither a long time."

There now remains only for me to relate the results of an experiment which I made, with the same intent, in the course of the year 1880, a year in which there was a full crop.

On the first of December I took about forty-four pounds of olives, half of which were pressed immediately, giving:

	lbs.	oz.
Oil	4	3
Residue	8	0
Water	9	13
Total	22	00

And the other half was stored to be pressed later. And, in order to put the olives into conditions perfectly identical with those which they are usually subjected to during fermentation, I inclosed them in a small net and put them into a cellar together with a large quantity of olives. On the first of January, 1881, that is to say, one month afterwards, I took out the olives stored in the cellar, and found they had lessened in size and weight; they weighed but sixteen pounds and twelve ounces. I extracted the oil and had:

	lbs.	oz.
Oil	3	12
Residue	6	2
Water	6	14
Total	16	12

Pausing now, for a moment, over the experiment of Caruso and over mine, it will be found that the four hundred and twenty-five pounds of fresh olives gave to Caruso:

	lbs.	oz.
Oil	78	9
Residue	167	15
Water	178	8
Total	425	00

That is:

Oil	18.50 per cent.
Residue	39.50 per cent.
Water	42.00 per cent.

And that the one thousand two hundred and seventy-seven pounds and five ounces, fermented for thirty days, gave him:

	lbs.	oz.
Oil	209	15
Residue	335	12
Water	356	13
Total	902	8

With a loss of three hundred and seventy-two pounds four ounces, and hence he had:

Oil	16.46 per cent.
Residue	26.45 per cent.
Water	27.98 per cent.
Loss	29.11 per cent.

The twenty-two pounds of olives which I pressed fresh gave me:

Oil	19.10 per cent.
Residue	36.50 per cent.
Water	44.40 per cent.

And the twenty-two pounds pressed after thirty days yielded:

Oil	17.20 per cent.
Residue	28.00 per cent.
Water	30.80 per cent.
Loss	24.00 per cent.

Thus, far from increasing the oil with the fermentation, the olives decrease it; and, indeed, Caruso obtained 18.50 per cent of oil from the fresh olives, and only 16.46 per cent from the fermented ones; these, therefore, yielded 2.04 per cent less of oil. If we compare the olives that is the loss, and 11.02 per cent if we compare the oil. I had 19.10 per cent of oil from the fresh olives, and 17.20 per cent from the fermented ones; consequently, the fermented olives sustained a loss of oil of 1.90 per cent as compared with the other olives, and of 9.95 per cent as compared with the oil which they would have yielded fresh.

The experiments of Caruso and myself must have a practical value, superior to that of the other experiments, since the preserved olives were put into the identical conditions under which they are usually found when preserved in cellars. And if some experimenter has been able to obtain from olives stored for some time a little more oil than was given by fresh olives, it is because he did not subject them to the true fermentation which they commonly undergo in the cellar, but to a simple desiccation.

It occurs to me here to point out another fact, and it is this: If the oil obtained from the fermented olives, instead of being compared with the original weight of the olives when put away, be compared with the weight they have at the time they are taken out of the crusher, the larger proportion of oil in the fermented olives appears real. And, in fact, if we compare the two hundred and nine pounds fifteen ounces of oil obtained by Caruso from the fermented olives with the nine hundred and two pounds eight ounces they weighed at the time they were taken out of the cellar, and not with the one thousand two hundred and seventy-seven pounds five ounces weight they had before being stored, the proportion of oil will amount to 23.25 per cent, with an apparent gain of 4.75 per cent, or a little more, over the 18.50 per cent yielded by the fresh olives. Similarly, if the three pounds twelve ounces of oil, which I obtained from the fermented olives, were compared with the sixteen pounds twelve ounces, and not with the twenty-two pounds, the proportion would amount to 22.63 per cent, with an apparent gain of 3.53 per cent over the 19.10 per cent secured from the fresh olives.

And this is the error which induces horticulturists to hold that fermented olives give a larger proportion of oil. Columella, therefore, justly said that the countryman forgetful of the first measurement of the olives at the time they are gathered and put away, observes only that which they have when taken out and sent to the mill, not reflecting that the olive shrivels and becomes smaller on the floor, and hence as everybody sees that it requires one third or one fourth the number more to make heaped measures, and that one has to make up by additional olives what is wanting to each measure.

From what has been said above, it seems to me that one may reasonably conclude that it is an error to hold that fermented olives give a larger proportion of oil, and that, on the contrary, they lose some. The loss may probably be accounted for by the separation of the mesocarp, by a partial dissolution of the oil into its elements, and finally, also, by means of the evaporation of the water. As the water evaporates, owing to the heating of the olives, it may carry away mechanically a small quantity of oil with which it finds itself in contact. It is not impossible that to this dispersion is added another of a wholly chemical nature, as pointed out by Caruso, namely, that part of the azotic substance, besides coagulating under the action of the heat, develops ammonia, a very powerful alkali, sufficiently to combine with a small quantity of oil and turn it into soap. The soap is recognized, inasmuch as it is soluble in water. But supposing, though it is not conceded, that with fermentation the olives gain a little in oil instead of losing, would it be expedient to sacrifice the good quality of the oil for a worthless increase in quantity, inasmuch as it is to be hoped no one will contend that the oil extracted from fermented olives is of good quality?

The oils secured from fermented olives are always strong-tasted and rancid, and I do not believe any one can be found who would be willing to exchange two hundred and twenty pounds, for instance, of fine oil, for two hundred and twenty-five, or even two hundred and thirty pounds of fetid oil.

It will not be superfluous to consider for what reason the oil is spoiled in the cells of olives subjected to fermentation. The olive, as every other fruit, or, better, as every organic subject of whatever nature, is subject to alterations and decompositions, which are developed always to the detriment of its component parts. And whatever be the cause of the alterations and decompositions, it is beyond question that their action will be more or less pronounced, according as the olive will remain more or less exposed to the air. The want of serious studies over an edible substance of such great importance makes it impossible to determine with true exactness the causes of the alterations of the oil in the olives, and of what nature these alterations are, and they may be ascertained *only by way of conjecture. Bechi assigns to the olives the following* elementary composing parts:

	In the Pulp.	In the Stone.	In the Kernel.
Carbon	65.40	35.30	60.34
Hydrogen	10.20	6.20	9.65
Azote	1.88	1.57	2.98
Oxygen	19.24	43.56	24.43
Ashes	3.28	2.37	3.00
	100.00	100.00	100.00

The conditions indispensable to the accomplishment of the alterations indicated are humidity, heat, ferment, or some other thing of similar nature, and if a single one of them be lacking, the fermentation no longer takes place.

Heat is sufficiently developed when the olives are placed in a heap. Presta asserts that he found a cellar containing olives where the temperature had risen to 34 degrees Centigrade, and Rozier is of the opinion that it may reach 45 degrees. Bianchedi, the engineer, found, also, a place with 45 degrees. Humidity, on the other hand, cannot be wanting, since, not to mention that the cellars where olives are preserved are usually very damp, the heaped olives continually emit moisture through evaporation, as is proved by the diminution of volume and weight they undergo. Neither can be wanting the third and last condition, that is to say, the presence of ferment, since air is not lacking in the cellars. Thus, with the concurrence of all the circumstances required for the fermentation, and hence for the alteration of some of the constituent principles of the olives, the oil must be altered and modified in such a manner as to render it disgusting. This fermentative action of the composing principles of the olives is sufficient to ruin the oil, since with that action is developed a rather high temperature, owing to which the oil becomes rancid, for, as we all know, one of the most effective causes of the rancidity of the oil is excessive heat.

Practice and science have ascertained that under favorable conditions of temperature the oil absorbs oxygen from the air, thickens, and becomes rancid. Whether the oxygen acts by its own virtue, as Liebig contends, or through the medium of the fermenting principles with which the air is loaded, as is maintained by Pasteur, it is not the province of the present work to determine; it is sufficient simply to know that the oxygen of the air renders the oil rancid.

There might exist yet many other causes, besides those indicated, which contribute to the ruin of the oil in the fermented olives, and it is to be hoped that in the future chemists will pay a little more attention to the precious fatty liquid, in order to disclose all those facts which lie in mystery.

It seems to me an established fact, therefore, that olives heaped up in cellars and kept there for a certain time, ferment, and that the fermentation produces alterations in the oil. The oil is not like the juice of the grape, which requires a second chemical process to transform its sugar into alcohol and become wine; the oil is found nice and all prepared in the fruit, and the best that can be done is to extract it just as it is, by breaking the cells which contain it by means of trituration, and pressing afterwards the paste resulting from the trituration.

Having ascertained that the olives heaped up in cellars give a smaller quantity and a lower grade of oil, it would be foolishness to keep up the practice of the fermentation, and it is expedient, therefore, that it be abolished, and forever.

I have thought it necessary to devote rather a large space to the preservation of the olives, because it constitutes the basis of oil making; the good quality of the oil depends mainly upon the state of the olives.

MODE OF WORKING THE OLIVES AND COLLECTING THE OIL.

Before describing the mode in which the olives must be crushed in practice, to be subjected afterwards to the action of the press, I deem it useful to make a classification of the oils.

The oils have been classified in several ways, and their classification is based always upon the particular manner in which the olives are worked. Here is how olive oils are classified:

First—Virgin oil.

Second—Oil expressed from the paste without water.

Third—Oil expressed with the aid of hot water.

Fourth—Oil of the second vat washed out with either hot or cold water, according to the season.

Fifth—Oil from reground paste.

Sixth—Oil from the residue pit.

Seventh—Washed oil.

The virgin oil, which might be called also superfine oil, is generally drawn from the paste without any pression whatever.

Oil expressed from the paste without any water is also a fine oil, and is obtained from paste subjected to the first pressure, it being put into a vat or tub as soon as pressed out.

The fine oil having been secured, the pile of bags is washed with hot or cold water, according to the season, in order to collect the small quantity of oil sticking to them, which is set apart, and constitutes the oil of the second vat.

It frequently happens in cold weather that the paste will not yield the oil unless it be washed out with hot water; otherwise the liquid would remain mixed with the dregs and water, and consequently would go for the most part with the washed oils; oil thus obtained is called "oil expressed with the aid of hot water."

The paste is then taken out of the press, treated with hot water, reground, and put again into the press, but the oil obtained is good only for soap making, for lubricating machinery, etc., and is called "oil from reground paste."

In some places the paste is ground for a third time, pressed, and made to yield still another quantity of oil. The third grinding of the paste is not practiced, however, in establishments where the dregs are passed through an agitator.

Lastly, the washed oils are those secured from the dregs by subjecting them to repeated washings, as will be seen a little later. This being premised, we can pass to the working of the olives.

Olive oil is found in cells, bright and ready made, and to obtain it one has only to mash the olives, and afterwards press them so as to make it come out with the water of vegetation, from which it separates by virtue of its specific gravity, since oil is to water as 913 to 1,000.

Thus, to secure the oil it is only necessary to mash and press the olives. However, with the olives are also triturated their tissues, the particles of which come out mixed with the oil and the water, and though they be of greater specific gravity than the oil they do not separate completely at first; hence, many particles naturally remain mixed with the oil, as also globules of oil remain imprisoned in the water of vegetation, and are carried to the bottom. This is proved by the fact that when the dregs and waters of vegetation are allowed to rest in reservoirs they become covered at the surface, after a certain time, with a thin layer of oil, which is collected, but is oil of very inferior quality.

Were all the oil separated at once from the water of vegetation, and from the particles of tissue, one crushing and one pression would be sufficient to draw it out completely, but this not being the case, it becomes necessary to practice a series of operations in order to be able to secure, if not all, at least the greatest part of the oil obtainable from the olives.

The first operation which the olives must be subjected to is the crushing. The fruits are carried to the crusher clean and freed from foreign

matters, and the charge varies according to the kind of crusher employed.

In crushers commonly used, the charge is about six bushels of olives, which weigh from three hundred to three hundred and fifty pounds. The charge may be increased to four hundred and fifty pounds of olives and over in crushers with two stones, to six hundred and fifty pounds in crushers with three stones, and it may go as high as nine hundred pounds in crushers with four stones. Whatever be the crusher used, it is essential to mash the olives in such a manner as to reduce them to a homogeneous paste. This requires a variable time, generally from half an hour to an hour. If it be desired, however, to obtain the superfine oil, called *virgin*, the crushing must not be completed, but only half done, so that the olives will be only half crushed, and in this way will be secured the finest oil that can be made. The degree of fineness of the paste from the olives depends, in hand-crushers, upon the relative distance of the cylinders from each other. In crushers provided with stones, it depends instead upon the number of revolutions of the stones and the skill of the operator.

It happens sometimes that the olives are rich in pulp and very watery and then escape easily from under the stone. In that case the paste becomes watery and lacks homogeneity, and when afterwards it is put into the bags some of the watery part runs out and occasions a loss of oil, which is carried away by the water. To obviate this some people advise to mix with the olives a small quantity of straw, which, getting mixed with the paste, facilitates its thorough grinding and prevents any loss of the liquid part, and hence of oil. The use of oil grounds instead of straw is advised, the same to be mixed in the proportion of thirty-five to forty quarts to every six or seven bushels of olives. Oil grounds are preferable to straw, since, as they absorb the superflous humidity of the paste issuing from the first grinding of the olives, the oil flows out purer and more easily. Moreover, by using oil grounds one saves expense and avoids the danger of giving the oil some disagreeable flavor; not to mention that the oil which is absorbed by the grounds may be recovered afterwards by subjecting them to the action of the agitator.

After a certain time, varying from half an hour to an hour, according to the perfection of the crusher, the olives are reduced to paste and ready for the press. If the crushing has been only half done, in order to obtain the virgin oil, the paste is then taken out of the mortar and put into a tub, where a small but rather deep trench is formed into it for the purpose of collecting the oil, which runs out without pressure. This oil is skimmed off with small and nearly flat ladles, provided with a curved handle, and it is the *virgin, or superfine oil.*

Virgin oil thus extracted is very rare and hardly ever made, either because it requires much care, time, and patience, or because it deflowers the oil remaining in the paste. There are people who find the virgin oil of little value and rather fat, but this defect may be easily obviated by filtering the liquid, as will be explained further on.

In order to have virgin oil one must, besides following the directions already indicated, maintain an almost exaggerated cleanliness in all the utensils, because without it the requisite excellence cannot be attained. As a matter of fact, it is customary with manufacturers of virgin oil to change tubs at every extraction of the liquid, as they hold that no matter how well the tubs are washed they do not possess the desired cleanliness.

The virgin oil having been collected, the paste is put into bags within the tub itself, and then subjected to the action of the press. But if the extraction of the virgin oil is not practiced in the manner indicated, or else it is not desired to collect it, the paste is passed from the mortar to a table and there put directly into the bags. In the southern provinces, where the common crushers are used, the filling of the bags is done in the mortar. This would be impossible with the crushers provided with troughs.

In many parts of France they sprinkle over the paste, before putting it into the bags, a certain quantity of good vinegar, which facilitates the flowing out of the oil and makes it come out in larger quantity. This practice is not to be despised, for, as the vinegar acts upon the mucilaginous matter, it separates it from the oil, which, being free, flows out in larger quantity, of better quality, and without any defect whatever.

The filling of the bags is an operation which requires much skill on the part of the operator. These bags must not be too full nor insufficiently filled, because, when under the press, they would not only let out the oil but also the batter which keeps the oil imprisoned. This work, therefore, should be assigned to skilled workmen.

The bag to be filled is set up vertically upon the bench and pressed from above with the left hand, so as to spread apart the two disks composing it, and have it present its mouth open towards the paste. As much paste as is deemed sufficient to fill it is then thrown into it with the right hand, after which it is set in a horizontal position. Grasping now the upper disk by the edge with his left hand, to keep it raised, the operator thrusts his right through the aperture and spreads out the paste evenly, beating it down a little. This being done, the bag is well stopped up with as much pressed paste as can be squeezed into its mouth, and it is carried to the press.

Even the disposition of the bags under the press requires skill on the part of the operator. The "tower" or "castle," as is commonly called the stack of paste bags piled upon the platform of the press, must be perfectly vertical, so that an even pressure may be exercised over the whole mass, a condition indispensable to obtain the greatest quantity of oil from the paste.

The number of bags to be piled upon the platform of the press is variable, and depends upon the size and power of the press. It usually runs from twelve to twenty.

Between each bag a metal disk is interposed of a somewhat smaller diameter than that of the bags. The metal disk inserted between the bags not only renders the action of the press more effective and regular, but prevents the oil, which flows out of a bag from above, from being absorbed by the paste below, and, on the contrary, leads the oil down the pile to the platform.

Most of the work just described is avoided by the use of the cylindrical recipients made of perforated iron plates, or of iron bands, held at short distances apart. To fill these recipients it is merely necessary to pour the paste into them a little at a time, level it, and insert at various points through it a few diaphragms or circular disks made of common wood. The recipients, however, should be lined first with

some sackcloth, so as to prevent the paste from running out under the pressure.

The paste bags having been piled upon the platform of the press, or else the iron recipients put into position upon it, they are capped with a portable wooden disk and two or four blocks, and then allowed to rest for a little while so as to permit the free flow of the oil, which comes out first under the light pressure exercised by the paste itself, by the wooden disk, and by the blocks. This oil is gathered separately, and it is the *virgin oil*. This stoppage, and this separation, are done away with if the extraction of the virgin oil has been effected previously in the tub, or if it is not desired to make any in order not to deflower all the rest. This being accomplished the pressure is brought on gradually, while at the same time an attendant guides the tower with his hands, in order that the descent of the screw of the press may not derange the paste bags in any way. If the bags have not been placed in order, and the "castle" is out of equilibrium, it is expedient then to take them down, and build the pile anew with greater attention.

The pressure at first must not only be slow, but it should be stopped once in awhile to give time to the pile to settle and to the oil to flow out of the pile. In presses with a simple lever the screw is first lowered by hand, and when the force of one man is no longer sufficient to move it a short pause is made. The short bar is used next, not forgetting to stop a little at every four or five turns of the bar. When the latter becomes unable to lower the screw any more, recourse is had to a lever nine or ten feet long, which is operated by hand at the beginning, but subsequently with the capstan. Even while the long lever is used one must not neglect to rest a few minutes after every three or four turns. In presses with a compound lever, the short bar is employed first and then the long lever, still bearing in mind the oft-repeated warning in regard to stoppages, in order to give the oil time to flow, or, as people usually say, to give the paste time to "digest." With these presses, however, the stops may be shorter, for the reason that the pressure of the compound lever is uniform and slow. The oil flowing out is collected in a tank, which is generally situated in a reservoir dug in the ground underneath the press, or else in large tubs, if the press is placed a little above the ground, and there is no reservoir. If the tubs be used, these must never be filled to the brim, but as soon as they are filled up to within one and one quarter to one and one half inches from the top they should be replaced by empty ones.

The oil obtained by this first working, and which we have called "oil expressed from the paste without water," is a fine oil, and it has been also designated by the name of "oil of the first pressure."

As soon as the pressure is completed, and no more oil flows from the platform, the pile of bags is washed with cold water, if the weather be warm, or vice versa, in order to secure the oil sticking to it. This oil is collected in a separate vat, as it is of lower grade than the first, and it is the one we have indicated by the name of "oil of the second vat washed out with water."

Should the olives be treated in the manner above described, when the season is unusually cold, the oil obtained by the first pressure would remain mixed for too long a time with the water of vegetation and the grounds, and consequently a great deal of it would go with the washed oils, and those of very inferior quality.

To avoid this it is usual with many to wash the paste with boiling water before subjecting it to pressure. The boiling water, through which heat is communicated to the paste, coagulates the albuminoid matters and frees the oil, which flows out easily. Boiling water is to be preferred, as cold water would be of no avail, and lukewarm water would impart to the oil a taste of smoke. The oil obtained from paste treated in this manner is called "oil expressed with the aid of hot water," and is inferior in quality to that yielded by paste not subjected to such a treatment, because hot water gives the oil a greenish color, and injures its flavor. Notwithstanding this, it is necessary in cold years to employ the means described, in order to have a larger quantity of oil. But for him who wants to make fine oils, let him be satisfied with spending a little more time and more labor in pressing the paste, and banish the boiling water. Its use is pardonable only in pastes giving oils of second or third quality, oils which as a rule are not employed as a condiment for food.

The oil having ceased to flow, the screw is raised and the paste bags are emptied into the mortar, so that the paste may be subjected to a second crushing. It is the general practice then, in order to facilitate the second mashing, and hence the flow of the oil which still adheres to the albuminoid matters, to pour on the paste some boiling water, which coagulates these matters, and makes the oil flow down the pile (of bags) with greater ease. But the evil effects of boiling water have just now been pointed out; this is why I prefer the recommendation of Caruso, which is to mix with the paste to be reground a few sliced lemons, or else a cold solution of tannin, or even a certain quantity of vinegar, as practiced by the French. The citric, tannic, and acetic acids coagulate the albuminous matters as well as the boiling water, without giving rise to the disagreeable effects produced by the latter.

The lemon, the solution of tannin, and the vinegar, are to be preferred also for the sake of economy, as their use involves but a trifle expense; and among them the most economical is the tannin solution.

The solution of tannin is prepared by steeping ground oak or maple bark in water for two or three days. Understand from this how economical its use is, and that it should be substituted for boiling water, which ought to be strictly excluded from the treatment of the oils.

The paste having been ground for the second time, it is put into the recipients once more and subjected to the action of the press, care being taken to follow the same directions given for the first pressure. The oil obtained therefrom is called "oil from reground paste," "oil of the second crushing," etc., and though it is somewhat inferior in quality to the first, it is still good.

In many places the paste is ground for a third time, after the second pressure, and then is secured the "oil of the grounds." It is much better though to omit this operation and subject the grounds to the action of the agitator, as will be seen later.

For the mills where the agitator is not used, the third crushing is excusable to a certain degree, although the oil secured thereby hardly repays the expense of extraction; but for the establishments in which the grounds are passed through an agitator, it would be a useless expense.

It seems to follow, from what has been said up to the present time, that one should employ three presses with each crusher, in order to be

able to perform the work quickly and without interruption. If only one press were run in connection with each crusher, the latter would do but little work, since the paste has to stay under the press, at each operation, for a time at least treble that which it takes to go through the crusher. Thus, while the press would be working all day, the crusher would work one third of the time only. In many oil mills I have seen two presses assigned to each crusher, and there, also, I have seen the crusher remain idle for a good part of the day.

We have now seen how to work the olives and treat the paste in order to obtain the oil, but with the latter come out many foreign matters, and especially the water of vegetation, which is more abundant than the oil itself; it is therefore necessary to say a few words concerning the mode of separating the oil from these foreign matters, or rather the mode of collecting it.

COLLECTING THE OIL.

To collect the oil from the tubs or the tank in the underground reservoir seems an easy task at first sight; however, it requires a certain dexterity and ability in the person who performs it; a dexterity and ability which it is difficult to teach by words, and still more by writing. I shall therefore confine myself to saying a few words upon the subject.

As soon as the oil separates itself from the substances with which it issued from the "tower," and it comes up to the surface of the water of vegetation, owing to its lighter weight, a trained workman collects it with a wooden or tin ladle and pours it into another recipient, stopping at intervals to give it time to rise. Whenever it is perceived that the water is nearly reached, which is indicated by the dark color presented, the operator lays aside his ladle and uses instead a lighter and nearly flat utensil, with which he slowly and very carefully skims off the surface of the liquid until the last drop of oil floating thereon has been collected.

Whatever be the skill of the operator there always remains some oil in the liquid, and hence it is usual to resort to various means in order to secure the most of it. Some people skim the surface of the liquid with dried panicles of marsh-reed, or else with cotton, or even a sponge; others, instead, wash out the residues with boiling water. However, there always remains some oil imprisoned in the water of vegetation and the other matters mixed with it, and it is not advisable, therefore, to throw away, as many oil makers inconsiderately do, these residues, which are designated by the name of grounds, dregs, lees, etc., but it is expedient to put them together in a ground reservoir, so that the oil may liberate itself in time and come to the surface, when it can be collected.

The oil having been collected, it is carried to the clarifying-room, where it is subjected to a few operations which will be indicated in the chapter devoted to clarification. In the meantime, it is well to point out that the different oils obtained from olives subjected to different operations must be kept separate, because by mixing them the good oils always lose in quality, while the poor ones do not gain in any wise. The blending of oils is not expedient, though the blending of wines may be in certain cases.

The residual grounds still contain oil, and as soon as they are taken out of the recipients, after the second or even the third pressure, they are usually put into baskets and piled in large trenches, where they require a great deal of care, as will be shown when explaining the treatment of the grounds, to which is devoted the following chapter.

I will not close this article on the mode of working the olives and collecting the oil without giving a last warning in regard to the cleanliness of the utensils employed in the oil factory. The cleanliness of all the implements and machines is an indispensable condition for obtaining fine oils, favoring as it does their purity, their quality, and their preservation.

Oil makers must never weary of subjecting all the utensils which come into contact with the olive paste and oil, to free and frequent washings, using for that purpose water containing from 2 to 5 per cent of soda in solution. As to the recipients in which the oil is carried, it is better to rinse them with a glassful of vinegar every time they are used. Finally, one must avoid burning in the factory any substance which might emit any bad smell.

Let the oil makers bear in mind that olive oil is a very delicate liquid, which can easily acquire a disgusting flavor, and, therefore, that the cleanliness of the oil factory, tools, machines, and utensils can never be carried to excess.

MODES OF WORKING THE OIL GROUNDS.

The grounds are the residue of the paste which has already furnished oil, and they are for the most part used as fuel and as food for hogs, because people do not stop to reflect that they still contain oil, and in considerable quantity, as is evidenced by the ease with which they take fire, and the bright flame they emit—an oil which, if it cannot be utilized for cooking, may be employed for burning, and for lubricating machinery.

The difficulty presented by the old methods of treating the grounds, and their want of convenience, have not been favorable to their introduction; to-day, however, the extraction of the oil from the grounds has become an industrial operation of some importance, as the means now employed insure the desired object. There are in Italy some establishments equipped for the express purpose of working not only the grounds which may be bought in the home market, but also grounds imported from Turkey and Greece. All this proves that they bring positive profits. It is expedient, therefore, to occupy ourselves, though briefly, with their treatment. The methods followed, and which deserve to be taken into consideration, are three in number, namely:

First—The method of the agitator, or of the washed oil.

Second—The chemical method, or that of the bisulphide of carbon.

Third—The method of steam combined with pressure.

The paste recipients having been emptied into baskets, the grounds are put into large pits dug in the ground to a depth of about ten or twelve feet, so as to save them from the action of the sun, which would dissipate a little of the oil. The sides of the pits should be walled up and the bottom left unpaved, or else covered with a rough pavement, so as to leave it permeable. An impermeable bottom would cause the lower stratum of the grounds to rot. The pits, besides, must be covered with a roof made of branches, or else bulrushes, or even lath-work; thus, while the grounds are protected from the heavy rains and the solar rays, they

are not deprived of the circulation of air, and hence do not run the risk of becoming moldy.

The grounds are thrown into these pits a little at a time, each layer being heavily trampled down. Some advise to pour into them, every week thereafter, as much water as is necessary to keep the mass cool, as it is claimed that it will not then enter into a too active fermentation, which would impart to the grounds a blackish and almost burnt color, and spoil most of the oil.

The compressed and wet grounds yield less oil than grounds that have been simply compressed. A lot of oil grounds were divided into two equal parts, one of which was wet and compressed, and the other was compressed without wetting. At the end of seventeen months 2.30 per cent of oil was obtained from the first, and 4.52 per cent from the second.

They might yet be preserved heaped up in a state of powder, but they then yield less oil than the compressed grounds. From grounds in powder 4.19 per cent of oil was had, and from compressed grounds 8.71 per cent.

The first method of working the grounds, which has been indicated by the name of the agitator method, is very much employed. It is also called "method of the washed oil," and the oil obtained through it is known under the name of "washed oil," as it is secured by subjecting the grounds to repeated washings with water. The washing of the grounds is, however, a difficult operation, and it requires more than ordinary intelligence in those who undertake it and in the laborers who perform the work. Furthermore, it is necessary that the establishment be situated close to a source of water, which is indispensable for the washing of the grounds.

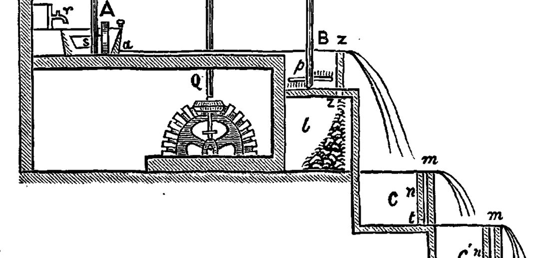


Fig. 15½.

The apparatus for washing the grounds must comprise a crusher with one or two stones and a set of basins or troughs. At *A*, Fig. 15½, we have a common crusher with trough, having at *a* an aperture with a small gate and a trapezium, *s*, in the vertical axis to stir up the paste. Over the mortar is a faucet, *r*, through which water may be poured continually into it. At *B* is a trough whose upper edge is lower than the bottom of the mortar of the crusher, and in the middle of which rises an axis provided at the base with a double comb, *p*, which serves to stir the paste. This apparatus constitutes properly the agitator. The trough just mentioned has in the bottom an aperture, *z*, provided with a small gate, and near the top another smaller aperture, *z*, furnished also with a small gate. The first aperture opens into the reservoir, *l*, underneath, and the second serves to convey the water to the basin, *C*. This latter, in turn, opens into the basin or trough, *C′*, and so on.

Each trough, as the reader will perceive, has an aperture, *t*, near the bottom, which communicates with a small vertical channel, *n*, formed in the edge of the wall after the manner of a siphon, and which goes through the thickness of the wall at *m*, a little below the upper edge of the mortar, and communicates with the next trough beneath. The crusher and agitator are put in motion by the shaft, *Q*.

The apparatus having been described, we shall now mention how it is operated.

The mortar is charged by degrees with about eight or twelve bushels of grounds, according to the size of the crusher and the number of troughs, and the stone is set in motion. The first portions of grounds are crushed in a dry state, and then the water is turned on so as to dilute the mass and separate the skins from the stones by virtue of the different specific gravity possessed by these substances. After three quarters of an hour the trituration and dilution of the grounds are complete, and the gate of the mortar is opened to allow the batter to run into the agitator, which is in turn put in motion, and by means of the combs and the copious supply of water soon separates the skins from the stones, the former rising to the top, and the latter falling to the bottom. This separation having been completely effected, which is indicated by the white color assumed by the stone, the gate at the edge of the agitator is opened and the water let into the trough below, into which it brings the floating skins and the oil. The skins go first to the bottom, owing to the fall, but they soon again rise to the top. And as the stream of water is continuous, and not only keeps the first trough or agitator always filled, but constantly flows into the troughs below to the same level as in the first, the heavy part—that is to say, the washed stones—remains in the first basin, and the rest is brought into the basins underneath.

The operation is finished when the water issues almost clear from the trough of the agitator. The lower gate of that trough is then opened, and the stones allowed to fall beneath, and the skins are gathered in the basins.

The washing furnishes two substances, viz.: oil and the skins, or pellicles, of the olives, which gather in the basins below the agitator. The oil is easily collected by transferring it from the last trough through a small channel to a settling tank near by, where it is afterwards separated from the water by means of the usual skimmer.

The skins, or pellicles, floating upon the surface of the liquid are collected with pans with perforated bottoms, or with baskets provided with a long handle, and then subjected to the press.

The pellicles may be pressed either cold or hot. In the first case they are put as soon as collected into baskets of peculiar texture and subjected to a first pression, after which the baskets are placed in cages and set under the most powerful presses. In the second case the skins are digested for about six hours in kettles filled with boiling water, before

being subjected to pressure. The oil which comes to the surface is collected with the skimmer, and the skins are gathered anew, put into the baskets and subjected to pressure as in the first case. To secure a greater quantity of oil, it is well to insert some metal disks at various points throughout the cages.

The cold system gives better oil, but a lesser quantity than the hot system. It may be stated, generally, that with the system of the agitator one succeeds in collecting from 2 to 4 per cent of oil from the grounds. Fresh grounds give more oil than old ones.

The process of extracting the oil from the grounds by means of bisulphide of carbon is no less in use than the agitator method. This substance is now very well known, at least by name. It is liquid at the ordinary temperature, without color, and emits a nauseating odor, similar to that of decayed cabbage. It boils at 46 degrees Centigrade, and takes fire very easily when exposed to the air, and therefore it must be handled with great care. It serves different uses. It is employed with success for extracting fatty substances from animal and vegetable tissues. It is also used with a special apparatus to extract bitumen and sulphur from certain stones in which these substances are found. It has been employed in the extraction of aromatic essences. This liquid lends itself also very well to the extraction of the oil from the grounds, and its application to this purpose is greatly practiced.

There are many apparatus employed for the extraction of the oil by means of the bisulphide of carbon. Whatever apparatus is used should have the following advantages:

First—It should not waste any of the bisulphide of carbon.

Second—It ought to save a great deal of time and labor.

Third—The oil of the grounds should be entirely extracted, owing to the property which the bisulphide of carbon has of dissolving fatty substances.

The bisulphide of carbon is poured on and passes through the grounds, which are placed in large metal recipients, and after dissolving in its passage the oil contained therein, it runs into another recipient also made of metal; there it is subjected to a slow heat, and vaporized so as to free the oil, which is poured into a separate vessel. The vaporized bisulphide of carbon is in turn passed through a cooling apparatus, where it is reduced to the liquid state, and it is used again in subsequent operations.

The third method of extracting the oil from the grounds is that of steam; it is called "system of hot pressure," and it will be of sufficient importance therefore to here describe this system.

The practical way of working is as follows: The grounds are taken out of the cellar and put into the crusher, which makes from eighteen to twenty turns per minute, in quantities of about one hundred and thirty to one hundred and fifty pounds at a time. As soon as they have been well triturated the pallets placed within the crusher are taken down and the gate at the lower edge opened, so as to let them fall into baskets underneath, and the baskets are in turn emptied into mechanical conveyors, in the buckets of which the grounds are carried to the heating pans above the presses, one heating pan being provided for every two presses.

The grounds deposited in the heating pans are continually stirred up by means of mechanical stirrers. In every one of these heating pans is a tube through which the exhaust steam from the engine is diverted onto the grounds contained therein. When these grounds have been thoroughly heated, the gate at the bottom of the pans is opened, and they are allowed to drop into the outer box of each press.

The heated grounds are placed in the outer boxes of these presses in the same manner as olive paste treated cold is, that is to say, they are dropped in by degrees, rammed down, and disposed in layers separated by diaphragms. The filling of the boxes occupies about ten minutes.

As soon as the boxes are filled the valve of communication between the pump and the press is opened, and the pressure brought on and kept up for about thirty or forty minutes.

Whenever it is time to unload, the discharge valve is opened for a moment, but as soon as the outer box has detached itself from the hinged top it is closed again and the valve of communication between the pump and press opened, in order to bring on the pressure once more, care being taken to open the three pieces which compose the hinged top by swinging them out of the standards of the press. Then the piston rises, and in its movement of ascension pushes the grounds out of the box, and as these are no longer held in check by the top, they may be taken without difficulty.

The oil which flows out of the four presses through a conduit is poured into a recipient, or into a large tank lined with sheets of tin on the inside, and of a capacity sufficient to hold the product of two or three days' work. The steam which has served to heat the grounds in the pans is passed through the tank containing the oil by means of a tube of forged iron, made like a worm, and it not only serves to heat the oil, but also helps its clarification.

As soon as it is seen that the oil on the top of the recipient is wholly clarified, it is taken out and poured into another recipient destined for this purpose. To prevent very serious losses it is necessary to warn people that the recipients containing the fine oil must be kept separate from those containing the oil of grounds. By keeping them together in the same place, the oil of grounds injures very much the quality of the fine oil, and occasions a heavy decline in the price it brings.

CHARACTERISTICS AND USES OF OLIVE OIL—CLARIFICATION AND DEPURATION OF THE OIL.

The oil that has been extracted from ripe and fresh olives, and has been clarified, has a color varying between amber yellow and greenish yellow, and a sweet and agreeable taste. It is without odor, or rather recalls a little the odor of the fruit. It is very fluid, transparent, and unctuous to the touch. It boils at about 330 degrees Centigrade, and a few degrees below zero it solidifies and takes the form of a buttery mass with radical crystals. Agitated with a mercurous-nitrate solution it solidifies; the "oleine" is transformed into "elaidine." Exposed for a certain time to the air it absorbs oxygen and becomes rancid. When pure and kept in cool places it is altered with much difficulty.

The chemical composition of the oil is:

Carbon	77.21 per cent.
Hydrogen	13.36 per cent.
Oxygen	9.43 per cent.

Its specific gravity at 12 degrees is 0.9192, a specific gravity which diminishes with the increase of temperature, and augments with the decrease of the same. It is insoluble in water, and very little soluble in ether and alcohol. It is the type of fixed oils, and is distinguished from the volatile by leaving a stain upon paper which does not disappear with heat.

The uses to which olive oil is applicable are very numerous. It is chiefly employed for table uses, for the fabrication of soap, for the working of wools, for illuminating purposes, and for the lubrication of machinery.

In the first case it is partly superseded by butter, lard, and even oils from certain seeds, but in many instances it has an absolute superiority over other fatty matters.

For palatableness it is considered as the first and best fatty oil, especially in the seasoning of food; also because it keeps longer and is less subject to alterations. In the manufacture of soap are also used palm oil and the oleine obtained from tallow in the fabrication of candles, but olive oils of inferior quality are, nevertheless, preferred, and are much sought for. The same may be said in regard to the working of wools and the lubrication of machines. In the matter of illumination, however, olive oil finds strong competitors in gas, in petroleum, and in the animal fats from which good and cheap candles are made.

From what has been said it may be easily inferred of what importance olive oil is in life, and how it is our highest duty to produce a larger quantity and better quality of oil, to treat the tree with a little more judgment, and to use greater care in the fabrication of the oils.

The oil after it has been collected from the tubs or the vat still contains matters in suspension which render it turbid, and it is not expedient, therefore, to put it into the store-room, where it must not enter unless clarified and depurated; but it is necessary to subject it first to clarification and depuration.

The clarification of the oil may be effected by natural means, as by rest and decantation, or by artificial means, such as filtration and treatment with alkalies, acids, etc.

The natural means, the filtration, and the vegetable acids are employed for fine oils, the treatment with mineral acids and alkalies for the common oils.

Truly, the clarification of the oils is not the business of the producer, but of the manufacturer; inasmuch, however, as the producer is generally manufacturer in the branch I have undertaken to treat, I do not believe it superfluous to say something in regard to it.

As soon as collected the oil is put into the basins described, in which it is allowed to rest for a few days, the basin being covered with suitable lids so as to prevent dust from falling into them. Thus at rest, the oil frees itself from the albuminoid substances, from the water, and also from certain finely crushed green particles of fruit, which are precipitated to the bottom of the basin, and it becomes clarified. If the clarifying-room has a southern exposure, and it is kept at a temperature of 12 to 15 degrees Centigrade, which is the most favorable to the clarification of the oil, the latter becomes limpid in a short time. Whenever it is perceived that the precious liquid has freed itself from the impurities, it is transferred into other basins to separate it from the sediment lying at the bottom of the recipients, and it is again allowed to rest, to be subjected afterwards to a second, then to a third, and, if necessary, to a fourth decantation. At least five or six days must elapse between each transfusion. Whenever desired, one may also effect the transfusion by means of pumps similar to those employed for transfusing wine. The sediment left by the oil in the basins should be deposited in a settling tank, as it yields a little oil in the course of time.

The oil having been clarified, it may be definitely put into the store-room, bearing in mind a few rules which will be indicated later. If the producer or merchant of fine oils is not obliged to sell or use them a short time after they have been extracted, he can obtain, by means of the natural clarification above mentioned, any degree of fineness he may desire, because the oils continue to clarify in the store-room. But it frequently happens that the need of raising money to meet expenses constrains him to sell his oils a short time after they have been expressed from the olives; and as the oils then cannot clarify of themselves quickly, owing to the low state of the temperature, he has to resort to filtration to avoid a slight turbidness in the oils, which would cause a diminution in the price.

I have sufficiently spoken of the filters in a previous chapter; hence, there is no need of describing them any further, nor is there any use of explaining how to handle them, as this is a very simple matter. It is merely sufficient to pour the oil to be clarified into the upper part of the filter, which has been previously prepared, and to collect it afterwards at the bottom of the same in a purified state. It is well to remark, however, that whatever be the kind of filter employed it always gets clogged up with the substances abandoned by the oil, and the latter then can no longer pass through. It is customary with some people, in order to make the filtration more effective, to mix with the oil before pouring it into the filter one twentieth of water, which, separating itself afterwards from the oil, carries off the mucilaginous substances.

The vegetable acids, such as the citric and the tannic, are better adapted than the filters to the clarification of the fine oils. By treating the oil with a diluted solution of these acids it clarifies in a short time, and in a perfect manner. The acids act upon the foreign matters in the oil chemically and mechanically. Chemically, by combining with the coloring and albuminoid matters held in suspension in the oil, and precipitating them to the bottom of the recipient; mechanically, by forming with the same a kind of net, which carries down with it as it descends the other heterogeneous particles, which it finds in its passage. In this way the oil becomes completely depurated without losing the sweetness, the perfume, and the daintiness which it possesses.

One must absolutely avoid an excess of acids, as such an excess would destroy the odorous particles of the oil, and, besides, the acids themselves might communicate their own savor to the oil by remaining in suspension. If the quantity of acid to be used could be determined in advance the inconveniences indicated would not occur, but the diversity of the oils, the larger and lesser quantity of albuminoid matters which they may have in suspension, and other circumstances inherent in the climate, the meteoric changes, the degree of the acid solution, etc., are all causes which affect the degree of impurity of the oil, and hence the quantity of acid to be used. It is expedient, therefore, in order to avoid the excess pointed out, to make experiments on small quantities, so as to be able to treat the larger mass with security.

For the preparation of the tannic solution, I refer the reader to a previous chapter, and as to the citric solution, it is prepared simply by pressing the lemons, mixing their juice with the water, and passing the mixture through the filter. The solution, whether tannic or citric, is poured little by little into the basins containing the oil, and the mass is beaten with a bundle of twigs, after which it is allowed to rest, and the recipient covered. The oil is purified in twenty-four hours, and it then may be deposited in the store-house. The residue should be carried to the pit of the oil grounds. Besides the means indicated, the oil may also be purified by the simple washing with water, which acts upon the mucilaginous matter, and upon the extractive and coloring principles.

In shaking the oil with the water the mixture becomes white immediately, owing to the interposition of the water between the molecules of the oil, but upon being allowed to rest the latter comes to the surface of the water clearer, and consequently purer and more edible.

It is advised to add to the water about one half per cent of tannin of commerce, which would contribute much towards depriving the oil of the mucilaginous and albuminoid parts. This would be but a treatment with acid much lengthened.

The common oils are sometimes purified by means of filters, but most manufacturers have resource to the chemical processes, as the filters cannot succeed in rendering them clear.

PRESERVATION OF THE OIL.

The oil, as we have seen, being a body easily altered both by increase of temperature and a prolonged contact with the air, it becomes indispensable, in order to preserve it well and unaltered, to store it in places where it may escape these baneful influences. To accomplish this it is necessary that the store-house be cool, dry, and well aired, situated in such a way that its temperature may be kept rather even, as in the cellars where wine is preserved, and that it be far from any place emitting bad exhalations. The store-house, therefore, in order to possess all these conditions, must have a northern exposure, and have its interior very clean.

The jars, tin vessels, or pots in which the oil is kept, should be placed all around the inner walls of the store-house, and the walled reservoirs or cisterns in the center of the same. If these latter do not exist, the center of the room may then be occupied by a circular group of jars; provided, however, there always remains sufficient space for attendants to move freely, and to permit the transfusion of the oil from each recipient. The cleanliness of the oil factories cannot be sufficiently recommended.

The oil recipients, whether they be new or old, must not be filled before they are washed with water containing 5 per cent of soda, then rinsed with clear water, and afterwards dried with a sponge.

As a general rule jars are to be preferred, especially for the preservation of fine oils, to the large reservoirs, for several reasons. In the first place, the recipients of smaller capacity lend themselves better to the clarification, which continues to take place in the oil, and to the transfusion of the latter; and they offer in their small volume a more extended space, and hence favor more the deposit of the sediment. Moreover, the separation of the different qualities of oil, and their examination, are rendered more easy by the use of the smaller recipients. It must not be expected, however, that the dealers in inferior oils, fit only for the fabrication of soap, the lubrication of machinery, etc., and who consequently have to handle large quantities of oils, will make use of jars, as it would subject them to heavier expense, for the reason that they would need an extraordinary number of jars, and hence larger store-houses. For the common oils the walled reservoirs are to be preferred. In a few words, it may be said that edible oils should be preserved in rather small recipients, such as jars, pots, or jugs, in which they may be looked after more easily, and that the inferior oils may well be kept in large reservoirs, as they are seldom transfused.

The new oil, although it may have been subjected to the processes of the clarifying-room, and decanted over four times, cannot be said to be wholly purified, as it still holds heterogeneous particles, which it can abandon only in course of time. This is the reason why oils that have been clarified and placed in the store-house continue to purify themselves, and hence, to deposit at the bottom of the recipients a more or less thick layer of sediment. Were the oil kept over this deposit, it would run the risk of getting spoiled, with the rise of the atmospheric temperature during the summer months; it is expedient, therefore, to liberate it from the sediment by means of the decantation. To this end it is convenient to always keep in the store-rooms a few empty and clean jars, into which the oil may be decanted whenever desired. The time most favorable to the decantation is the autumn or the spring. The winter would lend itself badly to such an operation, as the oil becomes more dense with cold, and keeps the impurities within itself. The summer, in turn, is not propitious to the decantation, as the hot sun would excite in the oil an effervescence, which, far from allowing the foreign substances to fall to the bottom, would keep them in suspension throughout the mass of the liquid.

The transfusion may be effected either by means of recipients, or by pumps similar to those used for wine. The recipients employed may be made of wood, terra cotta, tin, or zinc. The recipients of baked clay, tin, and zinc are cylindrical in shape, and have their mouths narrowed in so that they can be stopped. Whatever the recipient employed in the transfusion, it is necessary to fill it up completely every time, and close it well so as to prevent the oil from coming in contact with the air, and hence undergoing any alteration.

It is customary with good oil manufacturers to decant the oil twice a year, precisely as is done for wine, care being taken to keep it from contact with the air, in order to prevent the oxygen of the latter from exercising its action upon it and making it rancid.

There are some who separate the oil of the upper part from that placed between it and the sediment, effecting the separation at the time of the decantation. The first is designated by the name of clear, edible, and the second is termed oil from under the clear, oil from under the edible, etc. The difference between the two oils is that the first is more depurated, more palatable, and more fragrant than the second. And this is because the suboil still contains some substances in suspension, which, however, may subside later, and allow it to become as clear as the surface oil.

The oil having been decanted, there only remains at the bottom of the jars the sediment and a little oil of very low grade, which can be collected and employed for burning purposes. As to the sediment, it must not be thrown away as useless merchandise; but it should first be boiled, so as to obtain from it a little more oil, but of a very inferior quality.

DISEASES AND FALSIFICATIONS OF OLIVE OIL—MEANS FOR PREVENTING THE FIRST AND DETECTING THE SECOND.

Olive oil, like wine, does not keep if it be made without care, and it contracts diseases and spoils itself if exposed to the air for a long time. Science has spent much labor upon the diseases of wines; it has discovered the different alterations they may be subject to as well as the causes producing them, and it has suggested many remedies to counteract these alterations. The same cannot be said of the oil. The oil has been little studied; few scientists pay any attention to the alterations which it may undergo, and, consequently, of all the ills it endures, we know of but the rancidity.

Rancid oil has a disagreeable odor, a harsh and pungent taste, and a dark color. The cause of this alteration is attributed to the oxygen of the air, which being absorbed by the oil forms fatty acids, and especially the sebaceous, which liberate themselves.

The rancidity is produced because the mucilaginous and parenchymatous matters contained in the oil act as a ferment, putrefy, and produce the separation of the oleaginous or glyceric molecules, which become rancid all the sooner the more these matters are heterogeneous to the oil. Besides the formation of the fatty acids, it is believed that the oxygen forms also in the oil a little acetic acid.

The rancidity modifies after a certain time the density of the oil. That of olives diminishes in proportion as the degree of the freed acids or the rancidity augments; in the oils of sesame, of poppy, of cotton seed, etc., on the contrary, the density increases.

The proportion of the rancidity being variable, it is indispensable to know how to determine it in certain cases, as when it is to be decided whether the rancid oil should be employed in the manufacture of soap or for lubricating machinery, and also when it is a question to fix its price. Many are the means suggested for determining the degree of rancidity, but the most simple, and, perhaps the most exact, is the one founded upon the solubility of the free acids of the oil in alcohol.

The process in practice is as follows: One ounce of the oil under examination is put into a glass retort, together with two ounces of alcohol, at 92 degrees. The temperature of the mixture will be seen to rise to 30 degrees. The retort is next immersed in a water bath, agitated for a few minutes and then allowed to rest. The alcohol which holds the free acids in solution separates from the oil, which is precipitated to the bottom of the retort, and when the separation of the oil from the alcohol appears well defined, one ounce of the latter, or half what has been employed, is taken out, and hence, also, half the dissolved free acids. This ounce of alcohol is put into a capsule, previously weighed, and it is exposed to a gentle heat. The alcohol evaporates and the free acids remain in the capsule. The weight of this residue multiplied by ten gives the quantity of rancidness per cent.

Truly, such a calculation is not rigorously exact, because the ounce of alcohol taken out of the retort and weighed does not represent the weight of the alcohol alone, but also that of the acids dissolved in it, and, therefore, by computing in the manner indicated is committed an error which becomes the greater as the oil examined contains more rancidity. It is expedient, therefore, to correct the above calculation. This may be done simply by weighing the residue left at the bottom of the retort, and subtracting the amount from the ounce taken out, and thus will be had the true weight of the sole alcohol. Thus, if the residue amounts to .20 ounce, the 1 ounce of solution represents .80 of alcohol and .20 of acids, and consequently with the proportion .80:.20::1:x, we have .25, which is the true quantity of rancidness in each ounce of alcohol, and hence the actual quantity of rancidness in our case would not be represented by $4 \times 10 = 40$ per cent, but rather by $5 \times 10 = 50$ per cent.

To prevent rancidity in the oil one must, above all, clarify it well, as it does not very easily become rancid after it has freed itself from the mucilaginous and parenchymatous matters, and then use every effort to keep it in cool places and prevent its contact with the air.

Various remedies have been proposed to free the oil from the rancidity, but they do not all answer the purpose. I will, therefore, mention the most efficacious only.

We have seen that the rancidity of the oil is caused by the free fatty acids. If these be percipitated the oil must remain sound. The treatment with magnesia is the most rational and the most efficacious for this purpose. The proportion in which the calcined magnesia must be employed is of six and six tenths pounds to each two hundred and twenty pounds of oil. The magnesia is added to the rancid oil, which has been previously put into a recipient made of glazed terra cotta, or even of wood, and both are agitated together about six times a day, for a quarter of an hour at each time, during five or six days. The oil is then filtered and washed with boiling water, to give it a good taste and restore to it partly what it has lost. Soda might be used instead of magnesia, but the latter produces better effects.

Good results have been obtained by the use of alcohol. By mixing together ninety quarts of rancid oil and ten quarts of alcohol of good quality, and agitating the mass for half an hour, the alcohol subsequently separates and takes off the rancidity. It is necessary, however, to repeat the operation at least three times in succession in order to cure the oil completely. The alcohol is then purified with one fiftieth of slaked lime, and used again in other operations.

It is held by many that by mixing and agitating well twenty-five parts of rancid oil with five of vinegar, and repeating the operation three or four times in succession, the oil may be cured of its disease. One can also cure the oil completely of its rancidness by mixing and agitating strongly for half an hour fifty parts of oil with eighty of water at the temperature of 30 degrees Centigrade, containing twelve parts of common salt. The mass being allowed to rest, the water falls to the bottom of the recipient and the cured oil rises to the surface. In order that the effect be complete it is necessary to repeat the operation six times.

Of all the remedies reviewed, the magnesia is the one which gives the best results, and I do not hesitate in giving it the preference in the treatment of rancid oil. However, it is necessary to state that oil which has been treated for rancidity must be consumed immediately, as otherwise it might spoil once more.

PLUMS AND PRUNES.

THE PRUNE.

The "California" prune has made a wide reputation for itself in all the markets of the United States. A few years ago a box of "California" dried prunes were indeed very rare, but progress has made rapid strides, and at the present time our "California" prunes sell in advance from 1 to 2 cents per pound over the imported. The consumers have discovered for themselves which, according to quality and taste, best meets their wants, so to-day the "California" prune is master of all the markets to which it is exported.

NOMENCLATURE.*

The question of prune nomenclature remains at present unsettled. Pomological works describe some twenty-five distinct varieties. The term "prune," in the English language, signifies those varieties of plums that, when dried, are sweet. "Prune" is merely the French way of spelling "plum."

Here lies the source from which errors have sprung, many varieties of "plums" having been imported to California from Europe, and brought here by foreigners under the French name "prune," while in reality they may not have had the slightest right to the name "prune," viz.: a sweet dried fruit, as we understand it here.

For example, take what is commonly called Hungarian prune, and by shippers Gros prune, thereby creating a very erroneous and harmful impression upon the public as to the individuality of a California "prune" in a fresh state, for this Hungarian, so called, is nothing but a large, very showy plum, the other being extremely acid, and, as a dried fruit in any shape, neither profitable nor desirable. The correct name of this fruit, as Mr. John Rock has pointed out, is undoubtedly Pond's Seedling.

The prune generally cultivated here as † French prune, Petite d'Agen (petty prune), I believe to be synonymous with what Downing describes under the name of Prune d'Agen, having also seven French synonyms. There is one other variety, described by Downing, called Burgundy prune, which so nearly resembles it that it is doubtless either a seedling, or was grown under different conditions, which caused some modifications in its appearance.

I do not see any reasons for disputing the statements made years ago by Mr. W. B. West, of Stockton, after his visit to the prune-growing districts in France: First, that the prune known here as Petite d'Agen is the prune of Agen, the term "Petite" having been locally applied to

* Leonard Coates. Biennial report, 1887-8.

† Changed to "California." (See proceedings of Thirteenth State Fruit Growers' Convention.)

it in California, owing to its small size in comparison with other fruits; and second, that from time to time seedlings have been originated by the peasants, from which have arisen varieties, or sub-varieties, differing slightly from their parent, and yet being so nearly similar that all have been propagated under the generic name of Prune d'Agen.

I wish also to reiterate what I have said on a former occasion, that the French prune is liable to very noticeable outward changes, subject to stock, soil, and the season. I have grafted the same season large trees of apricot, German prune, and almond, with scions of French prune from the same stock, and, in two years, when all were bearing some fruit, the prunes differed very much in size and color. Some were as large as a small Pond's Seedling (Hungarian), showing that by heavy pruning and thinning the French prune will be as large as those that are graded by the French as their largest select fruit, but which are so large that many have thought, and so stated, that they must have been of another variety.

A prune that I imported from France, under the name Prunier Datte, is identical with the variety called by Mr. Rock, Robe de Sergent. I have both trees growing and fruiting together.

By reference to Downing, it will be seen that Robe de Sergent is given as a synonym of Prune d'Agen, and further the significance of the term Robe de Sergent, referring to the varied colors in a recruiting Sergeant's uniform, is lost entirely if applied to this fruit, which is nearly round, and of a dark purple color, never assuming those varied colors so often seen in the Prune d'Agen, or French prune.

I am therefore entirely at a loss as to the correct nomenclature of this variety. The wood and habit of growth are very similar to those of the French prune, but the fruit is very distinct.

The prune described by Charles Downing as Imperiale de Milan seems to be identical; it is as follows: "Tree vigorous, rather spreading, branches smooth. Fruit rather large, roundish oval. Suture broad, extending two thirds around one side, often enlarged. Skin deep purple, covered with a thick blue bloom. Stalk stout, set in a small cavity. Flesh greenish, juicy, sugary, adheres to the stone. Good. Early September."

The late Charles Downing accomplished a great work in classifying and describing the known varieties of fruits cultivated in this country and in Europe; but the most casual observer will notice at once the great number of synonyms tacked on to some of the fruits described. For instance, the variety under discussion is known in different parts of Europe as "d'Agen," "Prune d'Ast," "Robe de Sergent," "Agen Datte," "St. Maurin," "Prune de Brignole," and "Prune du Roi." Downing selects the name "Prune d'Agen" as correct, which coincides with Mr. West's conclusions when in France. "It is," says Mr. West, "undoubtedly the prune of Agen, cultivated there exclusively and in great quantities."

But nowhere do we find the name "Petite," or "French," both of which are of purely Californian origin. It is deplorable that we in California should have done so much to aid the already existing confusion in pomological nomenclature.

A cut of the Prune d'Agen, in "Downing," shows an outline which, together with the description given, exactly coincides with the fruit raised here as "French," or "Petite" prune.

The question is asked, "Have we the true type of French prune in California?" I answer, positively, "Yes." We have, however, another distinct variety of French prune in California, of which I do not know the name. This is the variety which has been called "Robe de Sergent" in the nurseries here; but as Downing gives "Robe de Sergent" as a synonym of "Prune d'Agen," it cannot be correct. It does not answer to the name "Robe de Sergent," being of a uniform color, and more sombre looking than d'Agen. Its growth is similar to d'Agen, but coarser and stronger, and the leaves are larger and much more shiny. I obtained some stock direct from France, and some, also, of the stock imported by Mr. Rock. They proved to be identical. It is rounder than d'Agen, with one side enlarged, and is more decidedly a clingstone, and more juicy.

The same prune about Napa City, and anywhere in the vicinity of the bay, is of a dull purple color; while those raised in the hot, sunny climate of Calistoga, at the upper end of Napa Valley, become a vivid crimson, some being beautifully mottled, readily explaining why the synonym "Robe de Sergent" should be applied to it.

I consider the question of the correctness of the variety generally cultivated here as "French prune" clearly proved, but suggest that we follow Downing and call it simply "Prune d'Agen." *Commercially* it will still be "French prune."

I am fully convinced in my own mind that the prune called here by nurserymen Robe de Sergent, is really the Prune d'Ente of Bordeaux.

PRUNE D'ENTE.

Syn., *Robe de Sergent.*

[Fig. 7, Plate II.]

In the past few years much has been written and said about a prune known by its synonym of "Robe de Sergent," and has been classed under various types of prunes grown in several districts of France. This variety was originally imported from France by Mr. John Rock, of Niles, Alameda County, and also by Mr. W. B. West, of Stockton. There is quite a marked difference in the size and quality of this prune compared with the Prune d'Agen (Syn., French), but the difference had not been noted from a shipping standpoint until quite recently.

"This prune is medium (to large) in size, and oval in shape, with a deep purple skin, approaching black, and covered with a thick blue bloom; flesh greenish yellow, sweet, and well flavored, sugary, rich, and delicious, slightly adhering to the stone."—Rock.

The tree is quite an upright grower, and has a much broader leaf than the Prune d'Agen.

*The first trees of the Prune d'Agen (French, so called) were grown by Louis Pellier, at San José, about the year 1857, the graft having been brought from France by his brother in December, 1856.

The French prunes, which are so largely exported from France, are made of the Prune d'Agen, or date plum, which is also named Prune d'Ente and Robe de Sergent. The Prune d'Agen is, according to the best authorities, the plum from which the finest French prunes are made,

*Hon. W. H. Aiken, Report, 1885-6, p. 290.

EXPLANATION OF PLATE II.

NEW FRUITS.

Fig. No. 1. Apricot-plum (*Prunus simoni*); natural size and color; mature.

Fig. No. 2. Apricot plum, divided; showing the size of the pit and flesh; also, its amber color before changing to brick red, and size and shape of the pit.

Fig. No. 3. Clyman plum; natural size and color; mature.

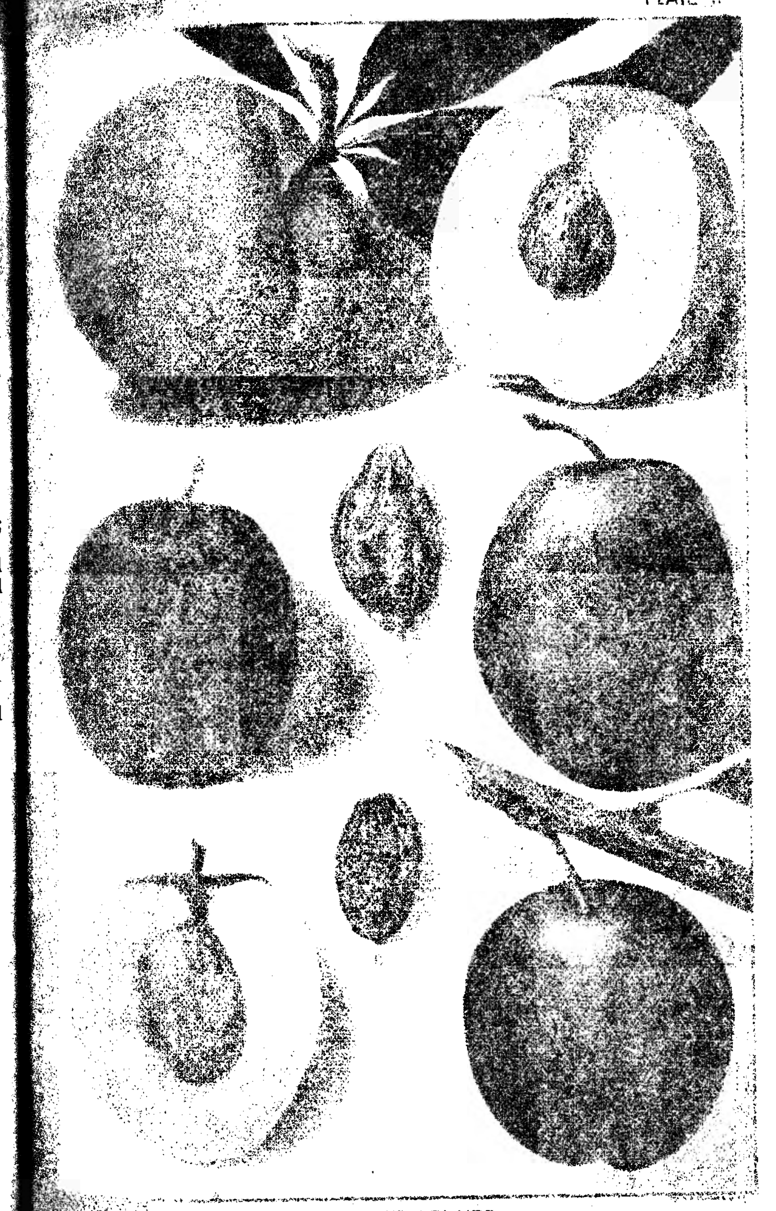
Fig. No. 4. Clyman plum, divided; showing size of pit and flesh.

Fig. No. 5. Tragedy prune; natural size and color.

Fig. No. 6. Pit of Tragedy prune; natural size.

Fig. No. 7. Prune d'Ente (Syn., Robe de Sergent); natural size and color.

Fig. No. 8. Pit of Prune d'Ente; natural size.



PLUMS AND PRUNES.

and is known as the prune of commerce. Orchards have been planted and cultivated in California for nearly thirty years, under the impression that we had the true prune of commerce, cultivated in France under the name of Prune d'Agen.

This was first seriously questioned by Mr. Felix Gillet, a Frenchman by birth, and a prominent and enterprising nurseryman at Nevada City, California, who asserted in July, 1884, that our Prune d'Agen (French) was very different from the Prune d'Agen of France, both in size, color, shape, and time of maturity.

He based his opinion upon the conclusions drawn by certain horticulturists in France, from an actual comparison of the prunes raised and sent to them by him for that purpose with what they claimed was the true Prune d'Agen.

They failed to agree upon the points of difference, one insisting that the California prune is a seedling from the Prune d'Agen, and not as large and fine; another, that it is the same in shape, but not so regularly ovoid; another, that it is the same shape and color, but that there is a difference in the pit; and still another, a leading prune merchant of Agen, France, that it is exactly the kind known in France by the name of Prune d'Agen, or Prune d'Ente, and that the nature of the soil has much to do with the beauty and size of the fruit.

Mr. Gillet, desiring to correct the error, and to introduce in California the Prune d'Agen, obtained trees from the north and south of France, and spared no expense in fully investigating the prune subject.

His investigations up to November, 1885, resulted in a change of opinion, as shown in his letter to the State Horticultural Society, in which he makes the following statement: "Our prune is a true type of the Prune d'Agen, and the kind grown in the north of France and the Valley of the Loire." Our prune is not the very type of the Prune d'Agen, cultivated in the Valley of the Lot, in France, where are grown the largest prunes, which are sold by merchants of Agen and Bordeaux under the name of Prune d'Ente or d'Agen.

Through the kindness of Mr. Gillet, I sent to a horticulturist at Agen a small package of my own prunes for inspection. In reply, under date of August 16, 1886, he states that my prune has the shape and color of the Prune d'Agen, but is not the same type, the difference being in the pit, and sent me two pits of his prunes for inspection and comparison.

I am of the opinion that the French prune of this State is a true type of the Prune d'Agen, the prune of commerce of France, resembling it in shape and color, though differing in pit; the exact difference I am unable upon inspection to clearly define. This slight difference may be owing to climatic influence.

TRAGEDY PRUNE.

[Fig. 5, Plate II.]

This valuable plum, which is of California origin, was originated at Courtland, Sacramento County, on the Sacramento River, by Mr. O. R. Runyon.

One of the great points in favor of this prune is that the tree is scale proof, being in this respect similar to the Black Tartarian cherry. The tree is a rapid grower and of a beautiful form. The fruit is quite large, and as shown in the illustration, of an elongated form, with dark purple skin. The flesh is yellowish green, and has a very rich flavor, and quite sweet, being so as soon as it begins to color into ripeness. This prune is among the first of early fruits (ripening in June), and commands very high prices for shipping. In the past two years shippers have bought the fruit of all orchards of this variety much in advance of other early plums. As a shipper it has given great satisfaction.

APRICOT PLUM.

Prunus simoni.

[Figs. 1 and 2, Plate II.]

This plum is of Asiatic origin, and until recently has been but little known. This is no doubt due to the fact that no attempt had been made to cultivate and test its qualities on a large scale. My first attention was called to this plum in the spring of 1887, when ripe specimens were exhibited before any other plum of any importance from a shipping standpoint. The experiments conducted in the past few years by Mr. I. H. Thomas, of Visalia, have demonstrated the fact that the plum is of more economic value than was at first supposed, and the shipments made last and this year fully establish this fact; letters from commission agents in the East being herewith appended to show its merits.

The plum, as shown in the illustration (Fig. 2, Plate II), before maturity is of an apricot yellow and very aromatic. In this state of ripeness it is very firm, and unlike many early plums is sweet before it reaches maturity. I have had specimens remaining as long as two weeks before beginning to assume its reddish cast. All these specimens, however, were at that state of ripeness quite sweet and palatable. In this state of ripeness it is quite aromatic and has a marked pineapple flavor. On ripening it assumes a dark brick-red color, as shown in the illustration (Fig. 1, Plate II). The pit is very small, as shown in the illustration (Fig. 2, Plate II), and adheres tightly to the flesh. There is no cavity between the pit and the flesh, as is the case with other plums of this species.

The tree does not attain a very great height, yet it is by no means a dwarf. The foliage resembles the foliage of the Satsuma plum. The tree is an upright grower.

This plum is indeed a valuable acquisition, because of its superior quality, and will prove profitable to grow.

Extracts from a Letter from Johnston & North, Commission Merchants.

NEW YORK, July 31, 1890.

I. H. THOMAS, *Esq., Member of State Board of Horticulture:*

DEAR SIR: In reply to your favor of the fourteenth, with regard to the "Prunus Simoni," we take pleasure in handing you the following report: We received the crate by express from Messrs. Sherman, Marr & Higgins, of Chicago, Ill., at 9 A. M., June 30, 1890.* On examination we found the prunes to be sound and mostly hard, with some of them softening into ripeness, and all of them throwing the sweat onto the wrapping paper, which takes place from four to seven days (according to the weather) before fully ripened. A few of the prunes had a tendency to rot on that part where they have been bruised against

* Shipped from California (Visalia) June twenty-third, in a tight baggage express car.

the box, but their main body was in good condition and not yet fully ripe. We kept it (the crate) in our cellar where it was cool, *without submitting it to any artificial low temperature.* Although the papers were damp from sweat, there was no noticeable heat in the fruit, but there was sufficient dampness to start heat in a few days. In one corner of the box there was the first sign of heat, in the shape of a slight cobwebbed mildew on the outside of the wrapping papers. On July first we made another examination at 5 P. M. (or, say thirty-two hours after the first examination, during which we had two very hot, sultry days), and found the fruit yet to be sound, but a good deal softer, and the papers had sweated up considerably more. The fruit had also ripened much more.

On July second the weather was rather cooler, and examination showed the fruit to be a shade riper.

On July third (weather cool), the change to further ripeness was hardly noticeable from the condition on July second. On July third, we shipped it (the crate) on the steamer "Umbria" to Liverpool.

Yours truly,

JOHNSTON & NORTH.

Mr. Thomas shipped, on June 14, 1889, to Messrs. Sherman, Marr & Higgins, of Chicago, a crate of plums in a tight baggage express car, the color of the plums then being light yellow; and received the following letter as to the keeping qualities of the plums, which is self-explanatory:

CHICAGO, June 20, 1889.

I. H. THOMAS, *Visalia, Cal.:*

DEAR SIR: We are to-day in receipt of the crate of "Prunus Simoni;" they are in good condition; the color is similar to a red June cherry, or dark red color. We will keep them according to your request, and report how long they will keep. Accept thanks for the shipment.

Very truly yours,

SHERMAN, MARR & HIGGINS.

On July 16, 1889, a letter was received, reporting the keeping qualities of the plums, as follows:

CHICAGO, July 10, 1889.

I. H. THOMAS, *Esq., Visalia, Cal.*

DEAR SIR: We have kept the "Prunus Simoni" two weeks, and find that they have carried in excellent condition, but are rather soft at this time; color, very dark red, almost black; flavor, fine.

Truly yours,

SHERMAN, MARR & HIGGINS.

CLYMAN PLUM.

[Figs. 3 and 4, Plate II.]

The "Clyman" plum was raised from seed planted by Mrs. Hannah Clyman, near Napa City, about the year 1865. The tree grew too large, being near the house, and was cut down, but at Mrs. Clyman's solicitations several suckers were cut off the root and planted in the orchard. These have for many years borne fruit like the parent tree, never yet failing to mature a full crop. Mrs. Clyman, who has lived in California since 1848, says that the fruit has always been eagerly sought after by neighbors.

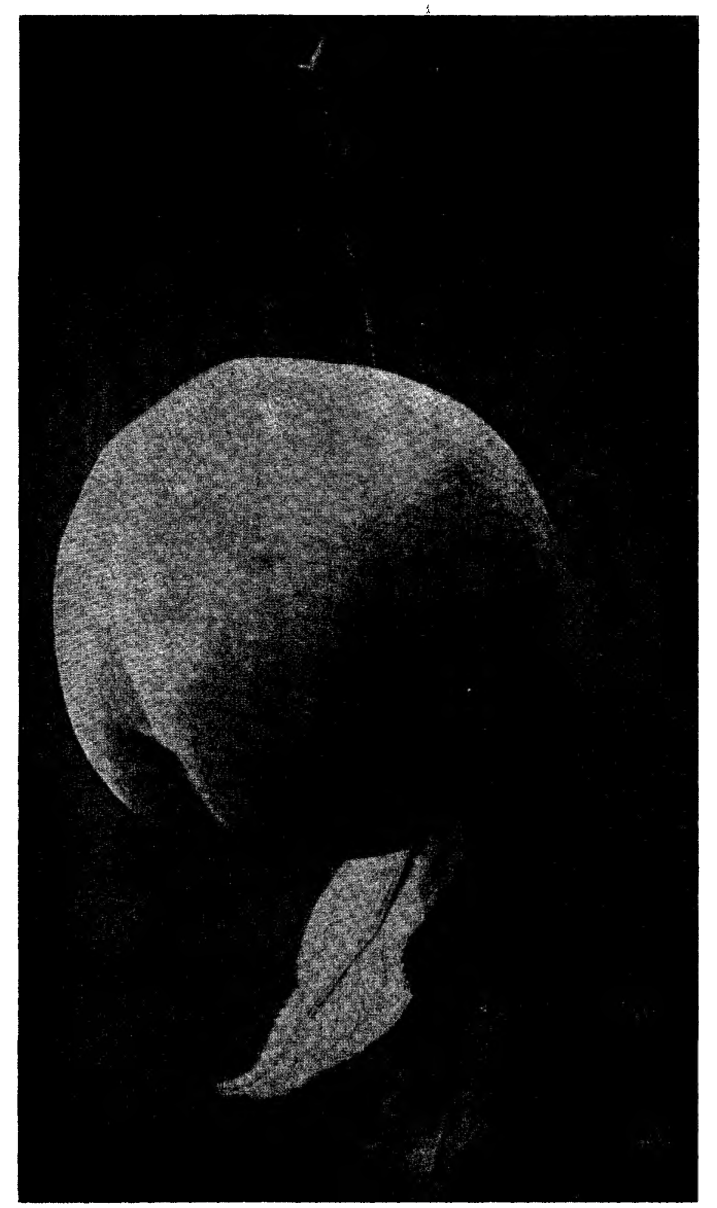
In 1886, the attention of Mr. Leonard Coates, the nurseryman and fruit grower of Napa City, was first attracted to this plum, it being then ripe at the same time with the common "Cherry" plum, in that locality (Napa), about June twentieth, in average seasons. In warmer sections of the State it has since ripened about June first, or earlier.

As shown in the illustration (Figs. 3 and 4, Plate II), the plum is of good size, even when growing in clusters, and the old trees are growing in an old orchard, overhung by large apple trees, and having very little cultivation. In color it is a rich purple, firm in texture, free stone, and of superior quality. Indeed, it partakes much of the nature of the Peach plum, of which it seems to be a seedling. The tree is an extraordinary grower.

Mr. Coates reports trees in his nurseries growing ten feet from the bud in one season, without irrigation, while in his orchard the trees grow double the size of other plum trees, under precisely the same conditions.

Mr. Coates distributed grafts in some of the early sections of the State, where they are reported as doing well, and a shipment made to Chicago early in June, 1890, sold at $6 per half crate.

NEW EARLY YELLOW PEACH.



Early Imperial.

EARLY IMPERIAL PEACH.

For many years experiments have been carried on by propagators and nurserymen in trying to originate an early yellow freestone peach. So far all the experiments have proved failures, because the quality of the varieties originated were of no economic importance. The first peach of economic value (as such is the Early Imperial) was originated with Mr. W. W. Smith, at Vacaville, and is a seedling of the St. John, fertilized by the Early Crawford. In order to produce this rare variety Mr. Smith budded the St. John onto the Early Crawford. The tree then became one half St. John and one half Early Crawford. The pits from the fruit were then taken and planted; numerous plants were thus produced, but only one of them bore good fruit, which was the one that produced this fine peach, and has continued to bear this handsome fruit for four years.

This peach ripens at least two weeks ahead of the Foster and the Early Crawford; indeed, it is the earliest yellow freestone peach ever originated. It is most beautifully colored, and, what is more, is free from curl leaf. So far it promises to be a good bearer and a thrifty grower.

Mr. Smith carried on at his place very extensive experiments for a period of about twenty years in trying to originate such a peach, and at last his labors were rewarded by its production, which has all the qualities that can be desired, and is no doubt the earliest good yellow freestone peach so far known in the State or elsewhere.

Mr. I. H. Thomas, State Horticultural Commissioner for the San Joaquin District, writes: "I fruited the Early Imperial peach this season on a tree that had a one-year old top graft. The peach was very highly colored, almost a dark red on a yellow ground peach, and very firm, and I believe it will be a good shipper. The time of ripening with me is about two weeks ahead of the Foster or the Early Crawford, and near the time of Hale's and Parson's Early. The great value of this peach is that it prolongs the time of drying two weeks. It dries fairly well. I consider this peach to be the most valuable acquisition that has been made to the peach family for the past twenty years."

FUNGOUS GROWTHS.

FUNGI.

Unlike ordinary plants, fungi are destitute of leaves, flowers, or seeds, in the ordinary occupation of the term, the productive bodies being known as spores, a name given to the fruit of all flowerless plants. These spores are exceedingly minute, often not more than the five-thousandth of an inch in diameter, are generally nearly transparent, extremely buoyant, and, forming at all times a considerable proportion of the atmospheric dust, are transplanted by the winds to remote distances. These spores are produced in numbers which, to one unfamiliar with the subject, appear almost incredible. Nature seems to have provided with bounteous prodigality for the safety of species of the lower orders, both of plants and animals, and the number of germs produced is in almost constant ratio with the danger to which the organism is exposed. Countless millions of germs may perish, but species live on. As an illustration familiar to all, I will mention the puff-ball, the "smoke" from which consists entirely of spores which separately are quite invisible to the naked eye, and each one of which is capable, under favorable conditions, of reproducing its kind. A single puff-ball (*Lycoperdon giganteum*) is so abundantly supplied with spores that the entire State might be planted from this individual, each square inch of the vast area being supplied with a spore. The consideration of these facts will explain why, when the conditions are favorable for the germination of an unusual number of spores, these microscopic organisms are able to devastate large areas in a single night, as often happens with fields of wheat, in which case it is only necessary in certain localities that there should be a warm, foggy night, continuing for a few hours in the morning and followed by warm sunshine, to produce the "red rust" of the grain, known to the mycologist as *Pruccinia graminis*. Probably every grower is familiar with this parasite, which first shows itself as a minute rusty spot upon the leaf or stem. If it appears before the formation of the head it causes little damage, but if, as occasionally happens, it should attack the plant while the berry is in process of formation it proves disastrous to the crop. In such localities the farmer soon learns to submit without repining to an evil for which no economical remedy can be applied, and to plant to other crops those tracts lying adjacent to the streams, which experience soon teaches him are most liable to be attacked.*

The conditions this year seem to favor fungoid growths. The fungoid diseases of fruit trees need more general attention on the part of the growers, as they rank second on the list of destructive agents, and as yet are but little understood. In the Eastern States where fruits are grown, the growers have suffered immensely from the attacks of fungi. The diseases most prevalent there, such as "Peach yellows," "Plum pockets,"

* Prof. H. W. Harkness, Report State Board of Horticulture, 1883.

"Brown rot of the cherry," "Rust of the orange," "Root rot," "Black rot," etc., have not yet made their appearance in this State, and all precautions should be employed to prevent their introduction. "Extreme conditions of weather are in general unfavorable to fungi, as their spawn is liable to be burnt up by drought, putrefied by long-continued wet, or destroyed by frost."—Berkeley. Thus it will be observed, that last winter, being an extremely wet one, was favorable to the development of all fungoids, and gave but little time for experiment in their destruction. Enough, however, has been observed to warrant the publication of this chapter upon parasitic fungi, though brief as it is, and regretting that a more extended report cannot now be given.

SHOT-HOLE APRICOT FUNGUS.

Septonia cerasina.

[Figs. 1, 2, and 3, Plate III.]

The apricot does not suffer from as many diseases as other trees do. It suffers, however, great damage through the attacks of the shot-hole fungus (*Septonia cerasina*). "It appears upon the leaves as irregularly rounded spots, of a dark brown color, varying greatly in size. (See Figs. 1, 2, and 3, Plate III). The spores are developed beneath the cuticle in black specks, scattered over both surfaces of the spot, and on arriving at maturity rupture their coverings and are borne away by the air. The mycelium penetrates through the cells of the leaf with great rapidity, sapping and exhausting them. The contracted cells separate from the healthy parenchyma and fall to the ground, leaving the leaf perforated by holes (see illustration), from which it has received the name of 'shot-hole' fungus."—Harkness.

This fungus has lately made its appearance in many new districts where it had been entirely unknown. It is first observed on the leaves, as they develop quicker than on the fruit. It appears on the fruit when quite young, and gives it the appearance of being infested by scale. The fungus develops very rapidly and retards the growth of the fruit. At first the fungus appears as small pimples, which develop and burst open at the top; a scab is then formed, which spreads and dries on the surface of the fruit. It appears on the leaves in the same manner, with the exception that instead of spreading on the leaves, it bursts, dries, and shrinks away, leaving a hole in the leaf. The leaves attacked by the fungus have the appearance of having been eaten into by insects. The fungus arrests the development of the leaf, which soon turns yellow, and the tree presents a sickly appearance. Lately it has been noticed that when other trees, such as the peach, nectarine, plum, prune, and even the apple and the pear trees, are near apricot trees infested by the fungus, that it was spread onto them; however, being observed mostly on the foliage, and not enough to cause alarm.

Remedy.

It is only until quite recently that any extensive experiments have been made to suppress this malady. Many growers have felt the attacks of this fungus but slightly, owing to late spraying in the spring of the year (just about the time the buds commence to swell) with the lime, salt, and sulphur remedy, as well as with other solutions into which fungicides have been added, such as sulphide of copper, sulphide of iron, hyposulphide of soda, sulphur, etc., and others. In adding these ingredients the greatest of care should be exercised that none such be added that will be destroyed by the action of the chemicals contained in the solution to which they are added, as in such instances it cannot be expected that any great benefits can be accomplished by their use. It is possible that the remedies which have been so successful in the treatment of fungoids mentioned in this chapter (apple scab and pear blight), may have a beneficial effect upon this fungus, and therefore they should be experimented with. This season (1889–90) was an extremely wet one, and for that reason such experiments could not be carried out; yet considerable has been done to show that the disease is arrested by this application. To insure good results the remedy should be applied just as soon as the buds begin to swell, and which must be followed by the application of fungicide solutions of a weaker kind during the growing period of the tree. The remedy should be applied immediately upon the appearance of the fungus, which is first detected upon the young fruit and the developed leaves.

PEACH CRACKING AND LEAF BLIGHT.

Entomosphorium maculatum.

[Figs. 4, 5, and 6, Plate III.]

This disease makes its appearance early in the spring, soon after the development of the leaves.

"It first shows itself in the shape of small, dull carmine red spots, which appear first on the upper, and finally penetrate to the lower surface of the leaf; the color soon changes from red to a dark brown, with a slightly elevated, minute, black spot in the center. The spots also increase in size, and if they are very numerous, as is most often the case, the tissue between them also turns brown and loses its vitality. If the leaf is young or belongs to a delicate leaved variety, it shrivels up by the contraction of the diseased portions; but if it is mature and consists of firm tissue it retains its shape, the only change being in the color. As soon as the leaf becomes badly diseased it falls off; and if, as often happens, another growth of leaves is produced, these too become diseased. The spots are about .11 of an inch in diameter.

"Trees seriously attacked by this disease can be distinguished at a distance by their defoliated appearance. This wholesale destruction of the foliage interferes very seriously with the growth of the wood and the maturing of the fruit, for the leaves are the organs which transform the food material that is brought up from the roots and absorbed from the air into a form in which it can be directly used by the plant in the making of wood and production of sugar in the fruit.

"But, in addition to this, the fruit and stems themselves often become diseased. The fruit also shows the carmine red spots, which afterwards become dark colored. The skin becomes very much roughened, and the growth of the epidermis over the diseased portion is checked, causing a crack which extends deeply into the flesh, so that, even if the fruit can obtain sufficient sugar to mature properly, its appearance is spoiled and the cracking makes it liable to decay.

"The development of the fungus on the branches does not differ materially from what takes place on the leaves. There first appear small circular spots on the young bark; these gradually become elongated and somewhat depressed, with a slight elevation in the center, and their color changes to a brownish black. Frequently the stem is completely girdled by these diseased areas, and, as a result, the end of the branch dies above the point where the fungus is present. The petioles and leaf scales are also often diseased. Indeed, there seems to be no part of the tree above ground, that is in active growth, quite exempt from the attacks of the parasite."—Galloway.

The Winter Nelis pear has suffered the most in this State from the attacks of this fungus. This spring, however, the early pears showed the presence of the disease. Early in June I visited several orchards of early pears, and in some the disease had done considerable damage, especially upon the Dearborn Seedling.

The winter of 1889–90 was an exceedingly wet one; the fungus developed more rapidly than at any previous season, and its arrest proved much more difficult, as men could not be put to work at the proper season, the ground being so wet as to prevent it. The remedies applied late in the season were more or less effective, but the results would have been more satisfactory had they been applied in season to do the most and greatest good.

Remedy.

The Section of Vegetable Pathology at Washington has carried on very extensive investigations on the fungoids that affect the trees on this coast. They have also carried on a series of experiments to arrest the malady, a summary of which is here given, as follows:

"This fungus causes the greatest injury to young trees, and especially those growing in nurseries. Burning the fallen leaves would serve as an important means of removing a source of infection. The best results will follow if the leaves are raked together and destroyed as soon as they fall; in other words, it would not be advisable to allow such leaves as may fall in midsummer from the effects of the malady to remain on the ground under the trees until the following autumn or spring. They should be destroyed as quickly as possible, before any of the spores have had an opportunity to escape.

"The development of the fungus upon the leaves or other parts of the plant may be prevented by the application of some fungicide. Since the spots make their appearance as soon as the leaves have attained full growth, the application must be made early, so as to prevent the spores from germinating. In no case should the application of the remedial agents be postponed until the fungus has made its appearance upon the leaves, for if this is done it will be of little use to apply them.

"Where the disease prevails more or less every year it would be well to thoroughly spray the trees, before the buds begin to swell, with the Bordeaux mixture, prepared as follows:

"Dissolve sixteen pounds of sulphate of copper in twenty gallons of water. In another vessel slake thirty pounds of lime in six gallons of water. When the latter mixture has cooled, pour it slowly into the copper solution, care being taken to mix the fluids by constant stirring.

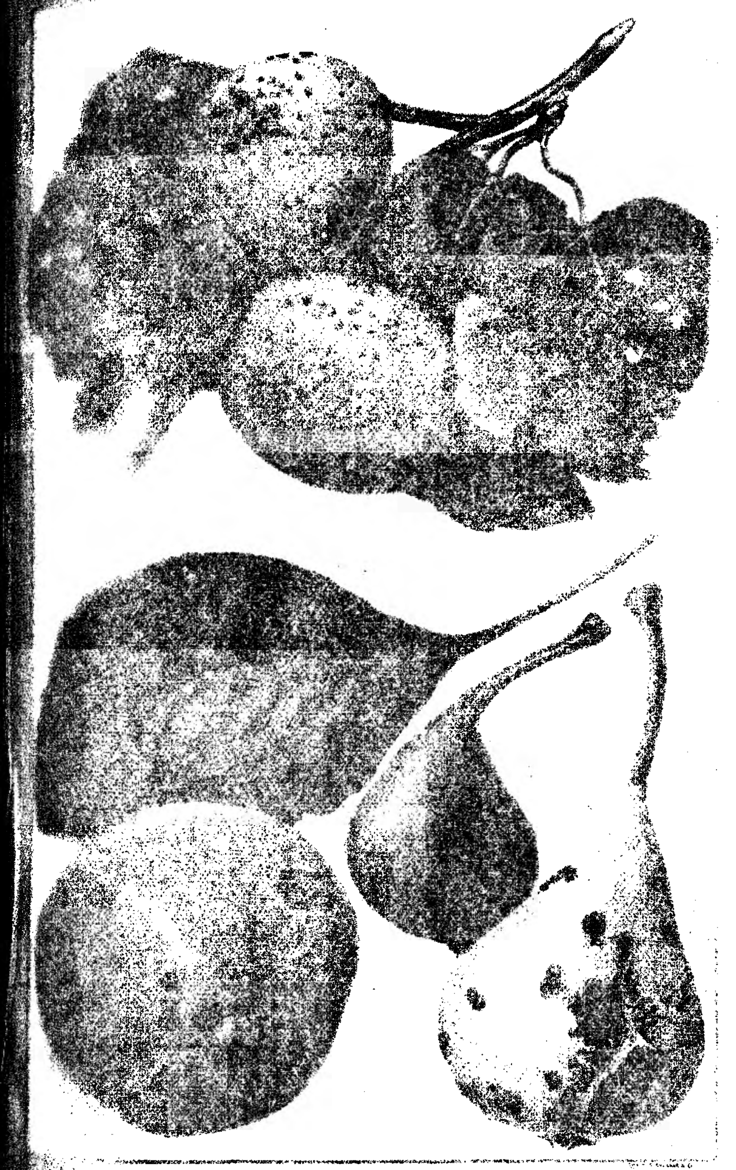
"When the leaves are about two thirds grown a second application

EXPLANATION OF PLATE III.

FUNGI.

Fig. 1. Shot-hole Fungus (*Septonia cerasina*) on ripe fruit; apricot.
Fig. 2. Leaf and branch affected by the Shot-hole Fungus.
Fig. 3. Shot-hole Fungus, on green fruit.
Fig. 4. Pear leaf, affected by Pear-leaf Blight (*Entomosphorium maculatum*).
Fig. 5. Dearborn Seedling pear, affected by Pear Cracking, or Pear Blight (*Entomosphorium maculatum*); its effects shown on small green fruit.
Fig. 6. The same as Figure 5, illustrating the disease on the ripe pear.
Fig. 7. Red June apple affected by Apple Scab (*Fusicladium dentriticum*), shown on ripe fruit.

PLATE III.



FUNGOID DISEASES.

should be made, this time, however, using a solution containing the ingredients in the following proportions:

Sulphate of copper	6 pounds.
Lime	6 pounds.
Water	22 gallons.

"Dissolve the copper in sixteen gallons of water and slake the lime in six gallons, then mix as described above.

"The object of the first spraying is to destroy any spores of the fungus that may have survived the winter in the crevices of the bark, while the second and weaker application is obviously for the purpose of preventing such spores as may fall upon the young leaves from germinating."

The experiments conducted in this State have been with the aim of destroying the scale upon the trees, as well as checking the progress of the fungus, and to this end numerous solutions have been applied. The most successful remedy has been the following:*

Sulphur	3 pounds.
Caustic soda (98 per cent)	2 pounds.
Whale-oil soap	25 pounds.
Solution (in all)	100 gallons.

Boil the sulphur and caustic soda together in about two gallons of water (this is done to allow the caustic soda to dissolve the sulphur). When the sulphur becomes dissolved, add the soap and boil until thoroughly dissolved, then add water to make in all one hundred gallons of solution, and apply warm.

Where the trees are affected with codlin moth, it is well to add Paris green (in the proportions recommended) to the solution, which mixes quite readily and serves two purposes.

APPLE SCAB.

Fusicladium dentriticum.

[Fig. 7, Plate III.]

"The diseases of the apple caused by the fungus parasite *Fusicladium dentriticum*, has long been known to growers of this fruit as 'apple scab.' Less frequently we hear it spoken of as 'black spot,' or simply spot disease of the apple, or, when on the foliage, 'leaf blight' or 'leaf mildew.' It has been known to botanists for a long time and has received many Latin names, but the one here adopted has been generally employed by mycologists since 1869.

"The distribution of this disease is coextensive with the cultivation of the fruit which it attacks, although there may be a few favored localities where it has not appeared. Throughout the Eastern and Central States one is almost certain to find it in every orchard, and on the Pacific Slope, in California, it is also frequent. For more than fifty years it has been known in Europe. It has become a serious pest in Australia, and we now possess reports of its presence in New Zealand."—F. Lamson Scribner, in Report of Department of Agriculture, 1887, p. 341.

The varieties of apples mostly attacked by this fungus in this State

* Somewhat modified from that given on p. 410, report 1885-6.

are the following: White Winter Pearmain, Early Harvest, Baldwin, Red June, etc. Mr. Scribner reports that the following varieties are comparatively exempt from the attack of the fungus: Ben Davis, Winesap, Willow Twig, Jonathan, Smith's Cider, Maiden's Blush, Grimes' Golden, York Imperial, Rhode Island Greening, Sops of Wine, Duchess, and the Russets, but adds that "varieties notably free from the disease in one section, when grown in some other locality more or less remote, may scab badly." He also cites that the Bellflower is nearly free from the scale for unknown reasons.

Conditions Favoring the Development of the Scab.—"The fungus of the apple scab appears to be retarded in its development by the heat of summer. Its most rapid growth takes place during moist, cool weather, such as usually prevails during the early months of spring or autumn. It may be observed that spots, which, during the hot summer months remain brown, at the approach of cool weather assume the olive green, velvety appearance indicating a renewed activity on the part of the fungus. The parasite doubtless retains its vitality throughout the winter, both on the twigs in the orchard and on the fruit which it infests. We have seen specimens of the latter in midwinter in the markets covered with spots on which the fungus was in a most flourishing condition. From the ease with which we know it can be propagated to healthy fruit, and from the appearance of apples in the public markets in the winter and spring months, we believe that the disease may spread after the fruit has been harvested and placed in storage. It is a well known fact that apples, after being gathered and stored, undergo a sweating process, and if healthy and diseased fruits are in contact during this period, infection of the former is very likely to follow.

"It is also well known that the 'scab' fungus is most severe in its attacks in seasons when damp, cold weather prevails at the time the fruit is forming. In the spring of 1885 the young fruit was closely watched for the first appearance of the 'scab' by my assistant. It was noted that at the time the young apples were about the size of peas a period of cold, damp weather set in. In a few days many of the varieties showed plainly the minute black specks which mark the first appearance of the fungus; later, these developed into the well known 'scab' spots. The spring of 1886, in the same locality, was very dry and warm, and there was a marked absence of the Fusicladium.

"The character of the soil appears to have little influence over the disease, although in heavy soils, particularly where the subsoil is wet or poorly drained, it is naturally more prevalent than in light or well drained lands. A damp, cool atmosphere, rather than an excess of moisture with heat, appears to be most favorable for the development of this malady."—Scribner.

The illustration (Fig. 7, Plate III) shows the disease on a Red June apple. Considerable infected fruit has been seen in the markets, and much more than at any previous season.

Remedy.

As yet but few have attempted to destroy the fungus with other remedies than those employed for the destruction of scale insects. Many of these remedies have, however, done much good, and especially where fungicides have been added to the solutions, and where care has been

exercised in not adding any such fungicides that may be destroyed by the action of the other ingredients in the solutions employed. Mr. Scribner says:

The fungus of the apple scab does not penetrate into the tissues of the host, and very early in its development it is wholly exposed to any application which may be made to destroy it. It appears, however, that the vegetative portion or plant body of this, as well as of many other fungi, is very resistant to the action of chemical reagents, quite as much or more so than are the tissues of the leaf or apple upon which it grows. We can scarcely hope, therefore, to accomplish its destruction, unless it be the growths infesting the young shoots and the scales of buds. Before the latter expand in the spring much stronger solutions can be applied than it is possible to use later in the season, and it is at this period that the warfare against this fungus should begin. It has been observed that the germination of the spores is wholly prevented in very dilute solutions of sulphate of copper, and our chief dependence in combating this disease appears to rest upon this fact—the possibility of preventing the germination of the spores where they can do harm. A practical treatment has been discovered by which we may prevent the germination of the spores of the downy mildew of the grapevine by applying various solutions of sulphate of copper to the surfaces of the leaves upon which the spores of the fungus fall. It is doubtless equally practical to accomplish by a similar treatment a like result in the case of the Fusicladium of the apple. Experiments already made with the sulphate of copper solutions indicate that they will, when properly applied, at once check the "scab." Further and more systematically conducted experiments are required in order to determine fully what preparation is most efficacious, at what season it is best to make the applications, and the strength to which the solutions must be limited. Where "eau celeste," prepared according to the original formula, has been tried, it has severely burned and injured the foliage. This preparation may be rendered less caustic by the addition of ordinary carbonate of soda, or by being prepared as follows:

In two gallons of hot water dissolve one pound of sulphate of copper; in another vessel dissolve two pounds of ordinary carbonate of soda; mix the two solutions, and when all reaction has ceased add one and one half pints of liquid ammonia; when desired for use, dilute to twenty-two gallons.

Another and more simple modification of the "eau celeste" is prepared by dissolving in one quart of liquid ammonia four to six ounces of carbonate of copper, then dilute with water to twenty-five gallons. The ammonia and carbonate of copper solution may be kept in a bottle and diluted when required for use at the rate of about one ounce of the solution to the gallon of water. Those who have used this preparation on the grapevine say it is perfectly harmless to the foliage and is as efficacious against mildew as "eau celeste." It is simple and easily prepared, and is very strongly adherent to the foliage.

Simple solutions of sulphate of copper ought not to be employed during the growing season, as their use is almost certain to result in injury to the foliage. The Bordeaux mixture may be used at any time without fear of injury, as follows:

Dissolve sixteen pounds of sulphate of copper in twenty-two gallons of water; in another vessel slake thirty pounds of lime in six gallons of water. When the latter mixture has cooled, it is slowly poured into the copper solution, care being taken to mix the fluids thoroughly by constant stirring. It is well to have this compound prepared some days before it is required for use. It should be well stirred before applying. Some have reduced the ingredients to two pounds of sulphate of copper and two pounds of lime to twenty-two gallons of water, and have obtained good results.

Using one or the other of the above preparations, the following course of treatment is suggested:

First—In early spring, before the buds have commenced to expand, spray the trees thoroughly with a solution of sulphate of iron, using four pounds of the iron sulphate to four gallons of water.

Second—As soon as the fruit has set, apply the Bordeaux mixture or one of the modified preparations of "eau celeste."

Third—If the weather should be such as to favor the development of the "scab" fungus, a third application should be made two or three weeks after the second, using the same materials.

In addition to the effect that these applications may have on the development of the fungus, they will doubtless keep off many pests.

The conclusions reached by Professor Taft (Section of Vegetable Pathology) in his recent experiments, is that the modified "eau celeste" solution gave the best results, and by its use a difference in the amount of scabby fruit of from 50 to 75 per cent was obtained; and adds, that thirty-two gallons of water should be used where the formula calls for twenty-two. The copper carbonate solution tends to give the fruit a russet coloring, but the injury is very slight.

ENTOMOLOGICAL.

BENEFICIAL AND INJURIOUS INSECTS.

THE STRUCTURE, ANATOMY, AND METAMORPHOSES OF INSECTS, AND NAMES APPLIED TO PRINCIPAL ORGANS.

The word "insect" is derived from two Latin words which signify "cut into," or "notched," the bodies of most of the tribe being divided by several incisions, and the parts between those lines or incisions are called "segments." Insects differ from other animals by not breathing through lungs, but through holes, or spiracles, placed at certain distances along each side of their bodies. Their lives are divided into three periods after they have emerged from the egg, the first of which is termed the "larva" state, and is applied to caterpillars, grubs, maggots, as well as to young grasshoppers and bugs before they attain wings. It is principally in this larva state that they do the greatest injury to vegetation, as they eat voraciously, and generally cast their skins several times as they increase in size. After the larva has attained its full size, the second change takes place, when it ceases to eat, casts its skin, and reappears as a "pupa," or "chrysalis," which is in color and outward form entirely unlike the caterpillar, or worm, from which it proceeded. This chrysalis is furnished with the rudiments of legs and wings, but is incapable of locomotion. In this state it does no injury, as it generally remains quiet and motionless, and takes no food whatever. After continuing a certain time in the pupa, or chrysalis state, it again casts its skin and issues forth a perfect and full grown moth, fly, or beetle, to deposit its eggs for future generations. The body of a caterpillar consists of a head and twelve segments, while that of the perfect insect is divided into three parts, the first of which is called the head, the second the thorax, or chest, and the third, the abdomen, or body. The head is furnished with eyes, two jointed horns called "antennæ," which differ greatly in various tribes, and a mouth, formed either for biting, chewing, or sucking. The second part—the thorax, or chest—is furnished either with two or four wings. The legs, generally six in number, are attached to the under side. The abdomen, or hind part, contains the organs of digestion and the piercer, or sting.

It is unnecessary here to enter into details or describe the several grand divisions into which insects are classed. The principal thing desired is to be able to identify the species most injurious and beneficial to cultivated crops; to know their habits, and repel or destroy those which are obnoxious, either in the larva, pupa, or perfect state. Many of the most destructive insects being extremely small and apparently insignificant, the fruit grower can never judge from the size or appearance of any particular species as to its capability of inflicting injury on vegetation.—Browne.

In the chapters that follow, the insects which are among the most important to the fruit grower are illustrated separately, to which is added the best means usually employed for their destruction. The predaceous insects, which are the fruit growers' friends, are also fully illustrated, to which attention is called.

DIRECTIONS FOR COLLECTING, PRESERVING, AND STUDYING INSECTS.

*Apparatus for Collecting Insects.**

One of the first essentials for collecting insects is the net represented in Fig. 16. To make this, obtain an iron wire about one sixeenth of an inch in diameter, and bend it into a circular ring twelve or thirteen inches in diameter, leaving the ends projecting at right angles to the circle, and welding them together so as to form a spur three or four inches

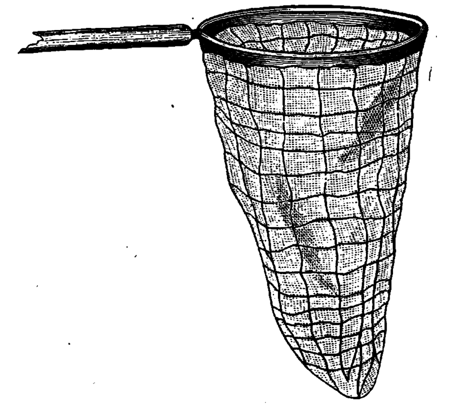


Fig. 16.

long. Fasten this spur into the end of a broomstick, or any convenient handle, three or four feet in length, as shown with handle broken off in Fig. 17. Now, sew over the wire circle a strip of strong muslin an inch or two wide, and to this sew a bag of mosquito netting, Swiss muslin, or some similar fabric, about three feet deep.

* Clarence M. Weed, Entomologist. Bulletin No. 1, Ohio Experimental Station, 1889.

A net for collecting water insects is shown at Fig. 18. It is made shallower than the first, and should be of firmer cloth—coarse millinet answers the purpose very well.

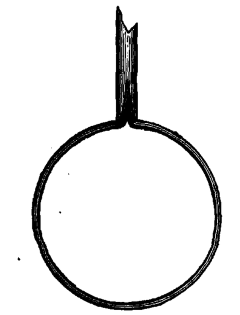


Fig. 17.

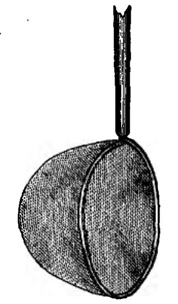


Fig. 18.

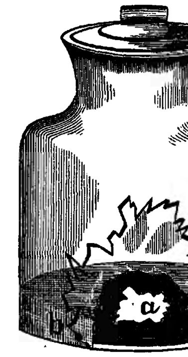


Fig. 19.

Another essential is some form of bottle for killing the specimens. The one in almost universal use among entomologists is the "cyanide bottle," represented in Fig. 19. To make this, obtain any wide-mouthed glass bottle, with a tight-fitting cork; place on the bottom two or three lumps of cyanide of potassium the size of a hickory nut; cover these with dry plaster of Paris, and finally add sufficient water to moisten the plaster, and make it "set." After it sets, pour off any surplus water there may be, and let the bottle become thoroughly dry before inserting the cork. In the figure the bottle is represented broken, to show the position of the cyanide, *a*. This cyanide of potassium is a poison, and, of course, must be handled carefully. If desired, the bottles can easily be prepared at drug stores. After the plaster has set, there is practically no danger, unless the fumes of the bottle be directly inhaled, for which there is no excuse. Keep the cork in, and when an insect is caught, simply put it in the bottle. The cyanide fumes rising through the porous plaster will kill it almost instantly. This cyanide bottle is to be used especially for moths, butterflies, bees, wasps, dragonflies, and the like, but should not be used for worms and caterpillars, which are more successfully killed and preserved in alcohol.

A pair of plain forceps like those shown in Fig. 20 will be found convenient for many purposes, especially in collecting small insects.

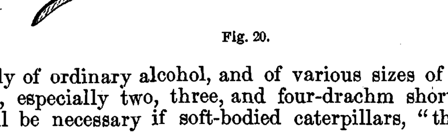


Fig. 20.

A supply of ordinary alcohol, and of various sizes of empty bottles and vials, especially two, three, and four-drachm short homeopathic vials, will be necessary if soft-bodied caterpillars, "thousand-legged

worms," spiders, and the like, are collected. Empty morphine bottles are very convenient.

An ordinary gamebag is an excellent thing for carrying the bottles, forceps, etc., in, while out collecting.

For rearing insects, to study their habits and transformations, breeding cages of various kinds are needed. Almost any box may be used for this purpose, covering it in part with gauze and in part with glass, and placing on the bottom an inch or two of moist earth to prevent the drying of the atmosphere. Ordinary jelly tumblers are very useful for rearing small leaf-eating caterpillars, and "bell glasses," or glass shades, serve an excellent purpose. I have not space to discuss, in this connection, the needs of the various classes of insects to be reared, but in general, it may be said that the cages should be examined daily, the food should be frequently renewed, and the conditions which the insect would have in its native haunt, so far as possible, should be supplied.

Apparatus for Preserving Insects.

The first requisite for preserving insects is a supply of entomological pins. These are longer and more slender than ordinary pins, and answer the purpose much better. They vary in size according to the number. No. 2 is used only for very small insects, and No. 5 is large enough for any of our species. For the majority of specimens of moderate size No. 3 may be used.

A supply of sheet cork is also desirable to place in the bottom of the boxes into which the specimens are pinned.

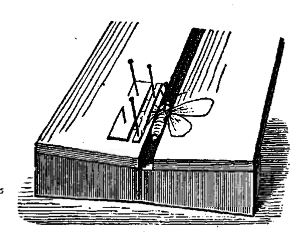


Fig. 21.

Butterflies, moths, and some other insects require, for their proper preservation, what is called a "setting board," one of which is shown in Fig. 21. It consists simply of two thin strips of pine board, twelve or sixteen inches long, nailed to end pieces, with a space varying from one fourth to three fourths of an inch between the long strips; a piece of thin cork is fastened to the under side of the strips so as to cover this space. The pin on which the butterfly is fastened is pushed through the cork until the side pieces are level with the base of the wings. The wings are then brought forward until the posterior borders of the front ones are at right angles to the body, and they are then fastened in place by pieces of cardboard held down with pins, as shown in the illustration. The insect should be left thus fastened until dry, so that the wings will remain in the position indicated. This usually requires ten to fourteen days.

Some sort of boxes or cases in which to keep the specimens are of course necessary. The cheapest and simplest receptacle consists of empty cigar boxes, lined on the bottom with sheet cork. Tight wooden boxes of almost any kind will also answer the purpose. Shallow drawers, with the bottoms lined with cork, are excellent.

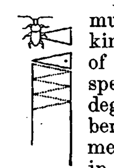


Fig. 22.

The specimens must frequently be examined to see that the museum pests—insects which live on dead animal tissues of all kinds—do not destroy them. When indications of the presence of these are found, the easiest way to kill them is to bake the specimens in an oven for an hour, at a temperature of 140 degrees Fahrenheit; or they may be exposed to the vapor of benzine, bisulphide of carbon, or some similar substance, remembering always that these vapors are explosive, and that fire in any form must not come near them. Napthaline placed in the boxes will also keep the pests away.

It is best to fasten small insects to a narrow triangle of cardboard, about three eighths of an inch long, as shown in Fig. 22. The insect is attached to the pointed end with mucilage, or glue, and a pin is thrust through near the base of the triangle.

Moths, butterflies, bees, wasps, and a large number of similar insects, should be pinned through the center of the thorax, or middle division of the body, the pin being pushed through until about one third of its length remains above the insect. Beetles, however, should be pinned through the right wing cover, as shown in Fig. 23, and the true bugs through the triangular piece at the base of the wings, called the "scutelum," as seen at Fig. 24.

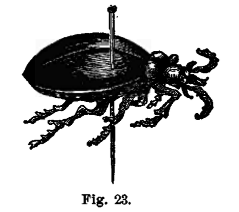


Fig. 23.

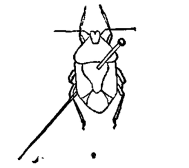


Fig. 24.

Studying Insects.

After a student has collected and prepared his specimens, he will need few directions concerning further study of them. He will have already noticed that there is a great variety of structure among them, and that on the other hand certain species look so much alike that they would naturally be classed together. This will lead to a study of the classification of insects, for which certain books will be necessary.

EMPEROR MOTH.

Platysamia cecropia, Linn.

This is one of our largest moths, the wings when expanded measuring from five to seven inches across. Fig. 25 gives a good representation of the moth. "Both the front and hind wings are of a rich brown, the anterior pair grayish, shaded with red, the posterior more uniformly

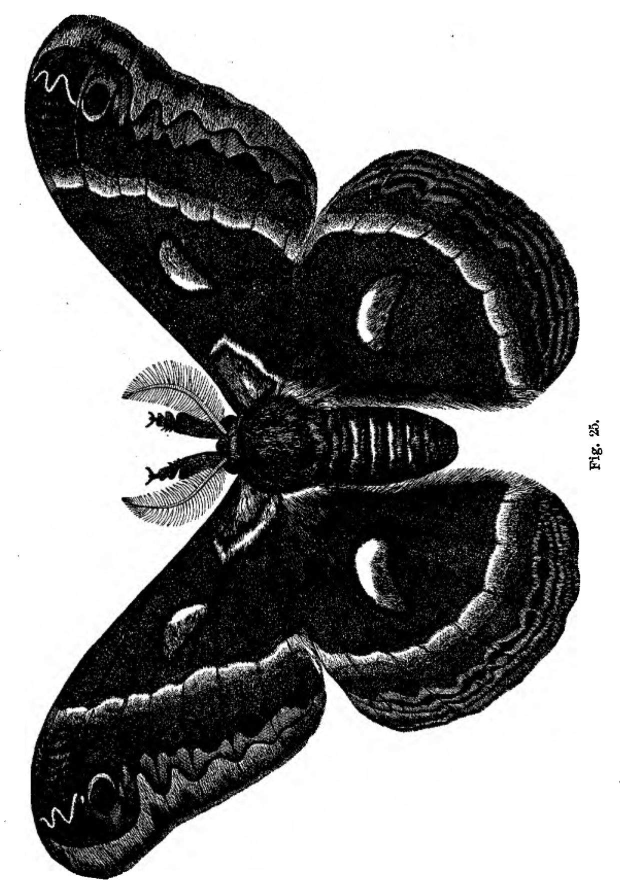


Fig. 25.

brown, and about the middle of each of the wings is a nearly kidney-shaped white spot, shaded more or less with red, and margined with black. A wavy dull red band across each of the wings, edged within with white, the edging wide and distinct on the hind wings and more or less faint on the front pair. The outer edges of the wings are of a pale silky brown, in which on the anterior pair runs an irregular dull black line. The front wings next to the shoulders are dull red, with a curved white and black band, and near their tips is an eye-like spot with a bluish white crescent. The upper side of the body and the legs are dull red, with a wide band behind the head, and the hinder edges of the rings of the abdomen white; the under side of the body is also marked with white."—Saunders.

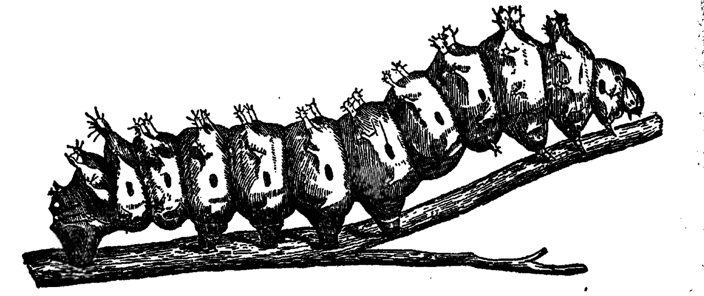


Fig. 26.

The moth lays its eggs usually in pairs, and firmly fastens them with a gummy substance. They generally lay the eggs on the under side of the leaf. When the egg (in about six to ten days) hatches, the young larva gnaws its way out.

Fig. 27.

At first the young larva (caterpillar) is black, and on its sides are little black knobs, and on these knobs hairs arise of the same color. The growth of the caterpillar is very rapid, and from time to time it throws off its exterior skin. At each change the caterpillar appears in different colors, which it assumes in molting.

The caterpillar (Fig. 26), when full grown, is from three to five and one half inches long, and fully three inches in circumference. The color of the caterpillar is pale green, and the warts, or tubercles, on each side of the body are dark red, with brown and blue intermixed. The tubercles on the back are yellow, except those towards the end of the body, which are about the same color as those along the side. These caterpillars, from the time they hatch until pupation, feed on the foliage of trees during the growing period, sometimes stripping young trees entirely bare. When the caterpillar attains full growth, it forms a cocoon, as shown in Fig. 27, which is about three to four inches long and more than an inch in width, and is of a rusty gray color. This cocoon is formed of two layers of silk. In this cocoon the chrysalis is formed, which is large and of a dark brown color, and remains in the cocoon during the winter months. In the spring (May and June) the moth emerges from the chrysalis to perform its natural functions, but does not attain full growth until a few hours after.

Remedy.

The best remedy is hand picking in the summer, and the gathering and destroying of the cocoons during winter. They are so large that finding them becomes an easy matter.

TOMATO HAWK MOTH.

Macrosila carolina, Linn.

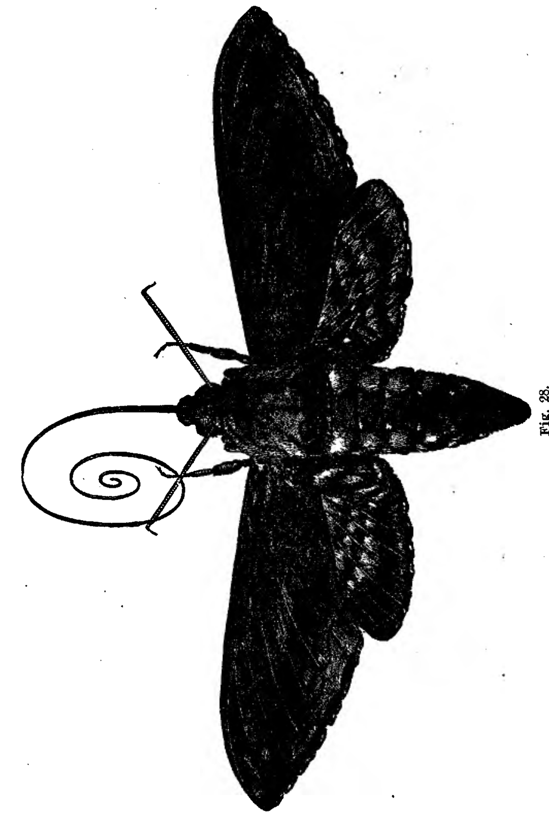


Fig. 28.

This is a very common moth, but does not increase as rapidly as other species do. The wings, when expanded, measure five and one fourth inches across. The head of the moth is quite large, and the wings rather broad, with the interior angles dilated. The hind wings are gray. There are two distinct angulated bands at the base of the fore wings.

The tongue of this moth is very long, in some specimens having measured nine and one fourth inches. The abdomen is marked with pink spots.

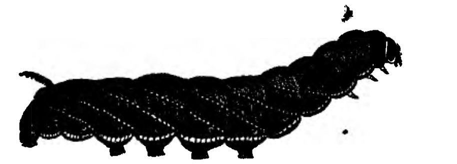


Fig. 28½.

The larva (caterpillar), Fig. 28½, is dark green, and measures from four to five inches in length. On the side of the body is a series of angular bands of greenish yellow. This caterpillar feeds on tomato and tobacco plants, but has also been observed feeding on other plants, as well as on the foliage of the apple, pear, etc.

Remedy.

The best remedy for the destruction of these caterpillars is hand picking. The plants should be looked over from time to time, and all larvæ found destroyed. The caterpillars feed upon the plants voraciously, and in a very short time strip them of their leaves. The caterpillars are so large, and as they consume considerable foliage, their damaging effects are soon observed on the vines; however, it is rarely that more than one or two caterpillars are seen on a vine, and therefore they are easily exterminated.

SPHINX MOTH.

Philampelis pandorus, Hubner.

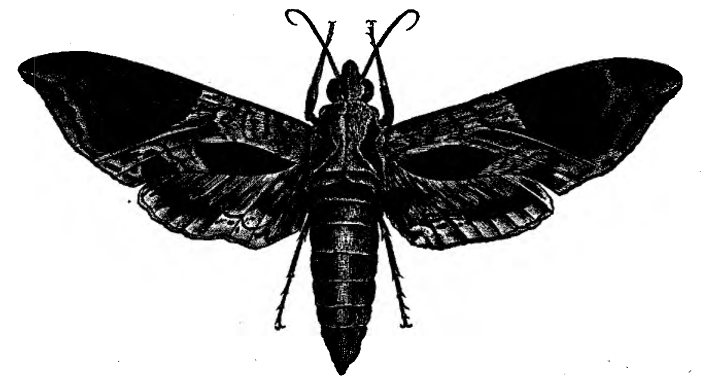


Fig. 29.

The wings of this moth, when expanded, measure from four to four and a half inches across, and are of a light olive color, intermixed with

gray, and very rich and velvety. The hind wings have a rosy-hued color. The moth makes its appearance in the spring (May and June), and sometimes not before July. The larva at first is of a pinkish hue along the sides; as the caterpillar increases in size it changes to a reddish brown color. The full grown larva (caterpillar) measures about four inches in length (see Fig. 30). The larva, when in motion (as shown at *a*), is much longer than when at rest (as shown at *b*), as when it is at rest the body shortens nearly an inch.

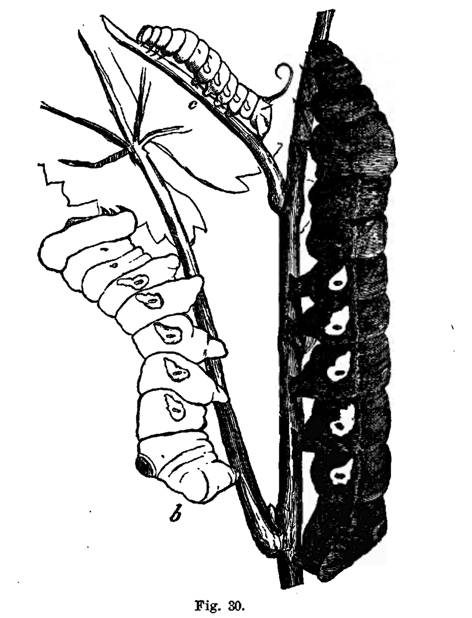


Fig. 30.

[(*a*) Caterpillar full grown; (*b*) Caterpillar nearly full grown; (*c*) Young caterpillar.]

As the larva is very large, it must necessarily feed voraciously upon foliage, and is therefore noticeable. The larva (caterpillar), as soon as it reaches its full growth, descends to the ground to pupate. It buries itself in the ground, where it forms an oval cell and changes within it into a dark brown chrysalis, where it remains in this chrysalis state until the summer following. There is, however, an exception to this rule, as the larva sometimes matures and transforms into a moth the same season.

Remedy.

The best remedy to decrease the progress of this moth is to destroy all caterpillars as they are found. Where the larva becomes troublesome it is well to examine the trees or plants every day, and in this way the damage becomes nominal.

WHITE-LINED SPHINX MOTH.

Deilephila lineata, Fabr.

Fig. 31.

This moth is very common, and is seen everywhere throughout the State. The moth can be seen sometimes flying in the daytime, but only seldom. It is mostly seen and is most active just about sundown, when it may be seen about flowers, resembling in this respect the humming bird. The wings of the moth, when expanded, measure about three and a half inches across. The ground color of the fore wings is a light green color. Along the middle of the wing and near the tip from the base, and along the outer margin, there is a band or stripe of a dark brown color, the veins being marked distinctly with white. The hind wings are quite small and have a wide band across them. This band covers a large portion of the surface of the hind wings. Above and below this band the color is dark brown, almost black. The body is marked with a white line on each side, which extends from the head to the base of the thorax. From the base of the thorax there is another line of the same color, extending down the middle, where it divides and a branch extends to each side. The abdomen is olive green and is spotted with black and white.

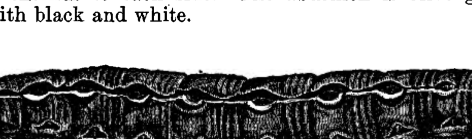


Fig. 32.

The larva (caterpillar) of this moth is one of the most common. It is usually found feeding on grape, apple, and pear foliage, and it also feeds on melon and tomato vines. The colors in the larva vary greatly, and for this reason the larva has often been mistaken for that of another species. The most common of these forms is shown in the illustration, Fig. 32. The body is yellowish green, and has a row of prominent spots

along each side. The breathing pores are lower down, and are margined with black and yellow. There is a pale yellow stripe extending down the back. The larva, when it reaches full growth, buries itself in the ground, where it changes into a light brown chrysalis, from which the moth emerges in the fall. These fall moths deposit eggs, from which the second brood of caterpillars are produced. The second brood of larvæ (caterpillars), as soon as they attain full growth, make their way into the ground, and transform into the chrysalis state, from which moths emerge late in fall, or early winter, but generally remain in the ground until spring.

Remedy.

The best and most practical remedy for all these large caterpillars is hand picking. For this purpose old pruning shears are often used; they are cut in two. This avoids the handling of them.

GRAPEVINE SPHINX MOTH.

Ampelophaga myron, Cramer.

Fig. 33.

This is one of the most common of moths found in our State. The moth deposits her eggs on the under side of the leaf. They are generally placed singly, but there is an exception to this rule, as they sometimes appear in groups of two or three.

The young larva (caterpillar) hatches from the egg in four to six days, and at once begins to feed on the foliage, at first attacking the softer portions of the leaves. In passing through its transformations the markings vary considerably at each molt. When full grown the larva is about two inches long, with a rather small head. The head is pale green, and has a pale yellow stripe down each side. The color of the body is green, and is covered with many small yellow dots. When full grown the larva descends from the vine or tree and draws a few leaves together, binding them with a thread, and within this nest changes into the chrysalis. The color of this chrysalis is dark brown, and the chrysalis is generally found at the base of the vine or trees upon which it has fed. Those of the fall remain in this chrysalis through the winter, and emerge into moths the year following, during the months of May and June. Those of the spring, however, emerge as moths in the fall. There are two broods each year.

The wings of the moth (Fig. 33) when expanded measure about two and one half inches across. The wings are long and narrow. The antennæ are of a variety of colors—dull white above, pinkish below;

the body underneath is gray. This is a night-flying moth, and can be seen flying about flowers just about sunset, and is very active.

Remedy.

The caterpillars are quite destructive to the foliage of some trees, vines, and also to garden truck. The only method employed in their destruction is hand picking. They are so large that they can be very easily found, the destroyed foliage generally indicating their presence.

ACHEMON SPHINX MOTH.

Philampelus achemon, Drury.

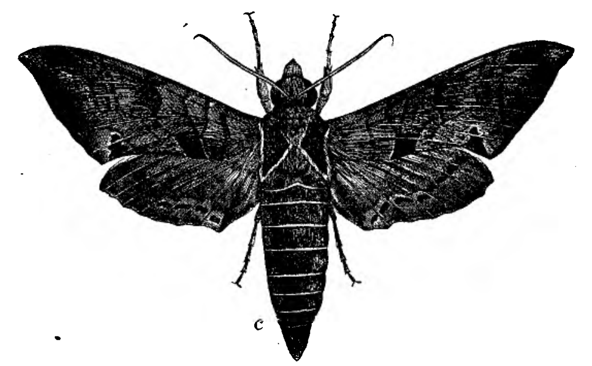


Fig. 34.

This moth is of a brownish gray color, and has very odd variegations of light brown, pink, and deep brown spots. The color of the hind wings is pink, which become of a deeper red nearer the middle. The body is reddish gray. There are two peculiar triangular patches on the thorax, which are deep brown.

Remedy.

This, like all large caterpillars, can be easily destroyed by hand picking. These caterpillars, however, are not found as numerous as the other species described.

SWALLOW-TAIL BUTTERFLY.

Papilio rutulus, Boisduval.

This is one of the largest of our butterflies, and one of the most handsome of the numerous species that abound in this State. It is very doubtful if many fruit growers ever noticed from which caterpillars these butterflies emerge, of the many they may have found in their orchards. This butterfly makes its appearance generally through the months of May, June, and July. The wings measure, when expanded, about four

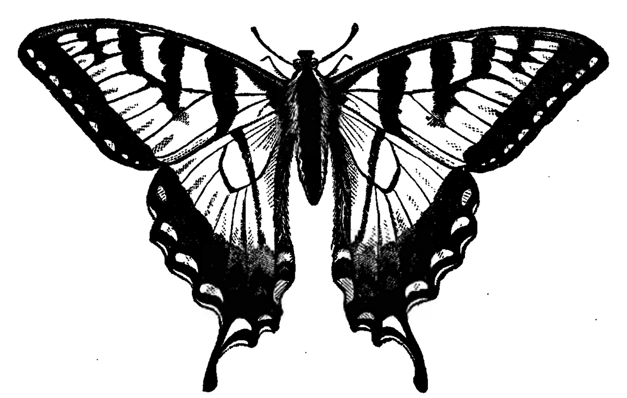


Fig. 35.

inches across. The wings are of a very rich pale lemon-yellow color, banded and bordered with black, as shown in the illustration (Fig. 35).

Fig. 36.

The larva (Fig. 36), when full grown, is from one and one half to two inches long, with a rather large reddish brown head. The body is green, and is partly covered with a whitish bloom. When the caterpillar attains full growth, and is about to change into a chrysalis, the color of the body grows gradually darker; it then spins a web of silk, with which it fastens itself onto a limb; it then casts its skin and remains a dull brown chrysalis until the spring following, from which the beautiful butterfly emerges.

Remedy.

The habits of this butterfly are somewhat peculiar, being solitary, and, therefore, the species is not of much importance. The caterpillars, however, feed upon the foliage of the grape, peach, apple, pear, etc. Whenever found they should be destroyed.

YELLOW BEAR MOTH.

Spilosoma virginica, Fabr.

This is one of the most common moths known. The moth is commonly known as the "white miller." The wings of the female moth, when expanded, measure from one and one half to two inches across. The male moths are somewhat smaller. The wings of both sexes are white, and have a few black dots; these, however, vary in number, as

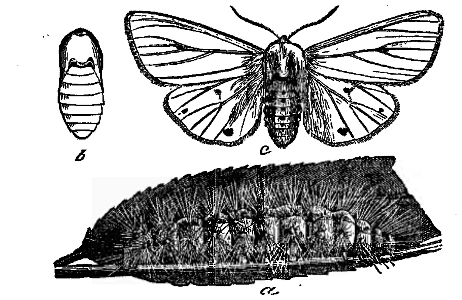


Fig. 37.

[(*a*) Caterpillar (larva); (*b*) Chrysalis; (*c*) Moth.]

upon some there are two on each of the front wings and three on the hinder pair, while in others these spots are wanting, or almost so. There is a dot near the middle of the front wings that is always seen, although at times with much difficulty. The abdomen at the under side is white and tinged a little with orange. The caterpillar (Fig. 37, *a*), when full grown, measures nearly two inches long, and is of a yellowish color, but this, however, varies from light to a dark shade. Upon attaining full growth it seeks some sheltered place, where it transforms to a chrysalis (Fig. 37, *b*) of a dark brown color. They pass through the winter in the chrysalis state, and the moths appear in early spring, when they begin to lay their eggs, which are generally deposited on the under side of the leaf, but sometimes on the bark of trees. The eggs are deposited in large clusters. In a few days the eggs hatch into small hairy caterpillars, which at once begin to feed on the foliage of whatever tree or vine the eggs may have been deposited on. At first the young caterpillars only devour the under side of the leaf, but in a very short time eat freely of all parts of the leaf, their digestive powers having become sufficiently strong to enable them to eat freely, even of most kinds of vegetation.

There are two broods each season, but moths and caterpillars are always found from early spring till late in fall, due to the intermingling of the broods.

Remedy.

These caterpillars are very easily destroyed by the application of Paris green—one pound to one hundred and sixty gallons of water. If they appear on plants or trees at a time when Paris green cannot be used with safety, hand picking should be resorted to.

CURRANT WORM.

Nemantus ribesii, Scopoli.

The larva (Fig. 39) of the currant sawfly (Figs. 38–40) gives at times much trouble to the orchardists, as it makes its appearance on the bushes at a time when they are full of tender foliage, and therefore difficult to treat. The female fly (Fig. 38) deposits her eggs on the under

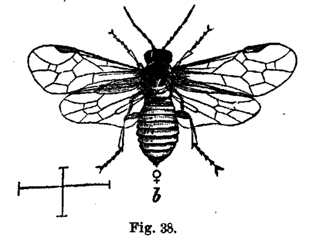


Fig. 38.

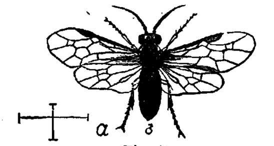


Fig. 40.

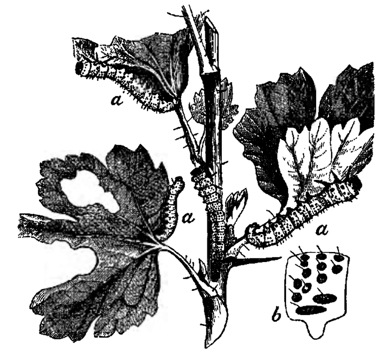


Fig. 39.

side of the leaf, and within eight or ten days the larvæ hatch, and very soon thereafter begin to feed, eating at first small holes in the leaf. They feed in droves of from twenty to fifty or more on a leaf, soon devouring all its soft parts, giving it a skeleton-like appearance. In a very short time the caterpillars increase in size, and assume a dark green color, with numerous black dots, and tinged with yellow; this, however, occurs just before transforming into the chrysalis state. The illustration (Fig. 39) shows the larvæ (caterpillars) in their full growth, and as they are seen feeding upon the leaves of currant and gooseberry bushes. When full grown they are about three fourths of an inch long. When the caterpillars reach full growth they form a cocoon, made among dry leaves, etc., under the bushes on the ground, and sometimes attach themselves to the leaves or twigs. Very soon the caterpillars change into a whitish green chrysalis, which is quite transparent, and from which the fly makes its appearance in early spring, and soon again lays her eggs, which hatch before the end of summer.

Fig. 40 shows the male, and Fig. 38 the female fly, both enlarged. The body of the flies is black, the under side being yellowish, and the legs are bright yellow. The female is larger than the male, and differs somewhat in the color of the body, which is mostly yellow, instead of black.

Remedy.

The remedy mostly used for the destruction of the caterpillars is powdered hellebore—one ounce to five gallons of water—sprayed on the bushes. This will not injure the bushes or tender foliage.

Paris green *should not* be used on currant or gooseberry bushes, unless after the gathering of the berries, when it can be applied successfully; one pound to two hundred gallons of water.

CURRANT SPAN WORM.

Eufitchia ribearia, Fitch.

Fig. 41.

[(*a*) and (*b*) Larva; (*c*) Chrysalis; (*d*) Moth.]

This caterpillar may be easily distinguished from the sawfly larva (*Nemantus ribesii* and of *Pristiphora grossulariæ*), especially by its mode of progression. At every step it arches its body into a loop, as shown in the illustration. When full grown the larva (caterpillar) measures an inch to an inch and a quarter in length. The larva is of a whitish color, and has a wide yellow stripe down its back. There is another yellow stripe along each side of the body and numerous black spots. The eggs are laid in autumn, and remain attached to the limbs or twigs until spring, hatching about the time the bushes are in full leaf. The larvæ (caterpillars) attain their full growth in about three or four weeks. When they reach full growth they descend to the ground and transform into a dark brown chrysalis, and from which the moth emerges in about three or four weeks. The moth (Fig. 41, *d*) is of a pale yellow color, and has several dusky spots; these, however, vary greatly in size and form. The wings of the moth when expanded measure about an inch and a quarter across.

Remedy.

Paris green is the most effectual remedy—one pound to two hundred gallons of water, and even stronger, but under no circumstances should this be applied until after the crop has been gathered. Powdered hellebore is a certain remedy, but must be used strong, as the caterpillars are quite difficult to destroy, therefore it should be used on these caterpillars at least double the strength as used for other sawfly caterpillars. Buhach is also effectual, one half of a pound to ten gallons of water. Buhach and hellebore can be applied on tender foliage without danger.

NOTODONTA MOTH (RED-HUMPED CATERPILLAR).

Œdemasia concinna, Smith.

a *b*

Fig. 42.

[(*a*) Moth; (*b*) Caterpillar.]

"Different broods of caterpillars of this moth make their appearance at various times during August and September. The eggs from which they proceed are laid in the course of the month of July, in clusters, on the under side of a leaf, generally near the end of a branch. When first hatched, they eat only the substance of the under side of the leaf, leaving the skin of the upper side and all the veins untouched; but as they grow larger and stronger, they devour whole leaves from the point of the stock, and go from leaf to leaf down to the twigs and branches. The young caterpillars are lighter colored than the older ones, which are yellowish brown, paler on the sides, and longitudinally striped with slender black lines; the head is red; on the top of the fourth ring there is a bunch or hump, also of red color; along the back are several short black princkles, and the hinder extremity tapers somewhat, and is always elevated at an angle with the rest of the body when the insect is not crawling. The full grown caterpillars measure one inch and a quarter, or rather more, in length. They rest close together on the twigs when not eating, and sometimes entirely cover the small twigs and ends of the branches. The early broods come to their growth and leave the trees by the middle of August, and the others between this time and the latter part of September. All the caterpillars of the same brood descend at one time, and disappear in the night. They conceal themselves under leaves, or just beneath the surface of the soil, and make their cocoons. They remain a long time in their cocoons before changing to chrysalids, and are transformed into moths towards the end of June or the beginning of July."—Dr. Harris.

This caterpillar is mostly to be found in prune and apple orchards, and is quite troublesome.

Remedy.

The best remedies for the destruction of these caterpillars are hand picking and Paris green. Upon jarring the branches all the large caterpillars fall to the ground, and should be thrown into a strong caustic soda solution, which kills them instantly.

In the bucket containing the caustic soda solution, a wire basket is arranged, which fits closely down to the bottom of the bucket. Before moving to another tree, this basket is raised up and its contents (caterpillars) thrown away. In this manner the liquid does not require to be renewed often. Spraying with Paris green will kill all the young caterpillars on the tree. The proportions used are one pound of Paris green to two hundred gallons of water. Great care must be exercised in the use of Paris green. It should only be used when the fruit is still green.

FALL CANKER-WORM MOTH.

Anisopteryx autumnata, Packard.

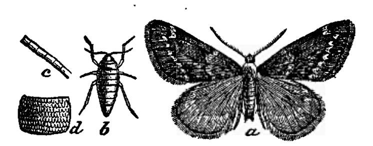


Fig. 43.

The female moth (Fig. 43, *b*) of this species is *wingless*, and in its movements quite sluggish. The body of the female is of a shining ashy color above, and gray beneath. It measures about four tenths of an inch in length.

The male moth (Fig. 43, *a*) is of a brownish gray color, and quite glossy. The fore wings are of a light brownish gray color, and are crossed by two quite irregular white bands, the outer one quite prominent near the apex, where a large pale spot is found. The hind wings are grayish brown, with quite distinct whitish band crossing them, as shown in the illustration. The eggs are laid side by side in regular masses. These egg masses are placed on branches or trunks of trees. In a very short time they hatch, but generally just about when the apple trees begin to bud out. The young larvæ cluster upon and eat the tender leaves. The newly hatched larva is of a pale olive green color. When full grown, it measures about an inch in length.

These caterpillars are often called "loopers," because they extend their body, and loop when traveling. These caterpillars are also given the name of "measuring worms." The larvæ, when full grown, leave the trees by letting themselves down by silken threads, or by creeping down the trunk. When they reach the ground, they burrow from two to six inches into the earth, where they transform into the chrysalis of about one half of an inch long, and of a light gray-brown color. The chrysalis of the male is slender, and is furnished with wing cases. The chrysalis of the female is much larger, and is without wing cases. They remain in the ground until autumn, when the moths emerge, and very soon thereafter begin to perform their functions.

Remedy.

The caterpillars are easily destroyed by the application of Paris green, one pound to two hundred gallons of water, but should be applied only when the fruit is quite small. The females being without wings, can be prevented from ascending the trees by placing on the trunk of the trees bands made of tarred paper, on which substances like printers' ink, slow drying varnish, etc., are smeared from time to time. In ascending the tree the legs of the female become entangled and she soon dies. The tin band tree protector (Fig. 44) has been used successfully in preventing the ascent of the moth.

This protector is made and placed on the tree as follows: Take a strip of tin four inches wide, of sufficient length when encircling the tree to leave a space of about six inches. The upper edge of the tin is bent over so as to receive beneath it a piece of muslin as long as the tin and

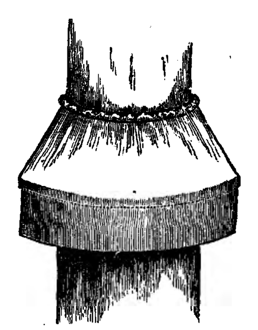


Fig. 44.

eight inches wide, to be held in place by pounding down the tin. The ends of the tin are bent in opposite directions, so that they can be hooked together. Placing this around the tree with the cloth upward, the cloth is to be firmly bound to the tree by a strong cord. In the above method, the insects, which will collect in large numbers below the obstruction, may be easily killed by brushing them with kerosene oil, without injury to the tree, unless an excessive quantity (a very little is needed) should be used.

SPRING CANKER-WORM MOTH.

Anisopteryx vernata, Peck.

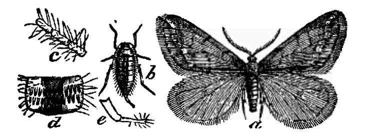


Fig. 45.

The female moth of this species, like that of *Anisopteryx autumnata*, is wingless, and differs from it very slightly. The moths lay their eggs in early spring, or about the time the apple tree begins to put forth its leaves, upon which the larvæ feed. The larvæ eat nearly all the pulpy part of the leaves and leave only the veins and midrib. They differ in color at different ages. This difference is also observed among those of the same size and age. When fully grown they assume an ash color on the back, and black on the side, and a yellowish line below. The larvæ on reaching maturity quit their feeding place, and some creep down, but the majority let themselves down by their threads, and, after reaching the ground, they burrow into and conceal themselves in the earth and transform into a light brown chrysalis.

BROAD-NECK BORER.

Prionus laticollis, Drury.

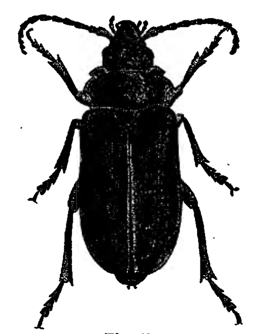


Fig. 46.

This gigantic beetle appears during July and August, but at times has been seen much earlier, and also late in winter. The beetle measures from one inch and a quarter to two inches in length. The color is dark brown, nearly black. The beetles possess strong, thick jaws. In the male the antennæ are rather slender (see illustration, Fig. 46, the male insect), as also the body. In the female the body is much broader and the antennæ not so stout. The larva (Fig. 47) is a large borer, with a broad neck. It measures from two and a half to three inches in length. The color of the larva is yellowish white.

Fig. 47.

The head is quite small, and is reddish brown. There is a light blue line down the back. It always attacks the trees or vines just below the surface. It bores a hole through the center of the root or into the trunk. On the trunks of trees or vines it never bores very deep, seemingly preferring to work just under the bark. The larvæ cannot easily be discovered, for the reason that the trees do not begin to show the effects until the larva has had time to develop to its full size, when it becomes a voracious feeder. The larva remains in that state three days, and changes to the chrysalis state about the month of June, as the beetles generally make their appearance in July.

Remedy.

It is very difficult to ascertain the presence of underground borers before the trees indicate their presence. Walnut and apple trees sometimes are observed to be bleeding (oozing sap) from a certain spot; this indicates a borer, or having been damaged otherwise. However, the cause should be carefully looked into by cutting into the bark, and the borer be destroyed. The wound should then be covered over with such material that will prevent the action of the atmosphere from injuring the tree. This borer attacks walnut trees, and they are often detected by the oozing of sap.

TWO-STRIPED APPLE BORER.

Saperda candida, Fabricius.

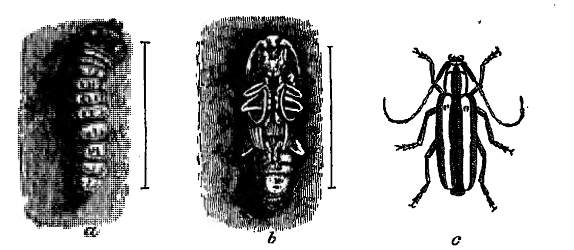


Fig. 48.

This borer in its perfect state is a very handsome beetle (Fig. 48, *c*), and is about three fourths of an inch long and cylindrical in form. In color it is pale yellow, and has two broad, creamy white stripes running down its back, the whole length of the body. The antennæ and legs are gray. The females have a shorter antennæ and are larger than the male. The beetles lay their eggs in the spring of the year and generally on the body of the tree near the ground, and within two or three weeks the eggs hatch. The young larvæ at once commence to bore with their sharp mandibles into the body of the tree, and as they increase in growth, to the interior of the tree.

It takes the larva (Fig. 48, *a*) about three years to reach maturity. The presence of this borer is detected by the bark oozing sap (a dark colored liquid), which generally runs down the trunks of trees. The part from where the oozing starts should be examined by cutting the bark and following their cavities until the borer is reached. When the larva reaches maturity it sheds its skin and transforms into the chrysalis state, in which condition it remains from ten to twenty days, and then emerges into a perfect beetle. The larvæ in many instances cause the death of trees by completely girdling them.

Remedy.

The borers may sometimes be reached by thrusting a stout wire into the holes and the destruction accomplished by turning the wire around several times. The trees should be looked over from time to time, and all borers found destroyed. Preventive measures may be employed, such as wrapping the trunk of the trees with tarred paper, or by giving the trunks a coating of soap (such as laundry or whale oil) and sulphur, such being repulsive to the insect, which will not lay its eggs on trees thus protected.

FLAT-HEAD APPLE BORER.

Chrysobothris femorata, Fabricius.


a *b*

Fig. 49.

The beetle (Fig. 49, *a*, enlarged) measures about three eighths of an inch in length; it is of a flattish oblong form, and of a greenish black color. The under side of the body and the legs have a copper shining appearance, and the feet are shining green. This borer does not confine its attacks to the trunk of the tree, but also attacks the larger branches.

The larvæ (Fig. 49, *b*) sometimes girdle a small tree in a very short time, and a single larva often causes the death of a tree. When mature, the larva (Fig. 49, *b*) changes to a chrysalis, which is at first white, but soon assumes the color of the beetle; which emerges in about twenty days.

Remedy.

Old, healthy trees do not suffer as much from the attacks of this borer as the young trees, and especially sickly trees. They generally attack a tree when injured by exposure to the sun.

The borers can be detected by the discoloration of the bark, which assumes a dried appearance, or by the oozing of sap and sawdust-like castings. Whenever any such indications are seen they should be carefully looked into, by cutting the bark at the part affected, and the borer, if found, destroyed. It is also well to guard the trees from sunburn by wrapping the trunks with tarred paper, or any common wrapping material, such as old newspapers, old sacks, etc., or by placing a shake on the south and west sides of the trees. Whitewashing the trunks of the trees is also effective, but the whitewash should contain, in addition to the lime, a few pounds of laundry or hard soap of any kind, and some sulphur. The soap will cause it to adhere to the body of the tree, and combined soap and sulphur give offensive odors, which are repulsive to the insect, and prevent it from depositing eggs upon the bark.

MAY BEETLE.

Lachnosterna fusca, Frohl.

This beetle makes its appearance early in May and June, flying mostly just about sunset; they remain in repose during the day. It is of a brown color, varying from light brown to nearly black. The beetle

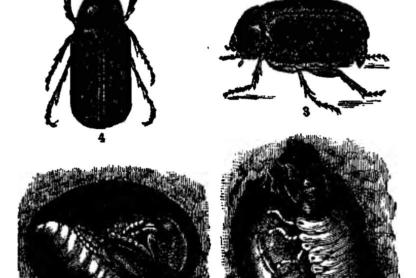


Fig. 50.

is about an inch long, and has a rather thick body. The thorax is punctured with small indentions. The wing covers are glossy and shining. The female beetle lays her eggs in the ground, and when hatched, the larva (a small, white grub) begins to feed upon the small plant roots. The larva is said to be several years in reaching maturity, therefore larvæ of different sizes are often found.

The larva (Fig. 50, *2*) is commonly known as the "white grub." They feed upon the roots of strawberries and other small plants, to which they are very injurious. The larva, when full grown, buries itself in the ground and remains there until spring. When ready to transform, the larva forms a cavity in the ground, which it lines with a glutinous secretion, and within it transforms into the pupa state, from which the beetle finally emerges.

Remedy.

The larva of this beetle is very difficult to destroy, as it lives in the ground, and we have to rely upon their destruction by domestic fowls and insectivorous birds. They, however, are not abundant, on account of the length of time required for the larva to reach maturity.

SPOTTED PELIDNOTA.

Pelidnota punctata, Linn.

This beetle resembles the May beetle (*Lachnosterna fusca*) in general appearances, excepting that its wing covers are spotted. The beetle measures about an inch in length, and is of an oval form, and of a dull yellow color. There are three black spots on each wing cover. There is also a small black dot on each side. The gauzy wings concealed under the wing covers are dark brown. The under side of the beetle is dark green. The larva, when full grown, measures nearly two inches in length, and presents the appearance as shown in the illustration, at *a*. This larva also resembles the larva of the May beetle. When it reaches full growth it forms a slight cocoon, in which it changes into

Fig. 51.

the chrysalis state. The beetles make their appearance in the spring, and are quite active during the day, and also fly at night.

Remedy.

For remedy, see remedy for May beetle (*Lachnosterna fusca*).

GRAPEVINE FLEA BEETLE.

Haltica chalybea, Illiger.

Fig. 52.

This beetle may be seen in early spring feeding on grapevines, and on various kinds of vegetables. It is very injurious to young plants, destroying their foliage. The beetle (Fig. 52, *d*) is about a quarter of an inch

long, and of a deep steel blue color; this coloring shade varies, however, as specimens are often seen on the same plant of dark purple, deep green, greenish blue, etc. Perhaps the tint most common is a glossy, deep greenish blue. The antennæ and feet are dull black. The body is oval, and the under side dark green. The beetles, when disturbed, jump rather than fly. The larva (Fig. 52, *b*) is about thirty-five hundredths of an inch in length, and is yellowish white (cylindrical), with a jet black head and black tubercles; on each side of the body there is a row of dot-like tubercles.

Remedy.

Paris green is the most effectual remedy; one pound to two hundred gallons of water; but should not be used on vegetables under any circumstances, or on fruit trees of very early ripening, unless after the fruit has been picked. Strong tobacco water is also very effectual in destroying the larvæ. Pulverized sulphur and lime (equal proportions) dusted over the plants drives away the beetles.

THREE-STRIPED SQUASH BEETLE.*

Diabrotica trivittata, Mann.

[Fig. 17, Plate IV.]

This insect is quite troublesome, not only to squash and cucumber vines, but also to trees, vines, and garden plants. In the larva state it bores into the lower part of the stem of tender vines. The beetle feeds on the leaves of plants, and also on the foliage of trees.

The beetle generally makes its appearance very early in the spring, in fact, it is wonderful that it seems to know just when the young leaves of vines are fairly above ground. When they infest very young plants, and after they have partially or wholly devoured the leaf, they follow the stem, eating it quite a way below the surface.

Remedy.

The best method for the destruction of the beetles is the application of a solution of Paris green—one pound to two hundred gallons of water. This application does not kill by contact, but by remaining on the leaves the beetles are poisoned while feeding upon them.

Paris green and sulphur—five ounces of the former to twenty pounds of the latter—have been used on the foliage of trees very successfully. The sulphur and Paris green are put into a sack, and the sack is tied to a long pole and shook over the trees. One application has driven away the beetles. This remedy should only be applied when the fruit is young.

SPOTTED DIABROTICA.*

Diabrotica soror, Le Conte.

[Fig. 16, Plate IV.]

Like the preceding one, this insect is very common throughout the State. In places the cherry trees suffer greatly from their attacks. They feed on nearly all kinds of vegetation, but prefer that which is

* Often mistaken for species of ladybird (*Coccinellidæ*).

soft and tender. They are mostly destructive to squash and melon vines, cucumber, and other soft-wooded plants. They are also destructive to corn and beans, by feeding on the tender leaves. The beetle is yellow, with twelve black spots, as represented in the illustration (Fig. 16, Plate IV).

Remedy.

Spray foliage with one pound of Paris green to two hundred gallons of water when the insects appear. (See remedy for *D. trivittata.*)

EXCLUDING SQUASH AND CUCUMBER BEETLES—MECHANICAL BARRIERS.*

A number of methods of fencing out the beetles with mechanical barriers were tested with very satisfactory results. One of the simplest and most successful methods is that of placing the ends of half a barrel hoop in the earth at the sides of the hill, and then laying over it a square strip of thin plant cloth or cheese cloth. The edges of the cloth are then drawn taut, and covered with loose earth or small stones, as shown in Fig. 53. This excludes the beetles, and at the same time allows access of air, moisture, and sunshine. Squash plants are able to grow until they get four or five leaves, and cucumbers and melons even more, before they are crippled by contact with the cloth.

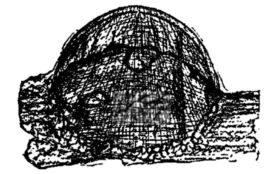


Fig. 53.

Instead of a barrel hoop, a wire may be used. On some of the hills a wire was used, bent as shown in Fig. 54, with excellent results. Another way is shown in Fig. 55, consisting simply of two pieces of wire bent over each other in the middle like the center arch of a croquet ground. Of course, the ends are pushed into the soil and the cloth

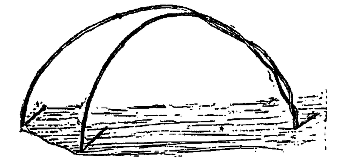


Fig. 54.

drawn over and held down by loose earth as described above. Good results were also obtained by simply placing the cloth over the plants without any standard, and covering the edges as above. By loosening the cloth occasionally it will not cripple the plants.

* Prof. Clarence M. Weed, Entomologist, Ohio Experiment Station.

We also tried various forms of gauze-covered boxes, one of which is shown at Fig. 56. These have, however, the decided disadvantage of

Fig. 55.

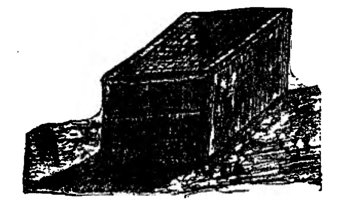


Fig. 56.

not allowing free access of air and sunshine, so that the plants are liable to be slender and weak, falling an easy prey to the voracious beetles after the protection is removed.

Summary.

1. The present article embodies the results of the first season's work on a series of experiments undertaken to determine the preventive or remedial value of various methods recommended to prevent the injuries of the beetle.

2. These methods are, for sake of convenience, divided into four classes, viz.: (1) The use of offensive odors; (2) Mechanical coatings of the leaves; (3) Poisonous coatings of the leaves; (4) Inclosing plants under tents or gauze-covered frames.

3. The experiments were made on a large scale, under ordinary field conditions, during the summer of 1889, when the beetles were exceedingly abundant.

4. Five substances of the first class were tested, viz.: hen manure, cow manure, kerosene, carbolic acid, and bisulphide of carbon. None of these proved practically successful.

5. Three substances of the second class were tested, viz.: coal soot, gypsum, and saltpetre. Of these, coal soot and saltpetre proved worthless, while gypsum showed some beneficial effect, not sufficient, however, wholly to save the plants.

6. Three substances of the third class were applied, viz.: pyrethum, slug-shot, and peroxide of silicates. Pyrethum killed those beetles with which it came in contact, when first applied, but soon lost its efficiency. Slug-shot injured the plants to which it was applied. Peroxide of silicates had a decided effect in preventing injury, and where the plants had been well started before being attacked saved them from destruction. But it did not save them where the beetles were so numerous that they burrowed down to meet the sprouting plants.

7. The results obtained from the fourth method—that of fencing out the insects by covering the plants with some form of tent or gauze-covered frame—were by far the most satisfactory. The cheapest and most successful method employed is that of protecting each hill by a piece of plant cloth or cheese cloth about two feet square. This may be done simply by placing it over the plants, and fastening the edges down by small stones or loose earth. It is better, however, to hold it up by means of a half barrel hoop or a wire bent in the form of a croquet arch.

EASTERN PLUM CURCULIO.

Conotrachelus nenuphar, Herbst.

[Fig. 18, Plate IV.]

This insect, which is illustrated in its natural size and color, is perhaps the worst enemy to fruit culture, especially to the plum, apricot, and cherry crops. In the Eastern States the growing of the apricot (although only grown in few districts) has been abandoned in many districts, as the ravages of the curculio are so great as to render its culture an entire failure. The growing of the plum and cherry is also quite difficult, having to resort to heroic treatment in order to produce a crop. It will be readily understood, then, how careful every one should be to avoid the introduction of the plum curculio into this State. A year ago it was rumored that it had made its appearance in this State. Officers were at once detailed to investigate, and the report of its appearance in this State proved to be without foundation.

There are several beetles on this coast that resemble the plum curculio, but before they are pronounced the same they should be thoroughly investigated, and reports should not be put afloat without any foundation of fact. "This insect has not yet been found, so far as we know, in California, or elsewhere on the Pacific Coast."*

The attacks of the curculio are not altogether confined to the fruits above mentioned; they attack peaches and nectarines, and, according to the reports from the East, they also attack the persimmon and several varieties of apples, such as crabs and haws. (See Report for 1889, State Board of Horticulture, page 224.)

Description.

In place of a description, I append the following extract from the report of the Department of Agriculture for 1888:

The Egg.—Having taken a strong hold on the fruit, the female makes a minute cut with the jaws, which are at the end of her snout, just through the skin of the fruit, and then runs the snout under the skin to the depth of one sixteenth of an inch, and moves it back and forth until the cavity is large enough to receive the egg it is to retain. She next changes her position, and drops an egg into the mouth of the cut; then, veering round again, she pushes it by means of her snout to the end of the passage, and afterwards cuts the crescent in front of the hole so as to undermine the egg and leave it in a sort of flap; her object apparently being to deaden this flap so as to prevent the growing fruit from crushing the egg, though Dr. Hull informs me that he has repeatedly removed the insect as soon as the egg was deposited and before the flap was made, and the egg hatched and the young penetrated the fruit in every instance. The beetle first makes a small crescent-shaped incision, with its snout, in the skin of the plum, and then, turning round, inserts an egg in the wound. The egg will hatch in from three to ten days, depending upon the weather, and, as the period of oviposition frequently extends over two months, a confusion of stages arises.

The Larva.—The larva of the plum curculio is white and footless, and furnished with a horny head. It works its way, immediately after hatching, in stone fruit to the pit, and there grows to full size, eating the pulp around the stone. The larva attains its full growth in from three to five weeks, when it is about 10 mm. (0.4 inch) in length, rather stout, and of a glistening whitish color. The head is light brown, and there is a pale line along each side of the body. There is a row of small black bristles below the side lines, and on the second segment a less distinct row of bristles above; also a few pale hairs near the anal end of the body. The fruit thus infested falls prematurely, in a large majority of cases, with plums, apricots, and peaches; cherries, however, do not fall, but remain upon the tree. One or two varieties, particularly the English Morello, are said, however, to mature and drop. In cherries seldom more than one larva is found in a single fruit, but several are often found in a single plum, peach, or apple. Rarely are as

* Report U. S. Department of Agriculture, 1888.

many larvæ found in the fruit as there are punctures under the skin, and many eggs, therefore, fail to hatch. After the fruit has fallen to the ground the larvæ may still remain within it for some time, but as soon as they are full grown they issue and enter the ground to pupate. Larvæ issuing from cherries drop to the ground for the same purpose. They seldom burrow to a greater depth than four or five inches, and at the end of the burrow they construct a small oval cell within which to pupate.

The Pupa.—The pupa is white at first, becoming yellowish as it grows older. It remains in this condition from three to six weeks.

The Adult.—The beetle is familiar to most fruit growers, and is, besides, so well shown in Fig. 18, Pl. IV, that a detailed description is unnecessary. While the females lay their eggs chiefly during the daytime, the insect is essentially nocturnal, flying freely during the warmer nights and only seeking shelter when the nights are cold.

BENEFICIAL INSECTS.

Nearly all of the species of ladybirds (*Coccinellidæ*) are beneficial, and most of them are great enemies to all kinds of injurious insects, and especially to aphis and scale. Sometimes it happens that the scale gets ahead of the ladybirds, and remedies have to be applied, and in so doing many of these friends are destroyed; and where the remedies do not affect the ladybirds the odor is so offensive as to drive the ladybirds away, as they are no doubt guided largely by the odor in the quest for their prey.

Those who find it difficult to determine in the mass of debris on a tree whether there are more dead scales than live ones, and by this reason are led to believe that the benefit derived from the ladybirds is but little, should watch the ladybirds in their search, and no doubt they will find that they pass by dead scales, and only stop to devour live ones. When the scales are thick on a tree they should be sprayed, and in so doing of course the food supply for the ladybirds is reduced and causes them to search more closely. Both the beetle and its larvæ are always active in searching for scales to eat; if they are seen to stop when moving actively, it is an indication that they are feeding.

In pruning an orchard the greatest care should be exercised that the brush be not burned before the ladybirds have again ascended the trees. The prunings (especially of orange trees) should be left a few days to wither, and by so doing the ladybirds and other predaceous insects will fly back onto the trees. When the ladybirds have had time to emigrate, the brush should be burned.

CALIFORNIA LADYBIRD.

Coccinella transversoguttata, var. *Californica*, Mann.

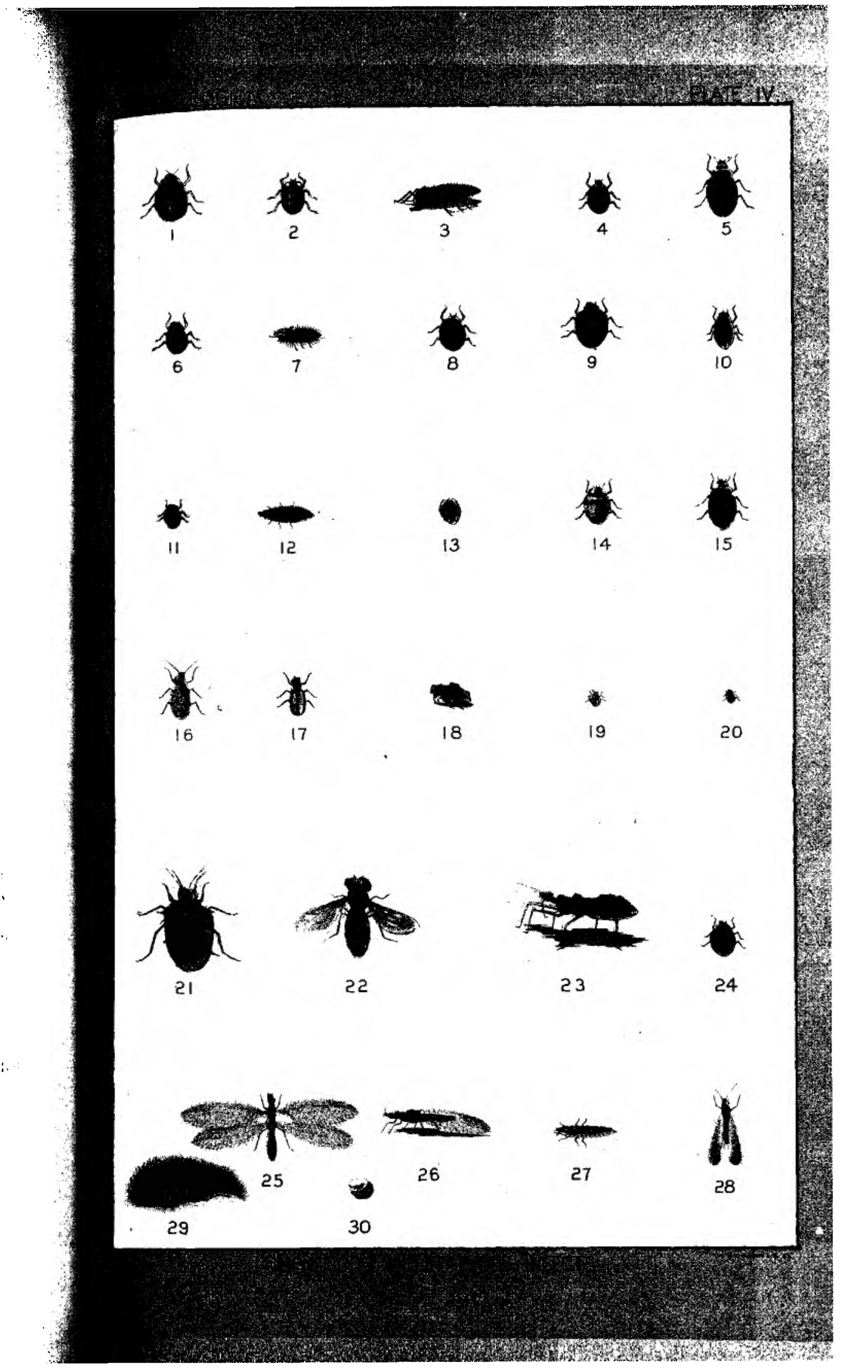
[Fig. 1, Plate IV.]

This ladybird is a California variety, and is a form with no spots. The wing covers are of pale orange color, the thorax is black, and has on each side a pale spot. This is a very common species, and the beetles at times have been found feeding on ripe fruit, but only that which had fallen and was partly broken or bird-eaten. The fact that it has been found feeding on ripe fruit has caused many to believe that it is injurious, but such is not the case. The larva is highly beneficial, and is always found where aphis abounds.

EXPLANATION OF PLATE IV.

ENTOMOLOGICAL.

Fig. 1. California ladybird (*Coccinella transversoguttata*).
Fig. 2. Two-spotted ladybird (*Adalia bipunctata*).
Fig. 3. Two-spotted ladybird, larva (*Adalia bipunctata*).
Fig. 4. Blood-red ladybird (*Coccinella sanguinea*).
Fig. 5. Convergent ladybird (*Hippodamia convergens*).
Fig. 6. Twice-stabbed ladybird (*Chilocorus bivulnerus*).
Fig. 7. Twice-stabbed ladybird, larva (*Chilocorus bivulnerus*).
Fig. 8. Eyed ladybird (*Coccinella oculata*).
Fig. 9. Pilate's ladybird (*Exochomus Pilatei*).
Fig. 10. Striped ladybird (*Megilla vittigera*).
Fig. 11. Australian ladybird (*Vedalia cardinalis*).
Fig. 12. Australian ladybird, larva (*Vedalia cardinalis*).
Fig. 13. Australian ladybird, pupa (*Vedalia cardinalis*).
Fig. 14. Julian's ladybird (*Coccinella trifasciata*).
Fig. 15. Ambiguous ladybird (*Hippodamia ambigua*).
Fig. 16. Spotted diabrotica (*Diabrotica soror*).
Fig. 17. Striped squash beetle (*Diabrotica trivittata*).
Fig. 18. Eastern plum curculio (*Conotrachelus nenuphar*).
Fig. 19. Spotted psyllobora (ladybird), (*Psyllobora 20-maculata, taedata*).
Fig. 20. Brown-neck ladybird (*Scymnus marginicollis*).
Fig. 21. Gray soldier bug (*Euschistus tristigmus*).
Fig. 22. Syrphus fly (*Catabomba pyrastri*).
Fig. 23. Spine-legged soldier bug (*Sinea spinipes*).
Fig. 24. Ashy-gray ladybird (*Coccinella oculata*, var. *abdominalis*).
Fig. 25. Lace-winged fly (*Chrysopa Californica*); showing fly with wings expanded.
Fig. 26. Lace-winged fly (*Chrysopa Californica*); showing fly at rest with folded wings.
Fig. 27. Lace-winged fly, larva.
Fig. 28. Brown hemerobius (*Hemerobius*); unnamed.
Fig. 29. Eggs, lace-winged fly (*Chrysopa Californica*); as they are laid on slender threads.
Fig. 30. Cocoon, lace-winged fly (*Chrysopa Californica*); before hatching.



TWICE-STABBED LADYBIRD.

Chilocorus bivulnerus, Mulsant.

[Figs. 6 and 7, Plate IV.]

This pretty little beetle, with bright red spots on its wing covers, resembles the eyed ladybird (*Coccinella oculata*, Say), and has often been described as such. It resembles Pilate's ladybird (*Exochomus Pilatei*, Mulsant), which is also a ladybird with two bright red spots on its wing covers; but this species is much smaller, and the spots are not red, but of a light yellow color. Pilate's ladybird is the largest of the three species so marked. The larva of this species is a very peculiar one, and differs from all the other species, excepting the larva of the *Exochomus Pilatei*. The body of the larva is covered with many long spines, which serve as a protection against other insects, as upon being touched the raising of the spines is noticed. The color is entirely black (see Fig. 7, Plate IV), with a yellow band across its back, indicating where the larval skin splits, after it has transformed into a pupa, and from which the beetles emerge.

The beetles are shining black in color. To the naked eye it would appear that the spots on its wing covers are perfectly round, which is not the case. They are very irregular.

PILATE'S LADYBIRD.

Exochomus Pilatei, Mulsant.

[Fig. 9, Plate IV.]

"The larva of this species quite closely resembles that of the twice-stabbed ladybird, but is of a lighter color, and attains a larger size, the full grown larva measuring about one quarter of an inch in length. The pupa is formed within the old larval skin, the latter simply splitting along the back, as in the preceding species. The exposed part of the pupa is of a pale yellowish color, and is marked with two rows of black spots. The beetle is larger than the twice-stabbed ladybird, and may easily be distinguished from it by having the posterior part of the under side of the body black, whereas in the preceding species this part of the body is reddish."—Coquillett.

This species feeds very largely upon the black scale (*Lecanium oleæ*), and is mostly found in the southern part of the State. At one time I confined several beetles in a box; four days later the box was opened, their food had become exhausted, and the larger beetles had eaten up the smaller. The larva of this species is larger and quite different from that of the other species. It is of a light blackish color, and has light reddish markings and a flat head, which is large and prominent. After the escape of the beetle the pupa case becomes of a white color and the spines black.

THE EYED LADYBIRD.

Coccinella oculata, Say.

[Fig. 8, Plate IV.]

"This species is not very common in this State, and I cannot find it mentioned in any of the lists as occurring east of the Rocky Mountains. It hardly seems possible that the form figured at 8 belongs to the same species as the one figured at 24, yet it is so regarded by our best authorities. Upon this subject, Dr. G. H. Horn, our best authority on this group of insects, writes me that, as strange as this may seem to you, it is a demonstrable fact. *Exochomus* and *Chilocorus* have species resembling the typical *Oculata*, but these have a very different thorax. I inclosed several ladybird larvæ in one of my breeding cages, supposing that they belonged to the same species, and from them I bred both the typical form of *Oculata* and also the variety *Abdominalis*, the larvæ and pupæ of these two forms being indistinguishable."—Coquillett.

This species resembles *Chilicorus bivulnerus* and *Exochomus Pilatei* very closely, the beetles of these three species having two red or yellow spots on the wing covers. There is, however, a very marked difference. The spots on the wing cases of this species are yellow, while those of *Bivulnerus* and *Pilatei* are bright red. These latter species have no markings about the head and thorax as in this species.

This species, however, is somewhat rare and is but seldom met with, although in some localities it has been found quite abundant, especially where the trees are badly infested with the black scale (*Lecanium oleæ*), upon which they feed.

ASHY-GRAY LADYBIRD.

Coccinella oculata, var. *abdominalis*, Say.

[Fig. 24, Plate IV.]

This very pretty beetle is found upon different kinds of trees throughout our State infested by various kinds of aphis and scale. It is not a very common species and is only found occasionally. It abounds mostly on citrus trees, especially where they are infested with the black scale (*Lecanium oleæ*). The larva, when about to transform into a pupa, attaches itself by the end of its abdomen, and the skin splits at the back of the head and shrinks back about the posterior end of the body. The beetle is of an ashy gray color, of semi-globular shape. It has seven very small black spots on the thorax, and eight prominent black spots on each wing cover. The illustration gives the beetle's natural size and color.

AUSTRALIAN LADYBIRD.

Vedalia cardinalis, Mulsant.

[Figs. 11, 12, and 13, Plate IV.]

Of the introduction and benefits derived from this ladybird the public is, no doubt, well aware; therefore, a repetition of the facts at this time seems totally unnecessary. (See Annual Report State Board of Horticulture, 1889, pp. 260–67.)

The beetle (Fig. 11, Plate IV) is a beautiful one, of black and vermilion red markings, as shown in the illustration. The larva (Fig. 12, Plate IV) is of a dark orange red color, and differs in form and general appearance from the larva of the other species. "When about to pupate the larva attaches itself by the posterior end of the body to the bark or leaf of the tree, and suspends itself head downward. It remains in this position about three days, when the skin along its back splits open, exposing a portion of the pupa to view. When the beetle is fully formed the old pupa skin partially breaks away, showing the beetle to be of a pale reddish color. It remains in this situation about two days longer, when the beetle issues clad in its normal colors of black and red;" * as shown in the illustrations, Figs. 11 and 13, Plate IV. This species does not feed, as far as known, upon any other insects than the cottony cushion scale (*Icerya purchasi*), although of late several statements have appeared in various newspapers to the contrary; but as this matter has been carefully experimented with, I doubt the correctness of the statements so made. (See Annual Report State Board of Horticulture, 1889, p. 269.) This species has practically exterminated the cottony cushion scale; at least, it is no longer a pest in California.

The winter of 1889–90 was a very severe one upon the increase of parasitic and beneficial insects, as it rained almost continuously until spring. This was the Vedalia's first winter in California, and grave doubts were entertained as to their living through it. In early spring (1890) it looked very much as if they had died out, as neither the larvæ nor the beetles could be found; but a few weeks of warm sunshine caused them to multiply, and our hopes were gratified by discovering thousands of the larvæ at the various stations of the Board, where they were placed with due precautions late in autumn, and before the wet weather had set in. From these stations all infested orchards throughout the State have been supplied with colonies of Vedalias, and they have increased so fast that no further distribution of colonies is at this time necessary.

TWO-SPOTTED LADYBIRD.

Adalia bipunctata, Linn.

[Figs. 2 and 3, Plate IV.]

In walking through the grounds of the Department of Agriculture at Washington (May, 1890), I observed this little beetle preying on the aphis upon some bushes, and on close examination noted the fact that they were destroying myriads of plant lice. I examined closer into their natural fecundity, and became so impressed with their work that three large colonies were captured and sent to this State for propagation, with the hope that they would increase and multiply rapidly enough so as to be able to distribute colonies to other sections.

The larva (Fig. 3, Plate IV) is a voracious one, very pretty, and quite large, as shown in the illustration. The beetle (Fig. 2, Plate IV) is of a dark red color, and has on each wing cover a round black spot. The increase of this species will be watched with much interest, and we shall hopefully look for its progress.

* D. W. Coquillett, in "Insect Life," 1889.

AMBIGUOUS LADYBIRD.

Hippodamia ambigua, Le Conte.

[Fig. 15, Plate IV.]

This species is very abundant, and is found in almost every section throughout the State. It resembles the blood-red ladybird (*Coccinella sanguinea*), but is much narrower in proportion to its length, and flatter. The larva is one of the largest of the ladybirds, and feeds upon various kinds of aphis. This species is found very abundantly in the corn fields during summer; it is also found very abundantly among squash and cucumber vines, and, in fact, among all such trees and plants that aphis attack. This ladybird has been often observed feeding on the woolly aphis; its larvæ feed largely upon this aphis.

CONVERGENT LADYBIRD.

Hippodamia convergens, Guerin.

[Fig. 5, Plate IV.]

This species, like the preceding one, is very common throughout the State, and is also found in the summer very plentifully among corn and vegetable growth. The larva feeds upon aphis, and upon other insects. The beetles also feed upon aphis, young scale, etc. The beetles vary in color; some are of a deep red, while others are of a dull brown; the markings, however, are the same. This species has also been observed feeding on ripe fruit, but only after other insects or birds had first eaten into it. This ladybird, like the preceding, has been found feeding largely upon the woolly aphis, and Mr. D. B. Wier's observations at Petaluma this season warrant him in saying that "they kept the tree pretty well freed from the woolly aphis."

BLOOD-RED LADYBIRD.

Coccinella sanguinea, Linn.

[Fig. 4, Plate IV.]

This species is not very common, and is only occasionally met with. The beetle is blood-red in color; this, however, varies to brick-red, and is, indeed, very pretty. It is quite small, as the illustration shows, and almost hemispherical in shape.

SPOTTED PSYLLOBORA.

Psyllobora 20-Maculata, var. *taedata*, Le Conte.

[Fig. 19, Plate IV.]

The larva of this species resembles that of the ashy-gray ladybird (*Coccinella oculata*), but is of a lighter color, being pale gray, marked with a few black and yellow spots. When full grown, it measures only one tenth of an inch in length. The pupa also resembles that of the

above species, and its colors are the same as in the larva. It measures one tenth of an inch in length.

"I have seen both the larvæ and the adult beetles engaged in feeding upon the common red spider (*Tetranychus telarius*)."—Coquillett.

This beetle is mostly found on orange trees, and on garden plants, or wherever black scale and red spider abound.

It is a very small beetle, and moves along very lively. Upon being disturbed, it draws its legs together and drops from its perch, seemingly to the ground, but, as it drops, expands its wings and flies away.

BROWN-NECK LADYBIRD.

Scymnus marginicollis, Mann.

[Fig. 20, Plate IV.]

This little ladybird may be seen on trees infested with scale, but mostly on trees infested with red spider. To the naked eye it appears deep black and shiny, and at the touch drops or rolls off, but before striking the ground spreads out its wings and flies away. The color of the body is yellowish gray, and is thickly covered with mealy powder. The head is black and the neck brown. The wing cases are black and covered with hair, as shown in the illustration (natural size). This ladybird is not very numerous in orchards, and does not seem to increase as rapidly as the other species, and therefore the benefit derived from it amounts to but little. This species is found generally throughout the State, but, being so small, is but seldom observed.

JULIAN'S LADYBIRD.

Coccinella trifasciata, var. *Juliana*, Mulsant.

[Fig. 14, Plate IV.]

This pretty, light colored beetle (Fig. 14, Plate IV) is one of the handsomest of the ladybirds, and was found by me feeding on the black scale (*Lecanium oleæ*), at Mission San José, Alameda County. The larva was not found, and cannot therefore be described. Public attention has never been called to its importance, and the beetle is now illustrated for the first time.

"On this continent it is found from the Atlantic to the Pacific Ocean, and it also occurs in Europe and in Asia. The earliest record I possess of its occurrence on this coast is by the Russian entomologist, Mannerheim, who records its capture in Alaska, in the year 1853. The species is very rare here, and I have never found its larva."—Coquillett.

The illustration is an exact likeness of the beetle, and its progress will be watched with much interest.

STRIPED LADYBIRD.

Magilla vittigera, Mannerheim.

[Fig. 10, Plate 14.]

This species of ladybird has often been mistaken for the striped squash or cucumber beetle (*Diabrotica trivittata*). As it resembles that insect somewhat it has been supposed to be injurious. This species usually collects in great numbers, and are mostly to be found on swampy land.

"They are found as far east as Kansas, and extend southward into Mexico."—Coquillett.

As they abound mostly on swampy land, it is reasonable to suppose that they prey upon soft-bodied insects that live in such localities. The beetle, as shown in the illustration (Fig. 10, Plate IV), is but a trifle larger than the three-lined squash or cucumber beetle (*Diabrotica trivittata*), but the stripes are of a much darker color, varying from dark brown to almost red. The antennæ of the diabroticas are quite long and slender and many jointed; the antennæ of this species are quite short, as shown in the figure.

SPINE-LEGGED SOLDIER BUG.

Sinea spinipes, Herrick-Shaefer.

[Fig. 23, Plate IV.]

This soldier bug is found in most parts of the State, but is by no means common. It is mostly found on orange and lemon trees where scale insects are numerous, also on trees infested with aphis. Fig. 23, Plate IV, shows the adult insect, natural size and color.

"They kill their prey by inserting into it the proboscis, which injects a most powerfully poisonous liquid into the wound. The victim thus pierced dies in a very short time. They then leisurely suck the juice out and drop the empty skin."—Glover.

They feed largely upon caterpillars, and upon all other insects they can overcome, even upon their own kind.

The soldier bug can always be seen through the summer months; those who prune trees become well acquainted with their larvæ (also that of the lace-winged fly), as they inflict severe wounds on the hands and neck of the pruner by action of their beak or mandibles.

GRAY SOLDIER BUG.

Euschistus tristigmus, Say.

[Fig. 21, Plate IV.]

This bug has often been supposed to be injurious, which is not the case; instead of being injurious it is highly beneficial, as it is a carnivorous insect. They attack caterpillars, aphis, etc., and pierce their bodies with their beaks and suck them empty. The color of the bug is dark brown, as shown in the illustration (Fig. 21, Plate IV). During

summer these bugs are seen on trees and small-fruit bushes, and have been found feeding on ripe fruit, but always on such fruit as other insects or birds had first punctured, and for this reason have often been pronounced injurious.

SYRPHUS FLY.

Catabomba pyrastri, Linn.

[Fig. 22, Plate IV.]

The larva of this syrphus fly is of great benefit in destroying all kinds of aphis. It is quite blind, but the egg from which it hatches is generally deposited by the parent fly in the midst of a colony of plant aphis, where it gropes about and obtains an abundance of food without much trouble. The larva is fleshy, thick, and blunt behind, and pointed in front.

Their mouths are furnished with a triple-pointed dart, with which they seize and pierce their prey, and, elevating it, deliberately suck it dry.

The flies (Fig. 22, Plate IV) are black, with transparent wings, and prettily ornamented with yellow stripes across their bodies. They are generally found on trees infested with black scale (*Lecanium oleæ*) or on trees infested with aphis.

The larva, when ready to change into a pupa, fastens itself to a leaf or branch by means of a glutinous secretion from its own body, and the outer skin, contracting into a pear-shaped case, soon hardens by exposure to the air; the pupa is formed inside. After a few days the perfect fly emerges from a hole at the blunt end of the case, to lay eggs among colonies of aphis. The fly has two transparent wings; its body is generally more or less banded with brown, black, and yellow, and it has the appearance of a diminutive wasp.

These flies make their greatest appearance in the early spring, and are quite common in most parts of the State.

LACE-WINGED FLIES, OR APHIS LIONS.

Nearly all the species of the subfamily *Chrysopinæ* pertain to the genus *Chrysopa*. These insects are known in the adult state as lace-winged flies, and in the larva form as aphis lions. The antennæ of the adult are long and setaceous. The venation of the wings resemble somewhat that of the subfamily *Hermerobiinæ*, but the subcostal and median veins are separate, and the transverse veins of the costal space are not forked. The lace-winged flies are very common insects throughout the summer months upon the foliage of trees, especially on citrus trees. They are usually of a light green color, or yellowish. While alive their eyes are very bright, and on this account they have also received the popular name of "Golden-eyed flies." Some species, when handled, emit a very disagreeable odor.

LACE-WINGED FLY.

Chrysopa Californica (new sp.), Coquillett.

[Figs. 25, 26, and 27, Plate IV.]

*Description.**—Fly: Pale green, a yellowish white dorsal stripe extends from front of thorax to tip of abdomen; front of head whitish; an irregular wine-red stripe extends from each eye to the mouth, and on its hind border, next the eye, is a black streak; front corners of thorax marked with black. Antennæ pale yellowish, minutely ringed with white. Wings greenish hyaline, obtusely pointed at their tips; veins and veinlets wholly green; seven or eight of the veinlets along the hind edge of front wings, before the tips, are forked; stigma somewhat opaque, yellowish green. Legs green, tarsi whitish, the tips brown. Eyes greenish golden, becoming glaucous brown after death. In dried specimens the green coloring becomes more yellowish, and the tarsi assumes a slightly darker color than the tibiæ. Length 9 to 10 mm. (about three eighths of an inch); expands from 24 to 28 mm. (about one inch, or slightly over).

In the monograph of the genus *Chrysopa*, given by Dr. Fitch, in his first and second reports as State Entomologist of New York, pages 84 to 92, the present species would belong to his division "25 (24)", which contains the single species, *Chrysopa Robertsonii*, found in the Indian Territory; but our species is easily distinguished from this by the markings of the head and thorax. Specimens have been submitted to Dr. Hagen, our best authority on these forms, and he regarded them as belonging to a new species.

Egg (Fig. 29, Plate IV) very pale blue, elongate-ovate, pointed at the base, the apex flattened, and in its center is a white, botton-shaped object; surface minutely granulated; length, three and one half hundredths of an inch; mounted on a bristle-like pedicel from thirteen to eighteen hundredths of an inch long.

Larva (Fig. 27, Plate IV) mixed with yellowish white and pinkish brown, the latter color forming a dorsal line and a series of lateral spots; along each side of the body is a row of yellowish white tubercles; head yellowish white, marked with two diverging black stripes on the top, and with a dusky streak each side, having in its middle a black dot; length 7 mm. (a little over one fourth of an inch).

Cocoon (Fig. 30, Plate IV) oblong in outline, being decidedly longer than wide; pale brownish gray, but when fresh is strongly tinged with green; length, 3 mm. (nearly one eighth of an inch).

BROWN HERMEROBIUS.

Hermerobius (unnamed).

[Fig. 28, Plate IV.]

This pretty brown fly with transparent wings, resembling the lace-winged fly (*Chrysopa Californica*), abounds in most orchards throughout the State, but is by no means common. The larvæ bear a strong resem-

*Described and named by Prof. D. W. Coquillett, Special Agent U. S. Dept. of Agriculture, at our special request.

blance to the larvæ of the lace-winged fly, but are much smaller. They feed upon aphis and other small insects. The larvæ, as they move about, are usually covered with debris, composed of the empty skins of victims, which they throw on their backs after having extracted their fluids. The fly is a very delicate one, as its increase has never been noticed. They no doubt die during certain climatic changes, as many of the dead flies are often found in the crotches of trees. This is evidently one of the reasons of their being so rare in places where, at times, they had been known to exist in great numbers.

CHEMICAL FERTILIZATION.

FERTILIZING AND FERTILIZERS—HOW TO COMPOUND FORMULAS.

Fertilizers have a wonderful effect upon plant life. The different elements described below are the most essential to plant growth. The best methods of compounding them are also described, although most of our soils possess the desired elements for plant growth, lacking phosphate.

POTASH.

Potash is the element potassium combined with oxygen—"potassium oxide," it is called by the agricultural chemists. Potassium itself is but a curiosity of the laboratory, for it can be kept pure only by excluding all air, and is therefore only to be found in the bottle of the chemist. The name "potash" was given it because it was made in iron pots from ashes.

Potash is a most caustic, biting alkali, dissolving and decomposing all organic structures it comes in contact with. It is one of the most powerful bases; in other words, it is a vigorous, unprincipled chemical thief, seizing upon and absorbing into itself the acids it finds combined with various saline compounds. Pure water could not dissolve the potash as it exists in the particles of feldspar and mica that are found in the soil; but, taking carbonic acid from the air, it has the power of dissolving the silicate of potash, leaving the quartz and alumina to form the clays. Caustic lime also has this power. The silica, combined with the potash, and marrying the lime, sets the potash free. In the vegetable kingdom it is held by plants while in the process of growth, in a soluble state, combined with oxalic, tartaric, silicic, and sulphuric acids. When wood is burned, these acids are decomposed; and, the potash combining with carbonic acid, we have the common form of carbonate of potash. Potash is not only one of the three essentials for all plant growth, but it is also found in the fruits, vegetables, and grains.

HUMUS.

There is a value in barn manure, in addition to its fertilizing properties. Its bulk has a mechanical effect on the soil, improving heavy soils and lightening the texture of all soils—a fact of especial value to market gardeners in their early crops. By its partial decomposition, it adds to the mass of dark brown earth which we so especially notice in old gardens, and which goes under the name of humus. Humus is dead vegetable and animal matter in process of decay. In good soil, there is, in a latent condition, potash, phosphoric acid, and lime. Carbonic acid changes these into plant food. Now, humus, by its decay, develops carbonic acid, and so brings about the decomposition of this latent food. Wet weather favors this action. That carbonic acid has this power to set free plant food in the soil has been proved by the experiments of Professor Stockhardt. Crops take up only a small portion of the fer-

tilizers applied before the nutrient substances they contain become insoluble. The humus keeps them in a soluble condition, which is an argument for the use of barn manure, or the plowing under of weeds or green crops, in connection with the use of fertilizers. It acts as a sponge to absorb and hold moisture in low, black soils, which are made up of dead vegetable matter in a state of semi-decay, halfway towards coal—a carbonaceous mass of stems, roots, and leaves. Burned, it makes an ashes red, from the presence of iron, having but one sixth the potash to be found in hard-wood ashes. The trouble is, that when dry it takes up water very slowly, and it takes therefore a good deal of rain to moisten it; while, on the other hand, when wet it keeps wet and cold too long for the health of vegetation. Without draining, manure is a waste on such soils.

Humus* holds a great store of carbonic acid, which decomposes the minerals in the soil, setting free potash and phosphoric acid. It also holds latent nitrogen, sometimes as high as 3 per cent, which is six times as much as in average stable manure. This is made plant food by the application of lime or carbonate of potash.

Humus is not in itself plant food. It is not necessary for the yield of heavy crops.

PHOSPHORIC ACID.

This, the third substance in the three components of a complete fertilizer, is composed of the element phosphorus, combined with the gas oxygen. The four great resources for phosphoric acid are the mineral called *apatite*, which contains 92 per cent of phosphate of lime, and is believed by some chemists to be the original source in Nature from which phosphate of lime is derived; the phosphatic guanos, which are the product of sea fowls, from which the ammonia has been washed out by the rain; the bones of all animals, and the mineral phosphate rocks, which are the remains of ancient marine animals.

BARN MANURE.

Its Composition and Fertilizing Properties.

The latest analysis made of fresh barnyard manure proved to contain the following kind and quantity of elements:

Water	71.3
Nitrogen	0.5
Silica and insoluble matter	10.5
Alumina and oxide of iron	0.7
Lime	0.5
Potash	0.4
Soda	0.1
Phosphoric acid	0.5
Chlorine	0.1

In about 4,500 pounds of fresh stable manure we should have in it 3,208 pounds of water, 22½ pounds of nitrogen, 472½ pounds of silica, 31½ pounds of alumina of iron, 22½ pounds of lime, 13½ pounds of magnesia, 18 pounds of potash, 4½ pounds of soda, 4½ pounds of sulphuric acid, 22½ pounds of phosphoric acid, and 4½ pounds of chlorine. By the composition given it will be noticed that bulk is not what is necessary,

*Professor Gregory—"How to Compound Fertilizers."

but instead of bulk the proper elements as fertilizers in a concentrated form are more valuable as plant food than many manures and many so called "commercial fertilizers" a hundred times as bulky. Fertilizers in some form can be made to last like barnyard manure, and feed several successive crops with a single application. For instance, in ashes and bone we have all the elements for a complete manure, when all that is required is to apply an extra quantity of ashes and a portion of the bone in a coarse state. Ashes are always enduring in their effect, and the coarser bone will be years in decaying and setting free nitrogen and phosphoric acid. To continually apply but a single one of the three elements which enter into the complete manure, and especially if that one should be nitrogen, and for a series of years be in marked excess of the other two, would, in the end, sooner or later prove that the conclusions often advanced are correct, however faulty they might have been in their reasoning. The fact that the one of the three elements, nitrogen, potash, or phosphoric acid, of which the soil has the least, and which has been repeatedly proven, will always be the measure of the crop. A hundred pounds of potash applied would not give a larger yield than five pounds (and so of the other two elements), if there is not a proportionate increase of the other elements.

"The right way is to make the most and best manure that is practicable upon the orchard, and piece out with such commercial fertilizers as experiments and experience prove profitable. At the same time there are many cases, especially near cities, where everything depends upon getting the largest and best (and earliest) yield, where the most exclusive use of chemical fertilizers is advisable." *

Artificial fertilizers are, of course, much more cheaply transported, and, unlike barn manure, they do not carry with them seeds of weeds into the soil, and as they contain the fertilizing elements in so condensed a form, the whole handling of them becomes much cheaper, where they can be obtained from reliable sources.

"Fertilizers rich in ammonia, Peruvian guano, sulphate of ammonia, etc., should be applied a little at a time, and often." †

Clayey soils do not, as a rule, need so much potash or nitrogen as phosphoric acid. Nitrogen tends to promote leaf growth. Fertilizers applied to poor land produce more effect than when applied to rich land. If the bone in the soil does not all decompose the first year, the nitrogen contained in it goes over with it and is not lost. If but one of the elements is to be used, it should, by all means, be bone, and the finer the bone, and the finer and drier the fertilizer, the more valuable it is. When the animal matter in bone decays, the phosphoric acid in the bone is in a reverted condition.

BONES.

The bones of land animals are composed of the following elements:

Gelatine, fat, and water	48.0
Phosphate of lime, with a little magnesia	46.0
Carbonate of lime	4.0
Potash and soda	2.0
	100.0

* Says Professor Atwater. † Professor Atwater, "Fertilization."

NOTE.—The grower should not forget that in using potash or phosphoric acid in any form, it never wastes in the soil to any extent, and one application will last several years.

The gelatine contains from 3 to 5 per cent of nitrogen, and the phosphate of lime (or bone phosphate) from 18 to 23 per cent of phosphoric acid. Bones are brought to the fertilizer manufacturer as the waste of the slaughter-house or butcher shops. Where they have been exposed to the action of the elements bones are found to have lost more or less of their gelatine, and hence are not so rich in nitrogen. The methods of preparing bones for plant food are numerous. By one method the gelatine is saved, and by the other lost. To make the phosphoric in this fully soluble, the bones must be first treated with sulphuric acid, though the results from burning the bones are to reduce the particles to so fine a state as to make them more or less available without the use of acid.

BONE MEAL.

This substance is made by cracking up and grinding dry bones. These contain, as materials valuable for fertilizers, phosphate of lime and certain complex substances containing nitrogen. The phosphate is the chief constituent; it forms the frames of the bones, and is what might be called the mineral portion of the same. The other plant food contained in bones belongs to that class of matter from which the plant obtains the material necessary for building (the so called albuminoid substance), to which those substances owe their nourishing and flesh-forming qualities. The more finely divided a fertilizer is the more valuable it is, on account of the greater readiness with which it goes into solution. Hence, in determining the value of a fertilizer, the mechanical analysis is of considerable assistance.

MANUFACTURING SUPERPHOSPHATE.

In the manufacture of superphosphate, Professor Nichols recommends the following plan: Take a plank box four feet square and one foot deep. This may be simply water tight, and if so there must be no nails that the acid can reach, for it will eat them out and so make a leak, or it may be lined with lead, all soldering being done with lead solder. The box will be large enough to take a carboy of sulphuric acid with the necessary quantity of phosphate material and water to make about a quarter of a ton of superphosphate. If finely ground bone be used, the result following will be a pasty mass, needing mixing with muck or other dry material to get it in good mechanical condition for use. If, instead of bone, bone black is used, the result will be a dry mass easily handled. To make superphosphate, a carboy of one hundred and sixty pounds of sulphuric acid or oil of vitriol (60 degrees), three hundred and eight pounds of bone black, and ten gallons of water are required. Having first donned old clothes, and having at hand a little saleratus or some alkali, ready to rub on any spot should by chance a drop spatter (for where it touches if not immediately neutralized it will char like fire), *be sure to first* pour in the water, and then the acid; next, slowly add the bone, stirring it all the while with an old hoe of but little value. There will be a great commotion, a great boiling, frothing, and foaming, and throwing off of heat with a suffocating vapor. Because of the suffocating vapor, it is better to do the work in the open air or under an open shed.

Professor Johnson in his report (Connecticut Experiment Station,

1881) gives two methods; the one which he considers best adapted for domestic use of any of the processes involving the use of oil of vitriol, is as follows: Take one hundred pounds of ground bone, such as contains 20 to 50 per cent, more or less, of material coarser than would pass through a sieve, having a one half inch mesh, twenty-five pounds of oil of vitriol, and six quarts of water. Separate the bone by sifting into two, or if the proportion of coarse bone is large, into three parts, using sieves of one sixteenth and one eighth inch mesh. Mix the coarser part of the bone in a cast-iron or lead-lined vessel with the oil of vitriol. When the bone is thoroughly wet with the strong acid add the water, stirring and mixing well. The addition of the water to the acid develops a large amount of heat, which favors the action. Let stand, with occasional stirring, for twenty-four hours, or until the coarser fragments of bone are quite soft, then three grades of bone are used. Work in the next coarser bone and let stand another day or two, until the acid has softened all the coarse bone, or has spent its action; finally, dry off the mass by mixing well with the finest bone.

In carrying out this process, the quantity of oil of vitriol can be varied somewhat; increased a few pounds if the bone has a large proportion of coarse fragments, or diminished if it is fine.

Professor Stockhardt, the celebrated agricultural chemist, recommends the following process: From a mixture of sifted wood or coal ashes and earth thrown upon a barn or shed floor form a circular wall so as to inclose a pit capable of containing one hundred weight of ground bone; then make the surrounding wall of ashes so firm as not to yield by being trodden on; sift off the finer part of the bone and set it aside; throw the coarser part into the cavity and sprinkle it, during continued stirring, with three quarts of water, until the whole is uniformly moistened; add gradually eleven pounds of oil of vitriol of 60 degrees strength, the agitation of the shovel being continued. A brisk effervesence of the mass will ensue, which will not, however, rise above the margin of the pit if *the acid is poured* on in separate small quantities. After twenty-four hours sprinkle again with three quarts of water, add the same quantity of sulphuric acid as before, with the same brisk shoveling of the mass, and leave the substance to act for another twenty-four hours upon each other; then intermix the fine bone previously sifted off, and finally shovel the ashes and the earth of the pit into the decomposed bone until they are all uniformly mixed together.

It will be noticed that the last two processes use half or less than half the usual quantity of acid allowed for a hundred pounds of bone. The phosphoric acid in finely ground bone can also be made available by the caustic action of the potash in unleached wood ashes.

Professor Nichols recommends the following method: Take one barrel rawbone flour, three barrels dry unleached wood ashes, ninety pounds gypsum, and ten gallons of water; make a heap of the solid materials on the barn floor, and add the water, stirring constantly with a hoe. The result is perfect plant food, containing all the elements plants require in about the same proportions.

Professor Dooling advises a little different method and proportions. He recommends the following: Mix five barrels of finely ground bone with five barrels of unleached hard-wood ashes, and add water sufficient to moisten the mass, and then cover with loam. Leave the heap three

weeks, adding a little water, if it, on examination, appears to be nearly dry.

WOOD ASHES.

Wood ashes are our great home source for potash. These are brought into the market from several sources. "Wood ashes," says Professor Goessimann, "have an agricultural value much above their chemical value." Professor Gregory adds that "the principal reason of this is that they contain not only potash, but all the elements of plant food except nitrogen, and these in just the same proportion as they exist in Nature, with the additional advantage of having them in a very fine state of subdivision."

The wood of different trees differ not only in the proportion of potash, lime, and phosphoric acid in their ashes, but also in the quantity of their ashes in equal quantities by measure of wood.

COAL ASHES.

Coal ashes contain no appreciable amount of potash; the chief ingredient is silica. They contain also some lime and magnesia. The trace of potash comes from the wood used in kindling fires, and the coal itself. Coal ashes prove of but little value on most soils, beyond making heavy soils more open and supplying silica to land of a much like character; still there is considerable of value in them when used in connection with manure.

COMMERCIAL FERTILIZERS.

THEIR USE OF MODERN ORIGIN.*

The use of fertilizers as articles of commerce is of modern origin. The fact that soils deteriorate by continued cultivation and removal of crops had long been observed before the cause was understood and the remedy applied. In the early history of this and other countries, the virgin soil produced abundantly, and continued to do so without application of any kind, until the idea was prevalent that fertile soils were inexhaustible. The impoverishment, however, which eventually followed set men to thinking, and to devising means for the restoration of lost fertility. A close study of the soil, of the plant, and of the atmosphere, has revealed the relations they sustain to each other, and the conditions under which each can best contribute its part to the production of abundant crops.

THE COMPOSITION AND FORMATION OF SOIL.

An examination shows that soil is a mixture of more or less finely divided mineral and organic matter. This mineral matter consists of sand, clay, gravel, etc.; the organic matter of vegetable substances in various stages of decomposition. A closer examination, or analysis by the chemist, shows that these materials are composed of certain primary elements, united in fixed and definite proportions.

The geologist tells us of a time, in the far distant past, when the earth existed as a mass of melted matter, which, gradually cooling, formed a solid crust. Upon this was precipitated the condensed moisture of the atmosphere, loaded with all the waters of ocean, lake, and river, in the form of aqueous vapor. The disintegrating action of this powerful agency, added to that of the atmosphere itself, acting mechanically and chemically, crumbled and pulverized the surface of this solid mass until it became ready for the introduction and growth of plants. These, at first scanty, germinated, matured, and decayed, until vegetable mold had accumulated in sufficient quantity to sustain the growth of organic substances in rich profusion. The vast beds of coal, wherever found, result from masses of vegetable growth, accumulated long before man existed on the earth. The geological changes of the past, however great and long continued, were the same in kind as those now going on, and the same forces, acting on similar materials, are still producing corresponding results.

THE DETERIORATION OF SOILS.

The introduction of man into the world, with his varied material and artificial wants, modified to no little extent the conditions previously existing. At first, the earth spontaneously produced sufficient for his support, but as population increased, new wants were developed. Instead of consuming his food on the soil where it grew, and leaving there the residue to fertilize succeeding crops, he stripped the land of its growth, and accumulated its products in towns and cities, and that which he did not consume was cast into the sea or wasted in many ways.

*N. T. Lupton, Bulletin No. 8, Agricultural Experiment Station, Alabama, 1889.

The forces of Nature continued their renovating action by the production of new soil, and by clothing the hills and valleys with vegetation to supply the loss caused by man's extravagance, but eventually the richest lands of every civilized country were seen to be gradually but surely losing their power of production. This naturally led to an investigation of the conditions of plant growth, and the means best adapted to restore and maintain a high degree of fertility. The results attained are the triumph of modern science and the boast of modern civilization.

THE COMPOSITION OF PLANTS.

The analysis of plants shows them to be composed of certain elements, from ten to fifteen in number. Ten of these are considered essential to plant growth, as follows: *Carbon, Nitrogen, Sulphur, Potassium, Magnesium, Hydrogen, Oxygen, Phosphorus, Calcium, Iron.*

Sodium, manganese, silicon, chlorine, with traces of bromine, iodine, flourine, and a few others are generally found, but are not considered absolutely necessary to the growth of vegetation.

These same elements are found in the soil from which they are derived, and a few of them in the surrounding atmosphere. So abundant are most of them that only a few are likely to become exhausted where a proper system of cultivation is practiced. These few constitute the valuable elements of

COMMERCIAL FERTILIZERS.

This term, as used, "does not include common lime, land plaster, cotton seed, cotton-seed meal, ashes, or common salt not in combination."

In estimating commercial values, only three constituents, viz.: phosphoric acid in its forms of solubility, potash, and nitrogen, are taken into account; not that these are more important to plant growth than others, but because they exist in such minute quantities in soils that they become exhausted very soon, and plants cannot grow without them.

So important for the manufacture of commercial fertilizers are the raw materials containing these constituents, that the earth has been searched and the seas explored to find localities where they exist. Millions of tons are used annually to supply the demands of modern agriculture.

SOURCES OF PHOSPHORIC ACID.

The chief sources of phosphoric acid are the bones of animals, guano, coprolites, or phosphatic nodules, mineral phosphates, and basic slag, generally known as Thomas' slag, or scoria.

The frame work of vertebrate animals consists of bones composed of about one third organic, and two thirds mineral matter. The mineral matter is almost entirely phosphate of lime, known to the chemist as tri-calcium phosphate. The organic matter found in fresh or raw bones undergoes rapid disintegration on exposure to the atmosphere, leaving the bone or tri-calcium phosphate as a white mass, insoluble in water.

Now, the plant requires its food to be in a soluble condition before it can be appropriated, and science has met this demand by converting insoluble bone phosphate into a soluble form. Sulphuric acid acts upon the ground bones by seizing upon a portion of the lime in the bones, and unlocks the phosphoric acid, producing the effect desired.

The natural phosphates are not absolutely insoluble in water, and, indeed, far from being so when in a finely divided state, and in the presence of acids in the soil produced by the fermentation of organic matter. Hence, ground bones, floats, and other forms of finely divided natural phosphates, have considerable value as fertilizers. Commercial acid phosphates are the results of the action of sulphuric acid on natural phosphates, which renders them soluble in water and better adapted to the necessities of plant growth. Phosphoric acid in commercial fertilizers exists in three forms of combination with lime, generally known as soluble, reverted, and insoluble. These are called *water soluble, citrate soluble*, and *acid soluble*.

The chemist, in analyzing a phosphate, first dissolves out and determines the phosphoric acid soluble in water, then acts upon the residue with a solution of ammonium citrate for thirty minutes, at a temperature of 65 degrees Centigrade, to dissolve out the citrate soluble, then acts on the second residue with hydrochloric acid to find the amount called acid soluble. A fresh portion of the phosphate is now taken, and the total phosphoric acid determined. From this, the sum of the water soluble and acid soluble being taken, the remainder is citrate soluble.

The water soluble is easily converted into citrate soluble by means of lime, and, without the addition of anything, undergoes a gradual change, and hence is said to be *reverted*. These two forms, water and citrate soluble, are considered *available* phosphoric acid. Animal charcoal, made from bones by driving off volatile matter, is known as bone black, and is used in large quantities to decolorize and refine sugar and other organic products. This bone black, in the course of time, becomes too impure for further use, and is turned over to the fertilizer manufacturers to be converted into acid phosphate.

Guano, the deposits and remains of countless flocks of birds which have inhabited from time immemorial the islands near the coast in tropical countries, is a prolific source of phosphoric acid. On some of these islands, such as the Peruvian, Patagonian, Falkland, and Ichaboe, it seldom rains, and hence the phosphate from this source is rich in salts of ammonia. Its condition is such that plants readily appropriate its constituents as food.

Fossil bones, in connection with phosphatic nodules, in immense quantities, are found in South Carolina, and to some extent in other States and countries of the world. These are the remains of extinct animals which lived and died in the swamps, shallow seas, and lakes of an age long anterior to the present.

It is estimated that over four million tons of South Carolina phosphates have been used since their discovery, some twenty or twenty-five years ago. These phosphates contain from 40 to 60 per cent of phosphate of lime, and are now the most abundant source of phosphoric acid.

Mineral phosphates, such as apatite, phosphorite, etc., apart from those

in connection with fossil bones, have not been used to any great extent in this country.

Basic slag, or Thomas' scoria, has of late years been used successfully as a source of phosphoric acid. Germany is said to have used three hundred thousand tons of this material during the past year. Many iron ores contain too large a percentage of phosphorus to be used in the manufacture of steel. Neither the smelting process nor the ordinary process of converting pig-iron into steel, removes the phosphorus contained in the ore. A few years ago a process was discovered in England and patented by Thomas & Gilchrist, which not only gets rid of the phosphorus in the steel, but leaves it in a condition to be used as a fertilizer. This process consists in converting into a phosphate of lime, by driving a powerful blast of air through the molten iron contained in a crucible lined with magnesian lime. The resulting lime phosphate contains from 15 to 25 per cent of phosphoric acid in connection with a large per cent of iron, and when reduced to a fine powder forms a good substitute for floats and ground bones. The iron ores of Alabama, similar to those in Europe, will doubtless in a few years be made to yield a slag sufficiently rich in phosphoric acid to serve as a commercial fertilizer. Experiments with this fertilizer have demonstrated its nature.

SOURCES OF POTASH.

Potash, a combination of the metal potassium and oxygen, is derived chiefly from kainit, muriate, wood, and cotton-seed hull ashes.

Kainit is found in some salt mines, notably in the mines of Stassfurt, Germany. It contains from 10 to 15 per cent of potash in the form of sulphate, the remainder being salts of sodium and magnesium.

Muriate is also a product of salt mines, and contains from 40 to 50 per cent of potash in the form potassium chloride.

The ashes of all plants contain potash in considerable quantities, and furnish a limited supply for the manufacture of fertilizers.

SOURCES OF NITROGEN.

Nitrogen, the most expensive constituent of commercial fertilizers, exists abundantly in the atmosphere, but in a condition that renders it unavailable as plant food. It must, for this purpose, be in combination as nitrate, nitrite, ammonia, or organic nitrogen.

Sodium nitrate, or Chili saltpetre, is extensively used as a source of nitrogen.

Ammonium sulphate from gasworks is also used.

Refuse animal substances, such as *dried blood, tankage, fish scrap*, etc., are valuable sources of nitrogen, but in the South *cotton seed* and *cotton-seed meal* are the most abundant sources of this element.

VALUE OF COTTON SEED AS A FERTILIZER.

A good sample of cotton-seed meal contains about 7 per cent of nitrogen, and in addition to this about 3 per cent of phosphoric acid, and $1\frac{1}{2}$ to 2 per cent of potash. The cotton seed itself contains about $2\frac{1}{2}$ per cent of nitrogen, $1\frac{1}{3}$ per cent of phosphoric acid, and $1\frac{1}{4}$ per cent of potash. One ton yields at the oil mill, on an average, seven hundred and fifty pounds of meal, one thousand pounds of hulls, two hundred and twenty-five pounds of oil, and twenty-five pounds of lint.

The hulls in one ton, when burned, yield about fifteen pounds of ash. The oil and lint have no appreciable value as fertilizers, and very little more can be said of the hulls, as they contain a very large per cent of woody fiber, and undergo decomposition slowly. Estimating the value of seed as a fertilizer, according to the valuation placed on its important constituents, it is worth $12 80 per ton, or 21⅓ cents per bushel. To the orchardist it has a greater value than this as a feed-stuff for cattle, and if the manure be carefully preserved, very little of its fertilizing value is lost in feeding. So the farmer, by careful management, can realize a double value from his cotton seed.

THE MANUFACTURE OF FERTILIZERS.

Any orchardist can buy the raw materials, mix them together, and thus manufacture his own fertilizers at much less cost than the same goods sell for in the market.

Composts are the cheapest of such mixtures, and, indeed, are the most satisfactory form in which fertilizing materials can be used, especially for permanent improvement of the soil. An excellent compost for general use may be made of cotton seed, barnyard manure, and acid phosphate, in the following proportions: seven hundred pounds of barnyard manure, seven hundred pounds of cotton seed, and six hundred pounds of acid phosphate.

Several methods are in vogue for mixing the materials. The most satisfactory one consists in mixing them on the smooth ground, one ton at a time. The barnyard manure and cotton seed are first mixed and thoroughly moistened with water, then rolled or mixed with the acid phosphate. The mixture is spread out from six to ten inches deep, another ton, thoroughly moistened and mixed, is placed on this, and so on until the heap is from four to six feet high. This is allowed to stand at least six weeks before using.

The old method is to spread the barnyard manure on the ground from three to four inches deep, then the cotton seed, then acid phosphate. Add layer after layer until the heap is from four to six feet high, watering the mass until it is quite moist, and let stand about six weeks before using. When chopping down for use, mix thoroughly.

A third method is to open a deep furrow, scatter in it the materials, either one at a time or previously mixed, and bed on them, thus dispensing with the compost heap.

To prepare a good commercial fertilizer for general application, a floor is needed upon which to mix the materials, and a hoe or wooden mixer for stirring them together. Acid phosphate, cotton-seed meal, and kainit, or muriate, are the materials required for a "complete" fertilizer, and may be mixed in the following proportions: one thousand pounds of acid phosphate, eight hundred pounds of cotton-seed meal, and two hundred pounds of kainit.

If the land needs more phosphoric acid and less potash, use one thousand two hundred pounds of acid phosphate and one hundred of kainit, or none at all, and if nitrogen is greatly needed in the soil, use one thousand pounds of cotton-seed meal.

In the above formula, the per cent of phosphoric acid, nitrogen, and potash in the mixture, will be about as follows:*

One thousand pounds of phosphate, containing 15 per cent water and citric soluble acid, yield 150 pounds phosphoric acid.
Eight hundred pounds of cotton-seed meal with 3 per cent phosphoric acid, yield 24 pounds phosphoric acid.
Eight hundred pounds of cotton-seed meal with 7 per cent nitrogen, yield 56 pounds nitrogen.
Eight hundred pounds of cotton-seed meal with 1.75 per cent potash, yield 14 pounds potash.
Two hundred pounds of kainit with 12½ per cent potash, yield 25 pounds potash.
Thus, we have in one ton, 164 pounds of available phosphoric acid, or 8.70 per cent.
Thus, we have in one ton, 56 pounds of nitrogen, or 2.80 per cent.
Thus, we have in one ton, 39 pounds of potash, or 1.95 per cent.
Commercial value, $25 92.

RATIONAL USE.†

While it is a fact that nitrogen, phosphoric acid, and potash are in most cases the only chemical constituents necessary to add to any soil to prevent ultimate exhaustion by continual cropping, the knowledge of that fact becomes profitable largely in proportion as it is modified by the individual farmer so as to conform to his soil and his crops.

It happens too frequently that the increase in crop from the use of complete manures is produced by one or two only of the elements present. When, as is often the case, nitrogen is either inactive or produces an abnormal effect from the presence of insufficient quantities of phosphoric acid and potash, and immediate returns are unsatisfactory, future gains are also problematic, since nitrogen in readily available forms is easily movable in the soil, and eventually lost. Phosphoric acid and potash, on the other hand, if inactive for immediate crops, are retained in the soil, and serve for future crops.

Statistics in regard to the composition and cost of complete manures in 1888, showed that the average cost of the nitrogen contained in them was just one third of their total cost. In the use of fertilizing materials, and especially of this most expensive element, *nitrogen*, great care should be exercised; and the use of unmixed materials, for studying the various soils and crops, is particularly advised.

APPLICATION OF FERTILIZERS.‡

With the exception of the second application of nitrate of soda, all fertilizers were applied and well raked into the soil previous to setting the plants. The mixed minerals and the manure were applied broadcast over the whole of each plot.

Each application of nitrate of soda was distributed evenly over about one half of the space occupied by the row.

NITRATE OF SODA, POTASH, PHOSPHORIC ACID.§

Used alone or in connection with Phosphoric Acid and Potash.

The experiments conducted with nitrate of soda, used either alone or in connection with phosphoric acid and potash, by Mr. Voorhees, proved

* N. P. Lupton, Chemist, Agricultural Experiment Station, Ala., Bulletin No. 8, 1889.
† Bulletin No. 53, New Jersey Experiment Station, 1889.
‡ Bulletin No. 63, New Jersey Agricultural Experiment Station.
§ Experiment on Tomatoes, New Jersey Agricultural Experiment Station.

conclusively the fact that nitrate of soda was effective in increasing the yield in every case. It was effective in *increasing maturity* from both the standpoints of *yield and money value* on six out of the eight plots upon which it was applied. The percentages of early yield and total money value did not show a marked variation, and averaged 20.3 per per cent and 46.1 per cent, respectively. These percentages were a gain over those on plots manured either in the fall or spring, and a loss over that secured from the use of phosphoric acid and potash. The total yield on one plot, however, was 33.5 per cent *less* than the average yield of four plots upon which nitrate was used alone, and 43.8 per cent *less* than the average yield from four plots upon which nitrate had been applied in connection with phosphoric acid and potash.

Both yield and maturity seem to have been retarded by nitrate of soda used in large quantities. In one application, the average value of early tomatoes on these plots was but 39 per cent of the total value; and the average total value of the product was 12.6 per cent less than the average value of the other nitrated plots.

With these two exceptions, there was a normal development of the tomato in all directions from the use of nitrate of soda, viz.: an increased yield, with a proportionate increase in early maturity.

These average results, while positive, show that the question of this section is modified by the elements of *quantity applied* and *method of application*, and point to these general conclusions:

1. That nitrate of soda *did not* increase the yield at the expense of maturity, when applied in *small* quantities, or in *large* quantities in *two applications*. This was equally true, both when used alone and when used in connection with phosphoric acid and potash.

2. That nitrate of soda *did* increase the yield at the expense of maturity, when *large quantities* were added in *one* application, both with and without the presence of a sufficient excess of phosphoric acid and potash.

AVERAGE YIELD OF CROPS.

Nitrate of Soda Used Alone.

160 pounds per acre	985 baskets.
320 pounds per acre	970 baskets.
Extra increase in yield from use of smaller quantities	15 baskets.
Two applications	995 baskets.
One application	960 baskets.
Extra increase in yield in two applications	35 baskets.

Nitrate of Soda, with Addition of Phosphoric Acid and Potash.

320 pounds per acre	1,104 baskets.
160 pounds per acre	1,034 baskets.
Extra increase in yield from use of larger quantities	70 baskets.
Two applications	1,130 baskets.
One application	1,002 baskets.
Extra increase in yield from two applications	128 baskets.

Yield with two applications of nitrate—	
With phosphoric acid and potash	1,130 baskets.
Without phosphoric acid and potash	995 baskets.
Extra increase in yield from use of nitrate with phosphoric acid and potash	135 baskets.

While this experiment was not planned to study the comparative effect of different fertilizers, points of interest have been developed which, if stated, may have an influence in guiding future practice with this crop.*

GROUND BONES.

The demand nowadays for fertilizing materials which are quick in action, has had a tendency to decrease the use of bones in many lines of agricultural practice, and their especial value, when properly prepared, is often overlooked. While those orchardists are becoming fewer who regard a fertilizer as of doubtful value which does not, in connection with a profitable increase in yield, also add to the fertility, there are cases which make that fertilizer a valuable one, which fulfills the latter condition. Market garden produce and quick-growing field crops, as a rule, respond more profitably to quick-acting manures, and require the continued addition of smaller quantities of the more soluble and available elements of plant food. On the other hand, fruit trees, permanent pastures, mowing fields, etc., while also responding to these, are further benefited by the addition of considerable quantities of materials which have a permanent effect, and furnish a gradual and continued supply of plant food.

Bones, though insoluble in water, are readily decomposed by the action of the soil, and furnish amounts of nitrogen and phosphoric acid to the crop from year to year in proportion to the fineness to which they are ground. These above conditions exist everywhere, and determine a place and use for bones, for which mixtures of other materials cannot be well substituted. It must be remembered, however, that ground bone is not a complete fertilizer, and also that permanent fertility cannot be secured, without a corresponding decrease in immediate gains.†

MECHANICAL CONDITION.

To determine the value of bones, both the amount of nitrogen and phosphoric acid and the degree of fineness are taken into consideration; the finer pure bones are ground, the more valuable they are, provided the whole of the bone is used to secure the fineness.

A mechanical analysis of a sample of ground bone consists in dividing it, by a system of sieves, into four grades, each grade having a different value for the phosphoric acid and nitrogen, as follows:

	Nitrogen, Per Pound.	Phosphoric Acid, Per Pound.
Finer than one fiftieth inch in diameter	16½ cents	7 cents
Finer than one twenty-fifth inch in diameter	13 cents	6 cents
Finer than one twelfth inch in diameter	10½ cents	5 cents
Coarser than one twelfth inch in diameter	8½ cents	4 cents

* Edward B. Voorhees, New Jersey Agricultural Experiment Station, 1889, No. 60.
† Edward B. Voorhees, Bulletin No. 60, New Jersey Experiment Station, 1889.

It is assumed that the relative percentages of nitrogen and phosphoric acid are the same in all grades. The values are computed by multiplying the pounds of nitrogen and phosphoric acid, per ton, as determined by analysis, by the per cent of each grade; the sum of the separate values of each making the total value of the sample.

NITROGEN.

While other conditions than fineness do have an influence in determining the agricultural value of the nitrogen in ground bones, it is quite reasonable to suppose that, with the present method of preparation, viz.: extraction of fat, subjection to steaming at high pressure, etc., the nitrogen contained in the finest grade is quite as available as organic nitrogen from other sources. The average cost per pound of the nitrogen from complete fertilizers, which is derived chiefly from organic matter, is this year 23.5 cents per pound. Considering it all to have come from materials equally as good as the finest form of bone, nitrogen in complete fertilizers this year costs almost 50 per cent more than the average cost of nitrogen in the finest bone.

PHOSPHORIC ACID.

It is well known that the principal advantage of soluble phosphoric acid lies in the fact of its easy distribution, and its immediate availability on most soils. Phosphoric acid in ground bones of the finest quality is practically insoluble in water, but is quite readily dissolved by ammonium citrate, under the methods of treatment for determining reverted phosphoric acid. Hence, available phosphoric acid in complete fertilizers, which includes both the soluble and the reverted, costs this year, on the average, 9.9 cents per pound. The phosphoric acid in bones of the finest character costs 6.8 cents per pound, and of the samples examined over 45 per cent of the material was of this fine grade. This value of the fine grade is modified somewhat by the less availability of coarser and cheaper grades, which accompany the finer in nearly all samples, and must be determined by individual ability to profitably use the latter.

ON THE MOST PROFITABLE USE OF COMMERCIAL MANURES.*

The aim of this paper is to present, in the briefest possible outline, the present situation, in several chapters, of manuring, and then to attempt to give proper place and value to the experience of the past decade in the science of manuring. This latter will at the same time be presented in somewhat changed and enlarged proportions.

I at once present this question: Under what conditions is it possible to essentially increase the return from the soil by the application of artificial fertilizers? The answer is: Wherever hungry plants grow, wherever the earth produces plants which hunger for nitrogen, phosphoric acid, or potash, there the application of commercial manures should be made.

The cause for small returns is not always a lack of plant food. Often the plant suffers from thirst; from insufficient porosity of the soil, whereby the root development is checked; from caking of the soil, which works harmfully; from impenetrability of the soil, by which stagnant water with all its attendant evils is entailed; from deficiency of lime, of humus, etc.; in short, there are very many physical and chemical relations of soil or unfavorable conditions of weather which prevent the plant from a healthy development, and which diminish the crop.

In such cases, generally, the plant has no need of a large addition of food; it does not hunger. The small quantities of nutriment present in the soil suffice to produce the crops possible under so unfavorable circumstances. Here the establishment of better conditions must be made by irrigation or draining, deep culture, better plowing, harrowing, hoeing, marling, mucking, etc. The plants will then attain a development requiring, for the production of the harvest then possible, a greater food supply than the unenriched soil can yield.

Deep, well tilled, humus loam, under good atmospheric conditions, offers, therefore, relatively the best pledge for a sure effect from commercial manures; and every means which improves the quality of soil advances the success of the same. Luxuriant plant growth and intensive soil culture are synonymous with intensive conversion of plant food into crops. The demand for, and consumption of, plant food must therefore always be greatest where the greatest yield is produced or producible. In a given case, the more favorable the conditions, aside from those relative to nitrogen, phosphoric acid, and potash, the faster will be the consumption of, and the quicker the hunger for, those substances, and just so much earlier can an addition of plant food, beyond that barely necessary to appease hunger, be made to the crops; that is, the crops can, as it were, be fattened.

* By Prof. Paul Wagner, Director of the Agricultural Experiment Station, of Darmstadt, Germany, translated by Prof. Charles Wellington, and published in a special bulletin by the Massachusetts Agricultural College, May, 1890, and now republished in answer to the demand for information on the subject.

In intensive cattle feeding, something more is sought to be accomplished than the satisfying of the mere needs of the animals. Were it simply a question of appeasing hunger, food could often be saved. But a further end is sought, namely: an intensive conversion of fodder constituents into animal matter within the animal organism, namely: a production of milk, muscle, fat, which shall be considerably greater than that actually demanded by the animals, and which can only be accomplished by increasing the appetite by the use of specially palatable and easily digestible food.

But the same order holds in crop production. When feasible, plants should be cultivated which possess prominent productive powers, as it were, great fattening capacity; and these plants should be stimulated to more intensive assimilation and work of transmutation than correspond to their normal necessities, by being supplied with easily soluble manures. As already stated, the best possible results are to be reached only on better grades of soil, and under relatively favorable conditions. Still, it would be a grave mistake to assume that artificial manures can be used advantageously only on the better grades of soil. This would be absolutely incorrect; for large, and, under favorable circumstances, larger results are secured from the application of artificial manures on poor and even neglected and exhausted soils. In such cases, the application of fertilizing materials must be made with greater precaution and intelligence; for it demands far greater attention to special conditions, and entails greater risk than with better soils. Saltpetre manuring, for example, on soils of low grade requires more precaution than on medium soils. After the application of saltpetre, the danger of loss of nitrogen has to be taken into account, in extremely permeable soils subject to repeated rain washings, and in heavy soils that are liable to cake and harden. Moreover, a very light soil often permits the plants to thirst in midsummer, and thus renders them incapable of elaboration of large quantities of nitrogen. For this reason, on such soils artificial manures are more frequently applied with winter crops, while in spring crops the chief feeding period is advanced as much as possible.

Unfavorable physical conditions of soil diminish the guarantee of a satisfactory effect from commercial manures; and yet, in the use of these, it is possible to check the interference of the former with plant development. Intensive nutrition of the plant in its earlier stages effects a deeper root growth, whereby evil results of drought are prevented; it likewise effects an early shading of the ground, which opposes surface hardening, also a more vigorous development of the plant, thereby diminishing danger from surface and subterranean enemies, which in unfavorable weather threaten in the form of fungous diseases, etc., and which, as is well known, are much greater in soils of poor quality than in those of better.

Although it is true that a soil well found as to culture and plant food better insures effect from artificial manures than a neglected and exhausted one, it is, on the other hand, important to emphasize the fact that a cautious and rational application of commercial manures to an exhausted soil can often bring about very valuable returns. As is generally known, an application of barnyard manure on such soils has very little effect at first; only after a series of years, and after repeated and heavy applications of manure, can the former fruitfulness of the soil be recovered. But, with the aid of artificial manures, we are in a position

to bring this soil to high productive power at once, and to retain it there until the barnyard manure yields generous results and has brought back a richness lost by previous irrational, exhaustive management.

By these brief hints it will be seen that artificial manures are applicable, not only to rich, but also to poor soils; and they can render the observant farmer, be his soil what it may, a most welcome service.

I will summarize as follows:

1. Commercial manures place the farmer who cultivates intensively in a position to bring his crops, even of those varieties which need most plant food, or are most productive, to their highest development, increasing the yield to a degree that is not possible by mere barnyard manuring; and, furthermore, they place him in a position to return very exhaustive crops to their former fields after relatively short intervals, and that without perceptible diminution of yield or exhaustion of the soil.

2. Commercial manures place the cautious and circumspect farmer in a position to increase, temporarily or permanently, the development of crops on every soil, even on the poorer, and to so adjust the nutrition of the same to the peculiar relations of soil, climate, and weather, as to secure full advantage from the favorable conditions, diminishing and, as far as possible, removing the unfavorable.

3. Commercial fertilizers enable the farmer who cultivates extensively to make the most of his wide acres for the storing of atmospheric nitrogen. Phosphates and potash salts give to lupine, clover, vetches, pease, serradella, etc., the power to withdraw from the atmosphere great quantities of nitrogen, thus enriching husbandry with the most valuable of all fertilizers. They also enable them to increase the food capital, and to gradually transform the extensive production into an intensive one, thereby increasing both the value of the land and the revenue.

The inquiry now is pertinent, What are the plant foods, and in what quantities shall we apply them in a given case in order to obtain the highest possible net profit? The answering of this query is fraught with difficulties. It is easy in a particular case to say whether or not commercial fertilizers would produce an increased yield. The crops often tell whether or not they are suffering from hunger. Their pale color betrays a lack of nitrogen, or a red-brown shade in the green of the leaves indicates that the slowness of their development, in spite of rain and sunshine, is a result of insufficient nourishment. A single trial even shows whether the soil is really receptive of manures, and, to the farmer's experienced eye, there is no particular difficulty in determining approximately the extent of this.

But the questions, which foods are superfluous, which, on the contrary, are necessary, and how much of each is demanded in a given case to reach the highest possible net gain, are not so easy to answer. I will attempt in a single example to state the case clearly, and to show the difficulty in question. Assume that we are able to raise the yield of a certain wheat field to the extent of two thousand pounds of grain. With what have we to fertilize the field? In two thousand pounds of wheat—grain and straw—there are, in round numbers, twenty pounds of phosphoric acid, thirty pounds of potash, and sixty pounds of nitrogen. Shall we produce the increased yield if we add these quantities of the respective substances to the soil? No; for with greater production of surface substance more roots are formed, and these also need food.

Furthermore, the fact must be borne in mind that the soil will not yield up to the plants immediately the entire amount of food which it has received. It retains sometimes more sometimes less for succeeding crops; consequently we must bring into the soil considerably more than the above.

Let us now assume that the following amounts have been added to the soil: one hundred and twenty pounds of phosphoric acid, eighty pounds of potash, and one hundred pounds of nitrogen. Can we now reckon on an increased yield of two thousand pounds of grain and about three thousand pounds of straw? Yes. But is this manuring a rational one? No; at least not unconditionally. And why not? Because we have wasted perhaps the one or the other of these food materials. Our task is to increase the yield by two thousand pounds at the least possible expense, for the gross yield is to us nothing, the net profit everything. In view of this, we must ask, is the soil really lacking in each of these food constituents, and to the amount assumed? Is it not possible that sixty pounds of phosphoric acid, instead of one hundred and twenty, would have sufficed, since perhaps the soil still contains residues of this material from previous manuring? Is it not possible that we could have omitted the potash application altogether, because the soil being naturally so rich in potash, has perhaps actually no need of application of potash salts? Or, again, if indeed one hundred and twenty pounds of phosphoric acid and eighty pounds of potash were really necessary to produce the increase, is it not possible that we could have economized in the costly nitrogen manuring? Is it not possible that the soil is chiefly exhausted only of phosphoric acid and potash, and that, in consequence of intensive barnyard or green manuring, or of the value of the humus or of rich nitrogenous remains, such as pea, vetch, clover, or lupine roots, etc., it contains an excess of nitrogen?

All this is quite possible. We have practiced great extravagance, and could have compounded a much cheaper manure and still have obtained the full increase. To manure rationally, we must question not only the needs of the plant, but also the manurial conditions and food supply of the soil. We must know both the quantities of food constituents which the crop needs, and also the amount of the various kinds of available food in the soil, to be able to judge whether the additional need of the crop in one or the other constituent cannot be supplied either entirely or partly from residues now in the soil.

By what means can we learn whether the soil contains a surplus of phosphoric acid or nitrogen or potash, or of any two of these? Can we learn by means of a chemical investigation of the soil? No; this has been tried repeatedly, but with no satisfactory result. The quantities of food constituents which are dissolved by chemical reagents do not always correspond to those quantities which the plant roots are able to appropriate from the soil. Therefore, conclusions respecting the fruitfulness of the soil, arrived at from study of the results of chemical analysis, are often entirely incorrect. Very often it has appeared that soils, which, according to the results of chemical analysis, are rich in phosphoric acid, are, so far as the plants are concerned, very poor in this constituent. Soils whose total content of phosphoric acid is relatively slight, are not always, by any means, in need of phosphate manuring.

Elements of plant food appear in great variety of combinations, and in many different degrees of solubility. Chemical analysis is not in a

position to apply a solvent to soils, corresponding to the decomposing agencies of the natural field and to the dissolving power of the roots. Such a solvent is not yet discovered. Safe conclusions concerning the needs of a soil, as to manuring, can be drawn from the results of chemical analysis only when these show exceptionally high or low amounts present. As a rule, therefore, we must seek other means for solution of the question before us. Such we have in the fertilizer experiment; and this brings us to a theme which might easily lead to tedious and prolonged discussions, but I shall endeavor to be brief. I will show in a few words that the fertilizer experiment, at least as it is commonly carried out, fails to accomplish the purpose.

Take, again, the above example, and let us assume that by the fertilizer experiment it can be proved whether potash or phosphoric acid or nitrogen, or any two of these materials, can be spared either half or entirely from the manure, without thereby diminishing the yield which would have been obtained by applying the entire manure. We make the following trials:

Number of Experiment.	Manurial Ingredients Applied in Pounds Per Acre.		
	Phosphoric Acid.	Potash.	Nitrogen.
1	—	—	—
2	54	36	44
3	—	36	44
4	—	—	44
5	54	36	—
6	54	—	—
7	54	—	44
8	27	36	44
9	27	18	44
10	27	—	44
11	54	36	22

Here are trials each of which should be made at least twice, which results in twenty-two trials. The amount of labor involved is great. Even if we brave the work and expense, will the result correspond to the trouble? Let us consider. Assume that the experiments have been carefully carried out, and are successful; that the weather has caused no failures; that there were no inequalities in character of soil; that birds have consumed the same amount from each plot; that the damage from insects, mice, and fungoid diseases, loss of seed in cutting, transporting, thrashing, etc., has fallen alike on all plots, so that the figures obtained can be accepted as sufficiently accurate. How far, now, do the results bring us? To what extent do they enable us to arrange a manure for our soils? Let us assume to have found, with or without phosphoric acid, an equal increase. We most certainly infer that, in the present case, it would have been rational not to fertilize this wheat field with phosphoric acid. But what further conclusion therefrom? That, in future, we do not need to manure this or similar fields with phosphoric acid? No; at least not without further study; for the phosphoric acid surplus shown by these experiments consisted, perhaps, simply of a quickly consumed residual from the last manuring, but not of an annually formed quantity of soluble phosphoric acid, coming from a reserve in the soil.

Thus, our twenty-two carefully executed experiments would have told us, at autumn, how we should have manured that particular soil in the spring. We do not know whether we should manure with phosphoric acid, and with how much we should manure the crops succeeding wheat, which would very possibly demand from the soil quite different proportions of phosphoric acid, etc.

This is indeed poor success. We may well counsel against such slightly profitable experiments, or indeed save ourselves even this effort; for the farmer, in spite of much advice to the contrary, never makes such experiments, and for this he cannot be blamed. I indorse his views, when he considers that a thorough and reliable experiment costs more than the value of the results, and that a superficial experiment and careless interpretation of results leads to very serious errors.

I am of the firm belief, that, in this entire subject, study has not been carried on in quite the right direction, and that fundamental reform must be aimed at, in order to render possible a well planned and rational application of artificial manures. At present, there is much to be desired. General rules are adhered to. Guessing and trying in every direction is the practice. Concerning the actual need of potash in the soil, we are ignorant; and we quiet our curiosity by applying here and there a little potash, without once knowing whether its application is in the right place, is sufficient, or, indeed, even necessary. We manure with superphosphate and Thomas slag according to the most general rules, but cannot possibly determine whether too much or too little is applied. We do not know how long a phosphoric acid application lasts, nor how much remains for the second and third crop after manuring. We do not know whether different phosphates become gradually more or less soluble in different soils, nor in what degrees. In short, we grope in the dark. The farmer can give himself no satisfactory account of his actions in these matters. It is therefore impossible for him to protect himself from profitless investment, or to get full advantage from opportunities offered. I will indicate the direction from which I hope for a change for the better, and present the following statements:

The belief in the necessity of accurately measuring the quantities of phosphoric acid and potash required by each cultivated plant is incorrect and irrational. The intelligent farmer, practicing intensive cultivation, long ago discovered the correct method of procedure. He places in the soil a surplus of phosphoric acid and potash; and this I hold to be entirely right. Nitrogen should be measured out to the plant as accurately as possible, but not phosphoric acid and potash. How much phosphoric acid is needed in a particular case, *i. e.*, for a particular plant on a particular soil, in order to produce the greatest possible yield, cannot be closely calculated. The one soil is rich in potash, the other poor; the one rich in phosphoric acid, the other poor. The one crop needs much easily soluble potash and phosphoric acid, the other little. The one soil yields the phosphoric acid, applied in easily soluble form, directly; the other renders it less soluble, and demands a relatively heavier manuring to produce an equal result. The one soil has never, or very rarely, received phosphates, the other large quantities almost yearly; and it is possible that the latter possesses a store equal to the demand for several years.

How can the farmer find his way through all these difficulties? He cannot. Nothing remains but to apply an excess of both food constituents; and in this there is indeed no danger, for potash and phosphoric acid are substances which the soil binds up and preserves for later crops, in case the one immediately following demands them only partially or not at all.

With nitrogen it is quite different. Nitrogen is not bound by the soil; it remains freely movable. The residual from a crop would be in danger, during the winter months, of being washed into the subsoil, and lost.

But, aside from all the difficulties, at present insurmountable, which prevent an exact measurement of phosphoric acid and potash, this is not the correct procedure; and, further, it is under all circumstances rational to apply a surplus of these food constituents. In support of this I adduce the following:

Assume that of the phosphoric acid in the soil not more than one half pound per acre can be assimilated. This, then, might suffice if the plant development progressed uniformly and the weather was favorable during the entire period of vegetation. But continuously favorable weather we never have.

Now, let the plants thirst for weeks at a time. No phosphoric acid is assimilated, nothing is elaborated. If rain comes and then warm weather, the plant must, if a maximum harvest is to be had, retrieve what has been lost, and within the next week elaborate as much as they should have done in two or three weeks' time. For this two or three fold daily production they require a two or three fold quantity of phosphoric acid; and this they can get only when there is in store a corresponding surplus, a supply from which, during a few days, the plant can draw more than under normal circumstances is necessary.

A sure maximum harvest, under actual circumstances, is only obtained when the plant is in position to take full advantage of particularly favorable weather, such as is presented only during very limited periods of time. The storage of phosphoric acid in the soil must, therefore, be sufficiently large to meet not only the normal demand of the plant, but also an occaional abnormal requirement. Consider the enormous amount of plant material often produced on a rich field, in a few days of warm, moist weather, and the large quantities of phosphoric acid which, within a short space, must be assimilated and incorporated.

What we have found to be true of phosphoric acid must also be true of potash; for this does not remain in freely removable condition, like the saltpetre nitrogen. It is absorbed, and only given up by the soil in small quantities. Therefore, I say a sufficient excess of phosphoric acid and potash must be present in the soil, a supply sufficient to satisfy the demand not only on days of normal production, but also on days of the most vigorous growth.

But if now we accept the demand for storing a surplus of phosphoric acid and potash in the soil as one of general importance, then the question relative to our fertilizer experiment takes a much more simple form, and its requirements are more easily fulfilled.

If a field be manured simply with the usual amount of phosphoric acid, leaving a small area—say fifty square yards—without application, it can be determined without difficulty whether the phosphoric acid acts or not. Any effect should be detected by the eye and, roughly, the amount. This is especially plain in the straw crops at a very early period, before and during the stem formation, and not, as has erroneously been supposed, at the seed setting. If the phosphoric acid acts, then surely the manuring was necessary, and a sufficient surplus was not previously on hand.

With the next crop the manuring is to be repeated; and again a small piece—of course, in a different position from the first—is to be left free from manure. Observation is again made as to any effect and its degree. In case of an apparent effect, especially of a very marked one, the phosphate manuring is continued perhaps through a series of years, and eventually increased. From year to year, then, the soil becomes richer in this food constituent; for, of every two hundred pounds of soluble phosphoric acid brought into the soil, the next succeeding crop uses, as a rule, not more than twenty, forty, or sixty pounds, one hundred and forty to one hundred and eighty pounds remaining in the soil for the use of the succeeding cultures. Thus, from year to year, the point is neared from which the phosphoric acid manuring can be diminished without danger of starving the plants. In the execution of the experiments just indicated, which I will more minutely describe in another place, there is no difficulty in following the changes in the fertilized condition of the soil, or in drawing practical results from observations made.

The question, With how much phosphoric acid and potash shall we fertilize our domestic plants, in order to reach an increased yield of greatest net profit? would accordingly be answered as follows: By means of an easily performed experiment, whose results can be determined even by ocular observation, we determine whether, in the soil to be fertilized, there is a deficiency or surplus of phosphoric acid and potash. If a deficiency is shown, we apply the food constituents named, in quantities within the limits of ordinary practice. During the first years, in case the soil has shown itself to be very much in need of manure, heavy applications (sixty to seventy pounds of soluble, or one hundred and twenty-five to one hundred and forty-five pounds Thomas, phosphoric acid per acre) are made, in order to insure a sufficient surplus. With the phosphate manuring in particular, one should not be too economical. Phosphoric acid is now at a very low price, and the Thomas slag offers a most advantageous means by which to supply the soil with this ingredient. In vineyards, orchards, and every field on which deep culture is practiced, the lower soil layers should be furnished richly with Thomas slag. After having applied phosphoric acid abundantly during a series of years, light manuring may take the place of the heavy (twenty-five to thirty-five pounds soluble, or fifty to seventy pounds Thomas, phosphoric acid per acre). The after effect of early manuring is now obtained, and by experiment we determine whether phosphoric acid application cannot often be entirely omitted. When, for example, Mr. F. Heine, of Emersleben,* reckons that during a period of sixteen years he has incorporated into his farm an average per acre of not less than fifty-seven pounds of phosphoric acid a year more than he has removed, it is not surprising that further phosphoric acid manuring should effect nothing in his soil already so strongly enriched, and that he could rely for several years on this collected supply.

The necessary surplus of phosphoric acid must not be permitted to become a superfluity. This is also to be said concerning potash; but naturally rich potash soils are far more abundant than those rich in

* Deutche Landwirtschaftliche Presse, 1886, No. 33.

phosphoric acid, and with the potash supply of the soil more caution is necessary. Potash is indeed absorbed by the pulverized soil, but it becomes soluble again more easily than phosphoric acid; and many domestic plants are very sensitive to strong potash manuring. More attention is therefore to be given to potash manuring than to that of phosphoric acid, and care must be taken to avoid a too great surplus of potash salts in the soil.

The rule which the farmer must follow in supplying his crops with these important foods is clear in principle and very simple, namely: "to enrich the soil with the food constituents under consideration, until they are present in sufficient surplus—that is, till a further enrichment is without effect, and to hold the soil in this degree of food surplus."

Having reached this fundamental law for phosphoric acid and potash manuring, we turn to the subject of nitrogen manuring, and first ask, Must we manure all domestic plants with nitrogen? To this question we say, No. Pease, vetches, clover, lupines, lucerne, and similar plants make far less demands on the nitrogen content of the soil than oats, barley, wheat, rye, buckwheat, beets, carrots, potatoes, tobacco, flax, rape, grass, spurrey, white mustard, etc.; so that in exceptional cases can it be rational to manure the first named plants with nitrogen salts. They possess a peculiar power to avail themselves of atmospheric nitrogen, while the latter lack this ability, and must therefore draw the entire amount of nitrogen necessary for their development from the soil.

I have carried out, in connection with this question, very many experiments in the most diverse directions, and will here adduce a few examples from my results.

Manurings of eighteen, thirty-one, and forty-five pounds of nitrogen per acre were given various crops. Barley, rye, oats, wheat, buckwheat, carrots, potatoes, beets, flax, rape, grass, and spurrey furnished considerably increased yields, and the latter stood in exact relation to the increased manuring; while with pease, red clover, lupines, vetches, and lucerne no increase of yield was obtained. Let the following figures serve as illustration. For more convenient reading, I have placed the yield obtained with barley, without nitrogen manuring, at one hundred, and have reckoned the other yields to correspond:

NITROGEN APPLIED IN POUNDS PER ACRE.	None.	18.		31.		45.	
		Yield Obtained	Yield Calculated	Yield Obtained	Yield Calculated	Yield Obtained	Yield Calculated
Barley	100	161	167	220	218	272	268
Spurrey	114	176	172	214	215	254	258
Wheat	138	212	211	270	266	316	321
Flax	145	205	203	245	247	291	291
Pease	935	938	-------	961	-------	883	-------
Lucerne	976	983	-------	1,000	-------	994	-------

Here can be seen with what regularity and exactness the yields of barley, spurrey, wheat, and flax increased in relation to the increased manurings; while with pease and lucerne absolutely no increase of yield was obtained by nitrogen manuring. From the figures it is seen at once that the pease and lucerne must have had access to a much richer source of nitrogen than the other plants. While the yield of barley, spurrey, wheat, and flax only reached one hundred to one hundred and forty-five on unfertilized soil, and could be brought up to about three hundred only after corresponding manuring; pease and lucerne gave on the same soil, unfertilized, a yield of nine hundred and fifty; and these plants obtained their nitrogen from so abundant a source that saltpetre manuring made no impression whatever on them. Similar results are reported by Hellriegel and E. v. Wolff. Still more striking are the data which I obtained from sterile sand taken from below the subsoil. The sand was placed in vegetation pots, furnished with all material necessary for plant nourishment excepting nitrogen, and planted with barley, rape, vetches, lucerne, and pease. Barley and rape developed on this almost nitrogen-free soil so scantly, that they furnished only from twenty-three to thirty-nine grains of vegetable matter; while, under the same circumstances, vetches, lucerne, and pease vegetated luxuriantly, and the latter yielded not less than one thousand three hundred and eighty-nine grains of vegetable substance. If we represent by one hundred the nitrogen contained in the barley and rape substance yielded, then the nitrogen of the pea substance harvested under like circumstances is presented by the enormous amount, eight thousand seven hundred.

Five years ago I proved and stated that lucerne, pease, lupine, clover, and similar plants possess powers of nitrogen assimilation specifically different from that of the straw crops, potatoes, beets, flax, rape, etc. The first named plants, as I said, draw from nitrogen sources which, for the straw crops, potatoes, and similar plants, are inaccessible, and in such large measure that, under normal circumstances of culture, a manuring with nitrogen salts is unnecessary.

We can therefore divide the agricultural plants into two groups, namely: nitrogen collectors and nitrogen eaters, as Schultz, of Lupitz, first proposed to name them; or, as I would suggest, into nitrogen increasers and nitrogen consumers. The nitrogen increasers (pease, vetches, lupines, clovers, etc.) are plants which increase the nitrogen content of the soil, and therefore the circulating nitrogen capital of the establishment, since they supply their chief need of this element from the atmosphere, and demand nitrogen food through the soil only during the first of their growth. The nitrogen consumers (straw crops, hoed crops, etc.) are, on the contrary, plants which consume the nitrogen capital of the establishment and of the soil; for they can appropriate what amounts to nothing from the atmospheric supply, and must absorb all nitrogen contained in their harvest products in the form of nitrogen salts. The great significance which the nitrogen increasers have upon the economy of the soil, and the magnificent service which they are able to render the farmer, I shall consider further on. We have to discuss at present the nitrogen manuring of these plants. In referring to what has already been said, I must again call special attention to the fact that the nitrogen increasers "attain the ability to supply their demand of nitrogen from the air only upon reaching a certain degree of development, and that it is very difficult for them before this period to dispense with the nitrogen of the soil." If, now, the soil contains nitrogen enough to feed these plants till they have attained this ability, an application of nitrogen is superfluous and absolutely irrational; but, if not

enough is present to quickly accomplish such a development, then a small manuring with Chili saltpetre or ammonia salts on the pease, vetches, clover, etc., is necessary, and can be made highly remunerative. In every single case the practical farmer must determine, if necessary, by experiment, whether the soil is so poor, so extremely exhausted, that even the nitrogen increasers must be given a nitrogen manuring. I believe that the application of nitrogen salts for these plants can be rational only in rare cases; and it is not difficult to determine such, for mere observation shows whether the plants require nitrogen or not. If one attempts, for instance, to grow vetches or pease on a completely sterile sand, devoid of nitrogen, the need of this element appears gradually but plainly in the diminutive form of the plant, and in the pale, sickly color of the leaves. These signs vanish quickly if the plants are fed with saltpetre. The pale color becomes green, new and healthy shoots appear, and a vigorous growth sets in. If, on the contrary, the plants are not manured, are allowed to hunger, the process of vegetation remains for several weeks in this inert condition; the evidences of starvation increase, till finally the atmospheric supply of nitrogen becomes accessible,, and the plants vegetate as luxuriantly as if they had been manured with saltpetre. Although it is indeed possible for pease, vetches, clover, etc., to attain the capacity, after continued starvation, to draw nitrogen from the air entirely, without the coöperation of soil nitrogen, it is nevertheless in the highest degree dangerous to expose them to this starvation cure, for in this way many individual plants are sacrificed. They are destroyed by pests, being too weak to replace losses caused by them; they dry up for lack of deep roots; they are attacked by fungous diseases, because their juices stagnate; or they starve out completely. Therefore, in such cases, and only such, the farmer should feed the starving plants a small quantity of nitrogen, either in form of Chili saltpetre or ammonia salts; but only a little, as much nitrogen salt would be an extravagance. A small application, of perhaps forty-five to sixty-seven pounds of Chili saltpetre per acre, can in such case be effective and remunerative; for it is simply necessary to assist the plants over that critical period, and to bring them as quickly as possible to a state of development in which they have the ability to draw nitrogen from the atmosphere.

Concerning nitrogen manuring proper, therefore, we have to discuss the question only with reference to the so called nitrogen consumers; and I now ask, With how much nitrogen shall we manure, in order to attain an increased yield giving the greatest possible net gain?

Here the answer is essentially different from that in the case of phosphoric acid and potash manuring. I state it thus: Soluble nitrogen is not to be offered to the plants in surplus, but is to be measured out to them as nearly as possible in needed quantities. If we assume that vegetation is governed by plant foods, then nitrogen is the real dictator in the matter of growth, with all plants requiring nitrogenous manure—that is, all nitrogen consumers. The nourishment of these plants, the application of food in proper quantity—indeed, the entire art of manuring—is dependent on a rational and exact application of nitrogen. The farmer applies all other plant foods in surplus, but nitrogen he deals out to the plants as he gives rations to his animals; and in this way regulates their productive activity, and gives them the power to realize the full benefit of circumstances favorable to vegetation, such as qualities of soil, climate, weather, be they continuous or intermittent.

We had assumed the task of raising the yield of a wheat field by two thousand pounds of grain, and had observed that this required the crop to consume about twenty pounds phosphoric acid, thirty pounds potash, and sixty pounds nitrogen, more than was before necessary for the production of superficial substance (straw and grain). Further reflection led us to the conclusion that an exact calculation of the phosphoric acid and potash necessary in this case would be impossible and irrelevant. We understand, moreover, that it is simply necessary to supply the soil with an appropriate surplus of these foods, and this presents no great difficulty. The supply of the nitrogen, then, is the problem presented, and one requiring a different solution from that in the cases of potash and phosphoric acid.

In this case we can and must calculate closely. We can, since we know that the entire nitrogen brought into the soil in the form of saltpetre and ammonia salts is at the disposition of the plants; for the nitrogen in saltpetre (and also ammonia, after transformation to nitric acid) is not bound by the soil, but is as freely movable as the water of the soil.

On the other hand, we must figure closely with the nitrogen, and not apply it in surplus, because, first, nitrogen is costly, and with it we cannot be extravagant; secondly, any nitrogen residue remaining in the soil during the winter months becomes lost; thirdly, a too ample supply of easily soluble nitrogen causes both an abnormal development of the crop, and also, under certain circumstances, a harvest of inferior quality.

But the difficulty in reckoning the nitrogen necessary for a definite increase of yield is not great. We can for the present assume, so far as investigations now indicate, that, of every three pounds of saltpetre nitrogen brought into the soil, an average of two pounds enters into the composition of the crops. Consequently, if we are to obtain an increased yield, containing two pounds of nitrogen, we need simply to bring into the soil one and one half this amount; *i. e.*, three pounds of soluble nitrogen. In the case under consideration, therefore, sixty pounds of nitrogen being necessary to produce two thousand pounds of wheat grain plus three thousand pounds of wheat straw, it is evident that ninety pounds of nitrogen are to be brought into the soil, in order to obtain the desired increase.

An approximate reckoning of the nitrogen necessary in every case offers consequently no difficulty. Let us assume, on the one hand, that of the fifteen and one half pounds nitrogen in every one hundred pounds Chili saltpetre, about ten pounds serve in the production of the harvest. On the other hand, we know how much nitrogen is necessary to form every one hundred pounds grain, or beets, or potatoes, with corresponding straw and tops. We can now reckon what increased yield we can obtain by the application of every one hundred pounds Chili saltpetre, and thereby obtain data for determining the quantity of nitrogen to be applied, and also for judging of the result of the manuring. I have made use of tables published by Lierke, in computing in this manner for several crops, and give here the results of these computations. They show the following increased yields to be produced by applications in each instance of one hundred pounds Chili saltpetre:

Wheat	350 pounds grain and 500 pounds straw.
Rye	330 pounds grain and 850 pounds straw.
Barley	420 pounds grain and 600 pounds straw.
Oats	350 pounds grain and 580 pounds straw.
Corn	420 pounds grain and 580 pounds straw.
Buckwheat	420 pounds grain and 640 pounds straw.
Potatoes	2,600 pounds tubers and 300 pounds leaves.
Sugar beets	4,500 pounds roots and 900 pounds leaves.
Fodder beets	3,900 pounds roots and 1,000 pounds leaves.
Carrots	3,700 pounds roots and 560 pounds leaves.
Chicory	3,400 pounds roots and 410 pounds leaves.
Meadow hay	645 pounds hay.
Corn fodder	5,300 pounds green fodder.
Rape	110 pounds grain and 600 pounds straw.
Hops	70 pounds heads and 320 pounds leaves and vines.
Tobacco	180 pounds leaves and 150 pounds stems.
Poppy	170 pounds seed and 500 pounds straw.

I also place here a second representation, which shows, in pounds per acre, the approximate limits within which it is customary to apply nitrogen in barnyard manuring:

	Nitrogen.	Corresponding to— Chili Saltpetre.	Sulphate of Ammonia.
Straw crops	13 to 53	89 to 356	67 to 267
Potatoes	22 to 45	143 to 294	–*
Sugar beets, carrots, and chicory	22 to 53	143 to 356	–*
Fodder beets	22 to 67	143 to 445	–*
Rape, turnips, poppy, and mustard	22 to 67	143 to 445	111 to 356
Tobacco	13 to 27	89 to 178	67 to 134

These extreme quantities, in connection with the previous table, will serve the agriculturist as approximations from which to reckon an actual case of nitrogen application. In my paper on nitrogen manuring† I explained at length how to make these calculations, and here will simply adduce a practical example. Let us assume that we are to increase the yield of a wheat field by application of Chili saltpetre; other conditions are favorable, the soil is rich in potash, and phosphoric acid is provided. How much Chili saltpetre must be applied? The above representation shows it to be customary to apply from eighty-nine to three hundred and fifty-six pounds Chili saltpetre per acre. These are wide limits. From the previous table we observe that an application of one hundred pounds Chili saltpetre indicates an increased yield of three hundred and fifty pounds grain; therefore, three hundred and fifty-six pounds saltpetre allows us to calculate a yield of one thousand two hundred and forty-six pounds of grain. In order to arrive at a result, we ask how much the field would produce without manure. This, of course, we cannot know exactly; but previous experience, knowledge of the condition of the soil and of the kind and quality of the foregoing crop, permit us to make an approximation. Assume that the crop would be two thousand pounds of grain per acre, how much can we increase this production? Here, again, it is impossible to know exactly; but, after considering the quality of the soil, the climate, the best harvests

* Not reckoned, because the ammonia salt manuring, for the potatoes and beets, proved to be far less effective than the saltpetre manuring.

† "The Increase in the Produce of the Soil through the Rational Use of Nitrogenous Manure." Translated by G. G. Henderson. Published in 1888, by Whitaker & Co., London.

which neighbors and others have reached by an intensive nitrogenous manuring, a certain amount may be stated, which can probably be produced. By application of three hundred and twenty pounds saltpetre we could calculate upon a yield increase of one thousand one hundred and twenty pounds, *i. e.*, of a harvest of three thousand one hundred and twenty pounds of grain; but now, should it be feared, in view of local conditions or previous experience, that this amount cannot be reached, we settle on two thousand eight hundred pounds, *i. e.*, an increased yield of eight hundred pounds of grain, and therefore on an application of two hundred and forty pounds Chili saltpetre.

Now, for determining the success of the experiment, two or three carefully measured plots are left without nitrogen application. The yield from these must be separately harvested and weighed, and from a comparison it may be seen whether or not the nitrogen application has produced the effect expected. If the result has fallen short of that—if, perhaps, instead of eight hundred pounds increase only six hundred and forty pounds have resulted—we must search for a cause. Perhaps there was a deficiency in potash, phosphoric acid, lime, water, or warmth, which prevented the full efficiency of the nitrogen; or perhaps the nitrogen applied could not be fully absorbed and assimilated, because of the influence of a heavy spring snow storm, for example, which washed the saltpetre into the subsoil. Perhaps the number of plants was too small, either because of meager seeding or destruction by late frosts; or there may have been too many plants—too much seed sown—and, because of crowding, their development was abnormal. The stand, becoming weak, suffered from deficiency of light, and lodged. Such questions must be raised and decision reached among these possibilities.

Should the cause be found by aid of further experiment, perhaps, then, must be considered how to neutralize it, in order to secure the legitimate effect of saltpetre application. If it proves to be beyond control, we consider whether less nitrogen may not bring greater profit. If those two hundred and forty pounds of Chili saltpetre fail of their full effect because of too dry soil, and if experience can give no hope for more moisture in following years, then it is highly probable that a smaller nitrogen application would be more profitable; and it is merely a matter of calculation to ascertain whether it is more advantageous to get full effect of a smaller manuring, or partial effect of a full manuring. It is not invariably true that the lesser application, although completely taken up, will furnish the highest net profit. Relatively, this would make the larger harvest. But a very important factor here is the absolute amount of gross return. Let us assume that a saltpetre application of four hundred and forty pounds, which costs about $10, gives an increased yield worth $25; and an application of eight hundred and eighty pounds, costing about $20, returns an increased yield not of $50, but of $40. Then the relative return from the smaller application is indeed greater, but less advantageous, for its net return amounts to $25, less $10, *i. e.*, $15; whereas, the heavier application furnishes a net profit of $40, less $20, *i. e.*, $20.

I believe now I have sufficiently explained the chief considerations suggested, in the application of artificial manures. These may be summarized as follows:

First—Artificial manures (phosphoric acid, potash, and nitrogenous

fertilizers) can effect an increase of yield when all other factors are either temporarily or permanently favorable.

Second—Phosphoric acid and potash are to be stored in the soil until a surplus is present; that is, until an excess beyond the demands of the most exhaustive crops is supplied.

Third—The nitrogen increasers (lupines, pease, clover, vetches, lucerne, etc.) need, under normal circumstances of cultivation, no fertilizing with nitrogen salts. Only on exceptionally poor soils can it be profitable to apply these, and in such cases the application should be small, and made during the first period of growth. This is for the purpose of bringing the plants, quickly and without disturbance, to that stage of development beyond which soil nitrogen is not needed, as the entire amount can be drawn from the air.

Fourth—The nitrogen consumers (straw, hoed and oil crops, flax, hemp, tobacco, etc.) require nitrogen manuring; but the nitrogen must not be applied in surplus, only in quantities which careful computation indicates necessary for a required increased yield of the crop in question.

We may now consider a few of the more special questions; and first of all, those connected with

PHOSPHORIC ACID MANURING.

Our cultivated crops must be given a surplus of phosphoric acid, *i. e.*, enough to produce, under any circumstances, the largest possible harvest. As has been said, this surplus must not be too great; it must not amount to a superfluity. If, year in and year out, considerably larger quantities of phosphoric acid are put into the field than the harvests remove, then a limit is gradually reached, beyond which a regular repetition of the same manuring would be irrational. When a sufficient supply of phosphoric acid is obtained, it should be held, but not increased. This is important, especially in manuring with easily soluble phosphates. Such phosphates, after application to the soil in surplus, become, from year to year, less soluble; whereas, surplus Thomas slag or bone meal becomes more soluble. It is, therefore, not necessary to be so cautious in applying the latter. They are cheaper, and gradually become more soluble; while dissolved phosphates are dearer, and gradually become less soluble.

An excessive surplus of phosphoric acid is not only an extravagance, but it is of disadvantage to the crop. The evil effects of heavy phosphoric manuring are indeed not yet proved with absolute certainty; but the probability is great, that under many circumstances they are actual. An explanation of this is not difficult to find. It is the same as that which I have given of the hastening effect of phosphoric acid in ripening.

Every farmer experienced in phosphate manuring knows that strong applications of phosphoric acid hasten the ripening process in cultivated plants, which are not supplied with a surplus quantity of nitrogen. The plants become yellow at an early stage, and ripen faster than those manured with surplus nitrogen. The cause of this phenomenon has been sought in a quickening effect, which phosphoric acid is supposed to exert on all the living functions of plants. Phosphoric acid is said to make the plants more vivacious. This, however, is not quite pertinent. A plant manured with a surplus of phosphoric acid does not, in my opinion, *live* faster, but *dies* faster. As is generally known, the so called ripening process of a plant consists in a cessation of activity in the manufacture of vegetable material, at the same time the elaborated products scattered through leaves and stems are transferred to surface or (as in beets, potatoes, etc.) subterranean deposits—the so called fruits. This transferring process is disturbed and prolonged when the ripening plant is induced, by continued applications of highly nitrogenous food, to continue its productive activity. If nitrogen is lacking, this process is hastened. But when a plant is manured with much phosphoric acid, and in consequence of this has formed much plant material and consumed a correspondingly large amount of nitrogen, it is very apparent that the nitrogen supply of the soil is exhausted correspondingly early, and nitrogen starvation sets in much sooner than when phosphoric acid is not applied. Then the plant stops production, and allows the ripening process to be completed undisturbed. This is presumably the explanation of the so called injurious effect of phosphoric acid, which is claimed to be observed in cases of diminished, instead of increased, yield, after heavy applications of phosphate. In such cases, the very rapid development of the plant causes great consumption of water and nitrogen; consequently, hunger and thirst appear early, and operate injuriously. If more nitrogen should be applied, either at first or promptly after the rapid growth, the injurious effect of the phosphoric acid would not be apparent.

It is often stated that "heavy applications of phosphoric acid readily produce injury on poor, sandy soil." But it should be observed how this effect of the phosphoric acid is brought about. Primarily, the phosphoric acid acts by no means injuriously. Plants manured with superphosphate appear at first more vigorously developed than those unmanured. Not till later does this "condition disappear." Then the plants cease to develop, and their leaves become yellow. Hot and dry weather is usual at this time, and the plants die. They "ripen too early." The phosphoric acid has "burned" them, as is frequently said. This "burning" by phosphoric acid is nothing else than the consequence of early nitrogen starvation, with heat and drought. The small amount of nitrogen supplied by a sandy soil is quickly consumed by those plants requiring much phosphoric acid, and consequently much nitrogen. The plants then starve, and the effect of heat, drought, and other unfavorable circumstances on a starving plant is, of course, far more hurtful than on a well fed one. Here, then, is the explanation why a crop heavily manured with phosphoric acid finally yields, in spite of an early, luxuriant development, a lighter harvest than another which has not been so manured. It should be remembered that these "evil effects of phosphoric acid" can be avoided by application of nitrogen, either at the beginning or at any time before the critical period is passed. Nitrogen salts, or more gradually acting compounds, as barnyard manure, green manure, ground meat, fish, dried blood, etc., may serve in such cases.

Loss of interest on invested capital, danger of lessening the solubility of phosphoric acid applied, and a possibility of an injurious effect, are not the only considerations which warn us from excessive phosphoric acid manuring. We may well ask, here, whether a heavy surplus of phosphoric acid may not cause the plants to take up considerably more phosophoric acid than they need in the elaboration of vegetable substance—that is, to consume phosphoric acid as a luxury. Comprehensive experiments, which I have carried out, have led me to the following

results: So soon as the plant lacks nitrogen or other food, a luxurious consumption of phosphoric acid can take place. The plant then continually absorbs phosphoric acid from the soil, which it cannot assimilate because of the lack of nitrogen. But if nitrogen is not lacking, then the danger of absorption of unassimilable phosphoric acid is not a present one. Aside from any such reasons, the agriculturist must never allow his crops to lack food. Only under this condition can the highest yields be produced. This condition fulfilled, a luxurious consumption of phosphoric acid is impossible. It is further to be noticed that the variations in content of phosphoric acid of the crop are found chiefly in the straw; not at all, or only to a small extent, in the grain itself. In my experiments,* for example, while the amount of phosphoric acid in rye straw was raised from 15 to 41 per cent, that in the rye grain was only raised from .92 to 1.06 per cent. In practice this is important; for the grain alone is sold, while the straw and fodder remain largely on the farm. Therefore, if the field has produced a straw or fodder richer in phosphoric acid than would have corresponded to an economical consumption, this excess is not lost to the farm, but is transferred to the barnyard manure, and goes back to the soil.

On this account, also, it appears to me wise to furnish fodder crops especially with a not too meager surplus of phosphoric acid. These plants need much phosphoric acid for their development; and if too much is given them, and more than they need is taken up, then the barnyard manure is simply enriched thereby, and from the luxurious consumption no injury to the farm, other than the loss of interest, ensues.

This consideration brings us immediately to the following general question: Which domestic plants are to be manured with a large surplus, and which with a small surplus, of phosphoric acid? Investigations concerning this subject have unfortunately led to no conclusions. When one considers, for example, that rape must assimilate fifty-three pounds and barley only twenty-two pounds of phosphoric acid per acre, to furnish an average harvest, we are forced to think that rape should be given at least twice as much phosphoric acid as barley. But that is not the case. The necessary amount of manure cannot always be inferred from the necessary amount of food. The necessary amount of food for a plant, as determined by chemical analysis of the crop, is often essentially different from the amount of manure which the same needs, as determined by the fertilizer experiment. The same soil from which one domestic plant can take only twenty pounds of phosphoric acid, yields without difficulty sixty pounds to another. We must, therefore, determine the amount of manure to be given, not simply by the need of a crop for plant food, but with reference to the manurial need of the plant—that is, its demand for easily soluble materials.

As I have stated, the investigations on this highly important question have not yet led to conclusions; but I hope soon to report, in this connection, very interesting data. At present I simply advise agriculturists to apply phosphoric acid chiefly to the fodder crops, and by no means to allow the meadows, clover, lupine, esparcet, and vetch to lack phosphoric acid. Moreover, those crops which it is important to hasten in the ripening process, *e. g.*, sugar beets, potatoes, large fruits, and

* "The Manurial Value and Rational Application of Thomas Slag, in Comparison to Superphosphate, Bone Meal, Peruvian Guano, and Ground Coprolite." Darmstadt, 1888.

grapes, should be furnished a large surplus of phosphoric acid; and especially when, because of a cold soil, a slow ripening is feared. But, on the other hand, where the species of plant or condition of soil (dryness, warmth, deficiency of humus) hastens the ripening, then great caution is necessary, lest the surplus amount to an injurious excess.

Another question here arises, namely: In view of present ruling prices, of special aims in culture, and of special qualities of soil, which phosphate is it most advantageous to use? The principal commercial phosphates are superphosphate, including all dissolved phosphates (Peruvian guano, dissolved bone, etc.), ground Thomas slag, and bone meal. These have very different market prices. Phosphoric acid costs per pound, in superphosphates, from 6 to 7 cents; in bone meal, from 4 to 4.5 cents; in Thomas slag, from 2 to 2.5 cents. What is the explanation of this difference in price? Has the phosphoric acid a different value in the feeding of plants, according to whether it comes from superphosphates, Thomas slag, or bone meal? No. It makes no difference with the plant whether phosphoric acid comes to it from guano, bone meal, ground phosphorite, superphosphate, ground coprolite, Thomas slag, or any other manure.

Here, however, is the explanation: Phosphoric acid cannot be taken from every manure with equal rapidity; and the manurial value of a phosphate, as well as the market price of its phosphoric acid, is determined relatively by the rapidity with which the plant can draw from it the phosphoric acid. It is important for the agriculturist to get return from his outlay as quickly as possible. Therefore, it is important that phosphoric acid applied to the soil should become dissolved, enter into the roots, and in the form of vegetable substance be returned at the first possible moment. A manure whose phosphoric acid comes back in the first crop, is, of course, much more valuable than one which returns the last portions only after six, eight, or ten years. Therefore, the rapidity of the effect is all-important, if we would determine the manurial worth of ground Thomas slag relatively to that of superphosphate and bone meal. We must ascertain how rapidly the phosphates are decomposed and taken up by the plants. But how do we accomplish this? By what method can we determine the solubility of Thomas slag phosphoric acid? Here is apparently no difficulty. A large number of chemical solvents are at our disposal. We can treat the ground Thomas slag with dilute acetic acid, citric acid, ammonia citrate, etc., and prove whether it is more or less easily and quickly dissolved than other phosphates. In fact, it has been found that all such solvents decompose Thomas slag more quickly and completely than, for instance, the undissolved coprolite meal. But this by no means suffices for reckoning the manurial value of Thomas slag phosphoric acid. Remarkable as it is that Thomas slag is dissolved with relative ease in acetic acid, and probable as it appears that the manurial value of its phosphoric acid would be great, this is nevertheless not yet determined. In the soil there is no acetic acid, no ammonia citrate. There we have to do with the combined effect of several solvent powers which proceed from humic acid, soil water, various soil salts, and the acids of the plant roots. How these coöperating agents behave toward Thomas slag, bone meal, superphosphates, etc., must first be determined, in order to reach a definite and reliable statement as to the manurial value of Thomas slag. This testing can only be accomplished by fertilizer experiments.

Exact and reliable fertilizer experiments are unusually difficult of execution. Experiments in the open field, on half or quarter-acre plots, are very tiresome and unremunerative. The measuring and staking out of plots, the uniform division of the manure, the harvesting of separate small crops, with careful taking of all weights, is troublesome and expensive work; and, further, the lack of uniformity of soil, unfavorable weather, crop enemies above and below the surface, accidents from all sorts of animals, are factors which, in coöperation, render the results to a high degree uncertain and useless. By field experiments one can be led into the greatest errors, unless results are checked, carefully, by numerous repetitions with similarly fertilized plots. In view of this, I have, during a long series of years, elaborated a method by which fertilizer experiments may be carried out, on a small scale, in great number and in an exact and reliable manner. More than a thousand such experiments are annually conducted in Darmstadt. As my method is generally known, both in principle and detail, no further description will here be given.* We now pass to a consideration of some interesting results furnished by these experiments. A very large number of experiments,† which were carried out with three different domestic crops—wheat, barley, and flax—and two different kinds of soil, with a view to ascertain the effects of commercial phosphates, yielded the following results. In order to produce the increased yield, which every pound of phosphoric acid in superphosphate produces, in the crop following the manuring, there are necessary, two pounds phosphoric acid, in form of ground Thomas slag; or ten pounds phosphoric acid, in form of steamed bone meal; or ten pounds phosphoric acid, in form of ground coprolite.

This result is very important, for it shows with what surprising rapidity the Thomas slag becomes effective, in comparison with bone meal; and we may well be allowed to draw the following conclusions:

First—Different series of experiments have shown that two pounds of phosphoric acid in Thomas slag produce, in the first year after application, the same as one pound of soluble phosphoric acid. It is, therefore, more advantageous to apply the Thomas slag; for two pounds of phosphoric acid in this cost only 4.4 cents, while one pound of soluble acid costs from 6 to 7 cents.

Second—Two pounds of Thomas slag phosphoric acid produced the same increased yield in the first crop following the application as ten pounds of bone meal phosphoric acid. The bone meal, therefore, must be considered, in comparison with Thomas slag, a much dearer manure.

These are very important results, practically, but they are not sufficient. We do not yet know what manurial value the Thomas slag and the bone meal have, in comparison to superphosphates. It would be a great mistake to reckon the relative value of superphosphate, bone meal, and Thomas slag from the yields of the first crops raised after manuring. These yields only show the rapidity with which the different phosphates become effective. Their complete manurial value, or their relative market value, can only be determined after ascertaining the effects of each phosphate on the *succeeding* crops, as long, indeed, as any effect can be noticed. I have, therefore, by further experiments, also deter-

* Information concerning my method is to be found in an essay entitled, "The Manurial Value and Rational Application of Thomas Slag," etc. Darmstadt, 1888.

† Minuter details in my paper above mentioned.

mined the after effect which the different phosphates are capable of exerting, during the second year after the manuring, on spring rye, turnips, and mustard. It was indeed to be foreseen, with considerable certainty, that the after effect of the Thomas slag would be greater than that of the superphosphates; for, on the one hand one hundred pounds of soluble phosphoric acid, and on the other two hundred pounds of Thomas slag phosphoric acid, were applied. In our experiments, sixty pounds of phosphoric acid are taken up from each manure; there then remains in the soil, of the one hundred pounds soluble phosphoric acid, only forty pounds, but of the two hundred pounds Thomas slag phosphoric acid, one hundred and forty pounds; and it is not otherwise possible than that the one hundred and forty pounds of Thomas slag phosphoric acid should effect very much more than the forty pounds of phosphoric acid in the superphosphate. This assumption was, in fact, proved by my further experiments.

In my above mentioned paper, on the manurial value of Thomas slag, relative to superphosphates, etc., I have given the results of a comprehensive series of experiments. From these I draw the following conclusions:

First—Two pounds of Thomas slag phosphoric acid (applied in the form of ground Thomas slag, containing 18 per cent phosphoric acid and 80 per cent fine powder) produced, the first year after manuring, the same increase of yield as one pound of soluble phosphoric acid.

Second—The after effect of the two pounds of Thomas slag phosphoric acid, in the second year after manuring, was twice that of the one pound of soluble phosphoric acid. If, now, we allow the increased yield produced by one pound of soluble phosphoric acid to be indicated by 100, then two pounds of Thomas slag phosphoric acid effected, in the first year after manuring, a yield increase of one hundred. In the first and second years after manuring, the increase was one hundred and twenty. On the other hand, two pounds of bone meal phosphoric acid produced, in the first year after manuring, an increase of ten, and in the first and second years after manuring, an increase of twenty-two.

These results show that, at present quoted prices, it is much more profitable to use ground Thomas slag as a manure than bone meal. Bone meal becomes effective very slowly, while even the coarse meal (the residue from sifting) of the Thomas slag acts more quickly. The results of my experiments, which have been subjected to rigid scrutiny, as well as the favorable experience of agriculturists generally, induce me to recommend very highly the use of ground Thomas slag. It should, however, be procured from a reliable source, the percentage of phosphoric acid and of fine meal should be guaranteed, and a sample of the material received examined for phosphoric acid and fine meal at the proper experiment station. These ingredients vary greatly in commercial wares. If the Thomas slag has less fine meal than corresponds to the normal of 80 per cent, it acts more slowly, and has therefore less value. Apparently, also, the phosphoric acid in a meal richer in this material, and consequently containing less lime, becomes active more quickly than the corresponding quantity in a meal with more lime and less phosphoric acid. My experiments in this connection are not yet concluded. I shall, however, soon report more definitely upon it.

Ground Thomas slag may be applied to all crops, so far as present experience indicates. A distinction is to be made, however, in its action in different places. Much better effect is noticed on clover and meadows, for example, than on sugar beets and spring grain crops. As the yearly quantity of slag obtainable can only cover a small part of the demand for phosphoric acid, and as we must now, as formerly, supply our principal need from the superphosphate factories, I will here indicate the most profitable disposition of these two phosphoric acid manures. I believe the quantity of ground Thomas slag yearly offered should be applied primarily on moor and meadow soils, of not too dry character, and then respectively on the heavy sand soils, all lighter loam and sand soils, and finally on the fields for fodder crops, clover and lucerne, winter crops, etc. This use would soon consume the three to four million hundredweight of ground slag annually offered by the German manure market, and this amount would not cover the special cases named. For what remains, and for beets, potatoes, spring grain crops, the lime and heavy clay soils, superphosphate should be taken. Wherever the soil conditions favor the decomposition of phosphates (in moors, meadows, moist and humus fields), or where it is wished to store a supply of phosphoric acid for several years (fodder fields, vineyards, orchards), or where, finally, cultivated crops are to be raised, which are to be distinguished by relatively long vegetative periods (winter crops, perennial fodder crops), there the phosphates which become soluble with difficulty, and which become active more slowly, are to be applied. The dissolved phosphates, *i. e.*, those acting more quickly, are, on the other hand, to be chosen under opposite circumstances. As a matter of course, prices and freight expenses must be brought into the calculation. If a choice must be made among the commercial phosphates offered, it should be remembered, for example, that the ground slag is considerably dearer for those places remote from the grinding mills. In such cases, superphosphates, especially the double superphosphate, which costs the least in transportation, may be applied more profitably than the Thomas slag.

MANURING WITH POTASH SALTS.

Unfortunately, the very important subject of potash manuring is at present but little investigated. Which domestic plants are most in need of potash; how heavy applications can be made without injury; in which cases it is better to apply potassium chloride, and in which potassium sulphate; what the chief and what the secondary actions of the crude salts, kainite and carnallite, are—of all this we know nearly nothing as yet. What little we do know can be expressed in a few words. I will present the following brief statements: Rich potash soils, that is, those not needing potash salts, are not so rare as those not needing phosphoric acid; and it can in general be assumed that the lighter soils are more destitute of potash than the heavier ones. The soils first to be supplied with potash are the moors. They are generally so devoid of potash, that, without heavy kainite manuring or its equivalent, no satisfactory yields are to be obtained from them.

Whether it is better to apply the crude salts (kainite and carnallite), or whether the pure and concentrated salts (potassium chloride and potassa sulphate), must be decided in the first place by the price at which the pound of potash is to be had in the different materials. Potash in local salt deposits is much cheaper in the crude than in the concentrated forms. As, however, the latter contain three or four times as much as the former, the freight on the raw salts amounts to three or four times that on the concentrated. Consequently, beyond a certain distance, the potash of purified salts is much cheaper than that of the crude salt.

In deciding this question, moreover, it must be remembered that the common salt (sodium chloride) of the crude preparations has a binding effect on the soil, and increases its power to retain water. It is this effect of crude salts which improves the character of light soils, but which, on the other hand, deteriorates heavy soils already possessed of too much binding quality. It is not advisable, therefore, to manure heavy soils with kainite or carnallite.

Again, it must not be forgotten that plants appear to be sensitive—some in a greater degree, some less—to concentrated solutions of chlorides. It is best, therefore, in the application of raw salts containing much chlorine, to spread them in autumn, or as early as possible in the spring. They will then exist in sufficiently dilute solutions in the soil before they come in contact with the growing plants. Whether it is true that potash salts, containing chlorine, have an unfavorable effect on the quality of many crops, is yet doubtful. It is only proved in the case of tobacco, which it is better to manure with potassa sulphate, or still better with potassa phosphate, than with kainite. As has already been said, if the soil needs potash, it should be given enough so that a surplus will always be present. But it must be remembered that plants are much more sensitive to an excess of potash salts than to an excess of phosphoric acid.

Potash salts also must be applied with more caution than phosphates. Manurings of six hundred and twenty pounds kainite, or one hundred and thirty-five to one hundred and eighty pounds potassium chloride, or corresponding quantities of other salts, are to be regarded as very strong applications. Concentrated solutions in the soil appear to be specially detrimental to beets and potatoes, on account of which it is customary to apply potash, in such cases, to the preceding crop.

Potash salts have an unusual importance in the manuring of the nitrogen increasers; *e. g.*, varieties of clover, pease, vetches, esparcet, etc., as well as meadows. The general practice in manuring meadows is bad. Not enough plant food is applied, and the manuring is not done rationally. The spreading of liquid manure, on such fields, is in many cases irrational. Economical considerations may often seem to compel this practice. It may not be known how otherwise to dispose of this material; but it must be remembered that the nitrogen of liquid manure renders poor service in meadows. On corn, fodder beets, rape, winter grain, and in orchards, this nitrogen accomplishes very much more. Meadows have no particular need of nitrogen manuring. They are in this respect independent. If simply a potash and phosphoric acid manure be applied to a meadow, its vegetation accommodates itself to this condition of things. Vetch varieties, clover, and similar plants then grow luxuriantly; they need no nitrogen manuring, for they take from soil and air enough to supply their entire need. A "grass meadow" is converted by potash and phosphoric acid manuring into a vetch and clover meadow. A meadow suffering neither from superfluity nor lack of water, manured with Thomas slag (during the first years about seven hundred pounds per acre, afterward less, and kainite four hundred and fifty to five hundred and sixty pounds per acre), often produces astonishing yields and an improved quality of fodder. Improved grasses and clover plants increase after such a manuring. In general, it is of the greatest importance to manure clover, pease, vetches, lucerne, and all nitrogen increasers, with much potash and phosphoric acid.

As proof of the luxuriance with which the nitrogen increasers grow, even upon soils with little nitrogen, when supplied with an abundance of potash and phosphoric acid, I cite here from my experiments the following example: On plots containing very little nitrogen, vetches and pease were sown, in August, during three successive years. In late autumn the green growth was turned under, and then crops of spring rye grown. These plowed-in crops grew with extraordinary luxuriance under careful cultivation, and with rich phosphoric acid and potash application. They furnished, in three successive years, about one hundred and seventy-eight pounds atmospheric nitrogen per acre in their surface growth, and thereby increased the rye harvest, in round figures, two thousand nine hundred and forty pounds of grain, and six thousand six hundred and eighty pounds of straw per acre.

This experiment shows with what luxuriance pease and vetches can grow without nitrogen manuring, on soils poor in nitrogen (but well supplied with phosphoric acid and potash), even when the nitrogen collected is continually removed from the soil in the chief crop. The power of these plants for collecting nitrogen is extremely great; and the sooner they can be satisfied with phosphoric acid and potash, just so much more quickly and vigorously do they take up atmospheric nitrogen. It is impossible to emphasize sufficiently the importance of amply furnishing these plants with phosphoric acid and potash, and sometimes even with lime. It must be apparent that the potash manuring of nitrogen increasers is far more profitable than that of nitrogen consumers. With the former, potash and phosphoric acid alone produce an increased yield; while, for the latter, nitrogen in addition must be bought and applied, and the profitableness of phosphoric acid and potash manuring thereby diminished.

Since the year 1887 I have begun a method of larger experiments concerning the different questions in potash manuring, and hope shortly to communicate important results in this connection.

MANURING WITH NITROGEN.

We have already considered the method for determining the proper amount of nitrogen for application in any particular case, and have here to consider simply the selection of manures and the best methods of applying them. Unquestionably, the atmosphere furnishes the cheapest nitrogen manure. It is a free gift. The farmer has it for the mere asking; and, as we have seen, an entire series of cultivated crops are capable of drawing from this ever-flowing source, with as much ease as from the nitrogen compounds of a richly fertilized soil. We possess in these plants a means by which we can increase the circulating nitrogen capital of the farm. With them we can replace the deficit caused yearly by the exportation of nitrogenous products; by the losses incidental to the collection and preservation of animal excrements; by the evaporation of soil nitrogen into the air, and by filtration through the subsoil.

Schultz, of Lupitz, deserves high recognition for having attracted general attention to the importance of utilizing atmospheric nitrogen, and of manuring the soil with nitrogen-collecting plants. He and Neuhaus, of Selchow, have shown, at once, the practicability of this process, and, in a most convincing manner, the great financial advantages which accrue to the farmer, who, whenever possible, feeds his plants with nitrogen from the air, and fertilizes his soil with atmospheric nitrogen.

I will briefly indicate the methods by which atmospheric nitrogen may thus be rendered useful:

1. Cultivate nitrogen-collecting plants as the chief crop, and turn under the entire harvest material as manure for the growth of the year following. This method causes the loss of an entire year's harvest, and is therefore applied only on light, dry, sandy soils.

2. Let clover and other leguminous varieties compose the chief crop to be harvested, of which the stubble and roots remain as manure for the succeeding crop.

3. Sow lupines, serradella, and clover varieties with the chief growth, consisting of some straw crop; and after harvest of the grain, plow under the growing plants, either in late autumn or in early spring.

4. Sow vetches, etc., in the *rolled* stubble of the harvested chief growth, and plow under in late autumn or early spring.

5. Sow Italian clover in the rolled stubble of the chief growth. In May, a fodder crop having been cut, the piece is plowed, and then the stubble and roots remain as manure for potatoes, fodder, beets, rutabagas, etc.

Method No. 3 is particularly recommended, and is chiefly applicable to rye culture, on soils of medium quality (loamy sand and sandy loam).

Mr. Neuhaus, of Selchow, who has had valuable experience in this process of culture, sows with machine in April, or beginning of May, from thirty-five to fifty-five pounds per acre, of good serradella seed. This is sown in the straw crop (rye, oats, or barley) when about six inches high. If not machine-sown, the seed must be covered by harrowing. In order to have the ground well covered, and to succeed with at least one of the so called intermediate crops, there are still thrown onto this ninety pounds of lupine seed, about the time when the rye is in flower, in case of a heavy stand; but, if this is thin, then later. The lupine seed lying on the surface must of course have rain, in order to sprout. In case of heavy drought, this sprouting is not satisfactory. But Mr. Neuhaus states that he has had poor success not oftener than once in six or seven years. In view of the slight cost of the seed, and of such possible great advantage, this is indeed no great risk. At the time of the grain harvest, the plants of the last sowing will have so far developed as not to be injured by the cutting, if the stubble is left somewhat long. If the autumn is exceptionally dry, they develop very luxuriantly, and in favorable years furnish a crop which, according to Mr. Neuhaus, corresponds (including the root mass) to not less than one hundred and twenty-five pounds of nitrogen per acre; that is, as much nitrogen as is contained in twenty-five thousand pounds of barnyard manure. In addition to this, experiments have shown me that nitrogen in green plant material acts much more quickly than that contained in barnyard manure.

As far as possible, therefore, the agriculturist must fully utilize the atmospheric source of nitrogen, and, by rich applications of phosphoric acid and potash, put the crops in position to take the largest possible

amount of nitrogen from the air. Plenty of water, plenty of phosphoric acid, potash, and lime; these are the demands made by the nitrogen-collecting plants on the soil. The nitrogen they provide themselves; and yet, for intensive farming, for an intensive culture of roots, grain, and oil crops, tobacco, potatoes, etc., the nitrogen possible from the air is not sufficient.

Commercial nitrogenous manures must come in here, to aid in reaching the highest possible net profit. Of these, Chili saltpetre and ammonia sulphate are by far the most important, for they appear in the market in much the greater quantities. Peruvian guano, with a high percentage of nitrogen, has become very scarce; and dried blood, ground horn, fish and meat, wool refuse, and ground leather, appear in the market in relatively insignificant quantities.

Nevertheless, the question as to the manurial value of the latter, that is, of organic nitrogen manures, is important enough to demand careful and exact investigation. I therefore arranged, in the summer of 1887, an interesting series of experiments intended to show:

(*a*) How quickly the nitrogen of these manures become active.

(*b*) How much nitrogen, in form of ground bone, dried blood, wool waste, etc., must be applied in the primary and after-manurings, in order to reach the same yearly effect which is obtained with one hundred pounds of Chili saltpetre.

(*c*) How much of the nitrogen brought into the soil, in these manures, is really available for plant feeding, and how much, on the other hand, becomes lost (as free nitrogen) by chemical decomposition.

These questions it was intended to solve by using marled and unmarled soils; and I hope to obtain, in the course of a few years, practical, valuable results. Experiments already made elsewhere have, unfortunately, not furnished sufficient data for the determination of the relative value of the manures in question. They have in every instance been executed during only one year. The after effects of the organic nitrogen manures have thus been left out of consideration; and, moreover, the results exhibit important contradictions. The only definite statements that can now be made are these: Dried blood and ground horn decompose more quickly than ground fish, ground meal, or bone meal. The decomposition of wool waste and ground leather proceeds very slowly. It is impossible, at present, to make definite numerical statements. The prices which it is customary to pay for the slowly decomposing nitrogen manures are proved to be too high in comparison with that of saltpetre and ammonia. Toward the close of 1889 I shall probably be able to communicate more in detail concerning my work in this connection.

The relative value of nitrogen in ammonia and saltpetre is also as yet undetermined. In comparative field experiments it has been found that the increase of yield, after manuring with ammonia sulphate, is sometimes higher and sometimes considerably less than that obtained after the corresponding manuring with saltpetre. In a majority of cases the ammonia manuring with sugar beets and potatoes has shown such poor results, in comparison with saltpetre manuring, that it is rejected as too unsafe for these crops. Chili saltpetre alone is recommended as a nitrogen manure for them, while with straw crops a still more unfavorable record has been obtained from ammonia salts.

No satisfactory conclusions have yet been reached from the field experiments, for the variations in results have been unusually great. If we represent the increased yield obtained with saltpetre nitrogen by one hundred, the corresponding results from ammonia manuring would give eighty-three, one hundred, one hundred and fifteen, and one hundred and forty-four; and then, again, forty-six, forty-seven, and forty-three. These are examples of what has been obtained with grains. A cause for such differences has not been discovered; and, indeed, it is not known whether the differences are reliable, or really due to difference in action of saltpetre nitrogen and ammonia nitrogen.

I have during the last two years carried on, and to some extent completed, quite comprehensive experiments on the effect of ammonia manuring in relation to saltpetre manuring. I have attempted to determine the magnitude of the difference between the effects of the nitrogen salts in question, and to explain the causes of the different effects. The following brief notes are taken from the results of my work:

1. Experiments with grass, oats, rye, buckwheat, and turnips, on loam soil containing a small percentage of lime carbonate, show, for the most part, no considerable difference between the action of ammonia and saltpetre, when the manuring was done in the spring, and immediately before sowing. To what extent the lime carbonate exerted an influence on the effectiveness of the ammonia, or whether it exerted an influence at all, I do not know. I am still to test this. In several series of experiments the effect of the ammonia nitrogen was precisely equivalent to that of saltpetre. In several cases the ammonia nitrogen effected somewhat more than the saltpetre, while in others the ammonia effect was from 10 to 15 per cent less than that of saltpetre. The causes of these differences have not yet been determined.

2. On a soil consisting of equal weights of loam and acid (mossy) turf, the effect of the ammonia manure was very late and slight, in comparison with that of the saltpetre manure. On the same soil, mixed with lime marl, the ammonia effect was from beginning to end precisely that of the saltpetre.

3. It has been supposed that the sulphuric acid, combined with the ammonia, acts disadvantageously on the plants, and to this the average lesser effect of the ammonia nitrogen is due. This is not the case, at least under all circumstances. Even exceptionally heavy applications, if not less than two hundred and sixty-seven pounds nitrogen per acre, furnished the same yield of oats and wheat, when in form of ammonia sulphate, as when in form of ammonia carbonate or nitrate.

4. On calcareous loam, very heavy manurings of ammonia nitrogen acted with equal rapidity to corresponding applications of saltpetre nitrogen. Under the condition of heavy and continuous rains, shortly after seed sowing, when the saltpetre was washed through the soil, and, for the time being, removed from the plant roots, the ammonia nitrogen produced quicker effect than the Chili saltpetre.

5. It has often been emphasized that ammonia, as such, before being transformed to nitric acid, can work injuriously on the plants. This may be, and it is possible that the sensitiveness of plants to ammonia is very variable. It is possible that the unsatisfactory experience thus far had in ammonia manuring, especially with roots and potatoes, is due to a particular sensitiveness of these very plants to ammonia. It is, however, singular that actual cases of damage (manifested by yellow color and scanty development of the plants) do not appear regularly

after very heavy ammonia manuring, but occur only rarely, and as exceptions. It is this irregularity in the appearance of an adverse effect, either slight or considerable, of ammonia manuring, which has induced me to advise caution in the application of ammonia sulphate, and to point out the slight value of average statements calculated from the results of field experiments.

6. It is remarkable that I obtained, repeatedly, after application of ammonia salts, considerably smaller yields than after saltpetre manuring. This the following experiment shows:

Oats were manured with ammonia sulphate, carbonate, and nitrate, and a mean of 20.3 ounces of harvest was obtained, the results mutually agreeing. The corresponding saltpetre manuring yielded 21.1 ounces. With no manure, a harvest of 9.4 ounces was obtained.

A crop of turnips (harvested early) followed the oats in the same year. The same nitrogen compounds were applied on the corresponding plots, as in the case of the oats. The ammonia salts furnished an average of 3.5 ounces of material; the Chili saltpetre, on the contrary, 4.8 ounces in excess of the unmanured. Saltpetre nitrogen thus produced a third more than the ammonia nitrogen. The cause of this result could have been that the soil conditions were unfavorable for the action of the ammonia, or that the ammonia had yielded less to the turnips than to the oats. In order to settle this question, plots were laid out in the the following year, sown with oats, and the respective nitrogen manures applied. It was then clear that the ammonia salts produced less than the saltpetre, even with the oats. The yield with saltpetre was 20 per cent more than that with the ammonia salts.

It is here apparent that the kind of crop did not cause the slighter effect of the ammonia, but changes in the soil conditions must have brought about the superior effect of the Chili saltpetre with the second or third crop.

The character of these changes must still be investigated. I will here call attention to one point, namely: that the soda of the saltpetre exerts a certain influence on the physical character of the soil. In reacting with the lime carbonate of the soil, soda carbonate is formed, which, by superficial attraction, is bound to the soil. This holds the soil particles more firmly together, and increases their water-retaining power. It was long ago discovered that saltpetre manuring tends to increase the crusting of soils, and at the same time their water-retaining power. No explanation has ever been given. It has simply been spoken of as an effect of saltpetre, with no further question as to a cause.

Now, we know that this is due to the soda, and also that a secondary and similar effect of the saltpetre must appear, whenever it is applied in quantities so large that the plants can no longer consume the soda. Investigations in this direction are certainly to be recommended. They are apparently destined to throw much light on many cases in which applications of saltpetre result more favorably than those of ammonia. The same behavior is noticeable with kainite. Kainite consists of one third sodium chloride; and, in consequence of this sodium content, it acts very favorably on light soils. It occasions the soil particles to adhere more, and increases their water-retaining power. In England, also, the superior effect of saltpetre over ammonia, in repeated heavy manurings, has been determined. At first, even for several successive years, the ammonia effected more than the saltpetre. Then this relation was reversed, and in the succeeding years the saltpetre produced regularly, and often considerably, more than the ammonia. In this entire question nothing is clearly understood. We do not yet know the factors which occasion the transformation of ammonia into nitric acid, which favor or which hinder. So long as we are ignorant of this, and investigations present such totally contradictory results, no conclusions can be drawn. Until the fundamental questions concerning the application of ammonia and its action in the soil are answered, we must defer any further explanation of the difference in action between saltpetre and ammonia manures. Nothing permanent and useful, at least, can be built on the present swaying foundation. Clear and definite knowledge as to transformation of ammonia in the soil is wanted. At present, I can only offer, as reliable, the statement that ammonia manuring effects very little in acid turf or humus soils, unless the same are previously treated with marl or lime.

We may now consider the application of Chili saltpetre. This salt contains nitrogen in a form which allows immediate absorption and assimilation. It is not subject to the absorbing powers of the soil, but remains perfectly free, and therefore becomes quickly effective. A plant lacking nitrogen, watered with a solution of saltpetre, shows, three days afterwards, the effect of the nitrogen applied. Its leaves become dark green—a sign of luxuriant growth. Chili saltpetre presents to us, therefore, as does no other nitrogen manure, a means with which to influence quickly the development of plants. By sowing saltpetre on a young crop which has perhaps suffered from frost or insect attacks, the plants are induced to sturdy and luxuriant growth. Even at a later period of vegetation, if necessary, we can give them nitrogen food in this immediately assimilable form. Although we possess in Chili saltpetre a manure freely movable in the soil, immediately effective for the plant, and which is absorbed with great avidity, precaution in its use must be observed, otherwise the best effect possible is not secured. But whatever may be true here, is of equal importance in the case of ammonia. Under normal circumstances, ammonia is converted with more or less rapidity into nitric acid (*i. e.*, the form of nitrogen in saltpetre), and then has all its properties.

Failures in manuring with nitrogen salts sometimes occur. We will seek a brief explanation of these failures and means for their prevention. In the first place, the nitrogen is often not sufficiently absorbed by the plant. This can be the case when saltpetre is not applied at the right time. Winter grain may be manured in the autumn, in many cases successfully, but in many others not. It must be remembered that young plants require relatively little nitrogen for a sufficient development before the winter rest begins. A well cultivated soil furnishes quite enough for this. In the experiments of Heine, of Emersleben, the highest yields were furnished by those wheat fields which received no nitrogen manuring in autumn, and all their saltpetre in May. It is certainly incorrect to furnish the plant its entire supply of nitrogen in the fall; only sufficient should then be given for absorption and assimilation before the commencement of the winter rest. A surplus is unnecessary, and it may become entirely lost during the winter months by filtration through the subsoil.

Ammonia, also, as my experiments have shown, is in danger of draining into the lower layers of the field. Although at first it may be combined with the finer soil particles, it is, nevertheless, converted into nitric acid, and this follows the course of the rain water, which, during the winter months, is forced through the ground. Only on very deep and retentive soils should a large application of nitrogen salts be risked in the fall. This danger of loss of nitrogen by percolation attends not only autumn applications, but those made at any time. Saltpetre nitrogen in the soil is in a condition of perfect freedom. It follows, consequently, the course of the percolating waters; therefore, the danger of loss of nitrogen by drainage increases with (*a*) the length of time between the application of the manure and the absorption of the nitrogen by the crop; (*b*) the quantity of manure applied; (*c*) the percolation in the soil; (*d*) the rainfall immediately after application.

If, now, the saltpetre is applied by sowing in the field after the plants have appeared, so that they quickly absorb it, the danger of percolation is only slight, or none at all. Fear is often entertained that if saltpetre is applied in this manner, the nitrogen will be supplied to the plants too late. On this account it is recommended to do away with such an application entirely for crops which must be ripened as early as possible; as, for example, sugar beets and potatoes, and to make use of it only as an after-manuring on the straw crops.

This rule is probably applicable in many cases, but the deeper we investigate the domain covered by the question in hand, the nearer we come to the conclusion that any rule must often be modified to suit a particular case. It is frequently desired to supply a crop with nitrogen at the earliest possible moment, and with the least possible waste. This cannot always be accomplished by manuring with saltpetre at the time of seeding. It cannot be done, for example, with spring grains, sugar beets, potatoes, carrots, turnips, flax, etc.

After the seed is sown, about eight days elapse with turnips and flax, ten to twelve with straw crops, two to three weeks with carrots and beets, and three to four weeks with potatoes, before the plants show themselves, and from that time, again, four to eight days pass before the young plants are capable of assimilating saltpetre nitrogen. If, now, during these periods there is a great fall of rain, and the water-retaining power of the soil is slight, the saltpetre is washed into the lower soil strata, and, in consequence, is removed from the plant roots. Sometimes it only becomes effective two weeks later than the ammonia salt, which is, as it were, held fast in the soil. This I have very often observed, and that, moreover, a part may entirely escape absorption by the plant roots. This danger is very considerable in cases of slowly germinating seeds. Saltpetre applied in my experiments with carrots the day before the sowing, effected very little, but a marked effect was produced when it was sown on the plot after the first carrot plants appeared. When a heavy saltpetre manuring is given, the entire quantity can be absorbed only gradually; but, until it is all absorbed, the residue in the soil is exposed to loss through drainage. In view of these conditions, it is doubtful if the application of Chili saltpetre, especially the quantity necessary for the crop, immediately before the sowing of spring crops, is, under all circumstances, the most rational.

Between the two extremes of applying all of the nitrogen before seeding, and all after the plants appear, there is indeed a series of intermediate procedures. The saltpetre can be sprinkled over the soil immediately after seeding, or one or two weeks later; or a part can be sown with the seed, and the other part sooner or later afterwards. The latter way is advisable, especially when large amounts of nitrogen, not so quickly assimilable by the plants, are to be given. The opinion is often heard, that nitrogen promotes leaf formation, that it increases the amount of straw, and tends to cause the plants to lodge, while phosphoric acid acts in an opposite direction. This, as is shown in my paper above cited, cannot be correct. A specific effect of nitrogen, in an abnormal leaf development, exists just as little as does one of phosphoric acid in an abnormal development of the grain.

If, after saltpetre manuring the straw yield is increased out of proportion to the grain, the explanation is simply that the saltpetre hastened the first development of the plant, established healthy and strong stalks, but was not present in sufficient quantity to support, in like manner, the later development of the seed heads. During the first stages the plant was supplied with the richest food, but afterwards the need for nitrogen was not met; and, in consequence, much straw and little grain was yielded. It must be remembered that saltpetre is very rapidly taken up by plants, very rapidly assimilated, and occasions not a gradual, steady development, but a tendency to quick, luxuriant growth. If a normal development of straw is to be had, a one-sided development avoided, the nitrogen feeding of plants must be so regulated as to correspond, as nearly as possible, to the conditions in an old, humus-rich, strong soil. It should be remembered that the important period of nourishment comes at the stage of development just after the setting of the stalks.

The greatest possible yield of grain with the least possible number of stalks is the aim in an economical nitrogen-feeding of straw crops. The stem-setting of the grain crops is confined to a definite period in their process of development. When this is ended, there is no longer an increase in the number of stems. A nitrogen manure, now assimilated, only develops and strengthens the stems, and feeds the entire plant; while if supplied during or before the stem-setting, it increases the number of stalks. From this we can draw the following rule: Soluble nitrogen should be given to the straw crops, before the close of the stem-setting period, only in the quantity necessary to produce the requisite number of stems. After this period, so much is to be given as is necessary for the most healthy development possible of stem and grain.

I know well that the rule is more easily made than followed, and that the weather can readily neutralize the farmer's most intelligent efforts. But we must be clear in theory. How far it may be practicable to answer the theoretical conditions is quite another question. Let us apply the rule in a few examples. If a soil is in good cultivation, rich in nitrogen from residues of pease or clover, then it will not generally be advisable to assist the stem-setting of the plants, either by an addition of saltpetre or ammonia salts, or, if at all, by a very slight one. The soil will furnish enough nitrogen for an adequate stem formation, and an application should only be made after the completion of the stem-setting. Then a much heavier quantity can be given, and without the danger of lodging, which would have attended an earlier application.

Heine, of Emersleben,* had the following experience in manuring winter wheat. With much hesitation he determined to apply to his winter wheat no nitrogen in the fall, and none before the first of May.

* "Deutsche Landwirtschaftliche Presse," 1886, No. 33.

But the success of this procedure was greater than those in which applications were made in autumn, February, March, or even April. In this connection, Heine says: "The question, At what time shall saltpetre be sown? is answered by my results in a manner which completely overturns the opinions hitherto held. The opinion that Chili saltpetre must be sown over the winter wheat as soon as possible in spring is by no means confirmed. On the contrary, the Chili saltpetre applied at the beginning of May, even when the plants were very far developed, increased the yield of grain."

As a matter of course, this does not imply that an application in May is, everywhere and in all cases, the best for winter wheat. Such a pedantic prescription would by no means answer the principles laid down. Another example, in which it would be necessary to proceed in an entirely different manner, is the following: Assume that we have a soil much exhausted of nitrogen, and have calculated that a manuring of one thousand pounds Chili saltpetre is necessary to obtain a maximum yield of wheat. If, now, we should apply the thousand pounds saltpetre in May, the result would be a miserable failure. The plants would, up to this period, suffer starvation, and the stem-setting would be very small. On the other hand, if the entire quantity were sown in autumn or early spring, the result would be equally poor. The larger part of the easily soluble nitrogen would accomplish the stem-setting in such a manner as to induce early lodging. A proper division of the nitrogen manure—an application of two hundred pounds in the fall, four hundred pounds in March, and four hundred pounds in May—would be the correct procedure.

Not infrequently such a case as the following appears: The soil being poor in nitrogen, by an application of saltpetre the maximum yield is attempted, but not secured. The large quantity of saltpetre has caused the crop to lodge. But lodging is only produced by the growth of too great a number of stems, forced on by too early nourishment of the plant. If the heavy manuring comes after the stem-setting, then the stems will not stand so close; they will have plenty of light, they will develop more healthily, stand upright, and furnish full heads. A necessary condition here is a soil well enriched with phosphoric acid and, of course, sufficient potash. The later the nitrogen is given, just so much more quickly must it be assimilated; and in order to do its work, the plant must be able to take up large quantities of phosphoric acid in a very short space of time.

A further study of many questions, very important in the application of nitrogen manures, would lead us away from our present purpose. I must refer to my often quoted paper, and also to future publications in which I hope to give many practical results of my investigations. I emphasize once more that the greatest importance must be placed on the rational nitrogen manuring of plants. This is the central point in the entire doctrine of manuring.

Nitrogen holds, in plant life and in the economy of field culture, an entirely different position from potash, phosphoric acid, lime, or any other plant food. Nitrogen is indeed an organic constituent of plant substance, while phosphoric acid, potash, lime, etc., are only agents in the formative processes of organic substance, and only in the capacity necessary. Nitrogen, in the burning plant material, flies away; while phosphoric acid, potash, lime, magnesia, etc., remain behind as ash constituents. But the nitrogen also comes and goes by slower processes. It wanders from the air into the soil, and from the soil into the air. Again, it passes from the atmosphere into the plant, and from the plant, when it decays, into the atmosphere. It is continually passing from the free condition into the chemically combined, and as constantly again becoming free.

The three most important and difficult tasks in manuring are, to catch the nitrogen, to hold it, and then to obtain from it the greatest possible service. It is, in the meantime, the important and urgent task of scientific investigation to further and further discover the laws which govern the movements and changes of nitrogen; for a knowledge of such laws will enable the farmer, in a large measure, to control these phenomena, and with the least possible expense to acquire the greatest net profit.

FRUIT CULTURE IN HUMBOLDT COUNTY.

ROHNERVILLE, CAL., September 17, 1890.

Mr. B. M. LELONG, *Secretary State Board of Horticulture:*

DEAR SIR: In accordance with your letter of instructions, I beg leave to submit this brief report upon the fruits, varieties, etc., grown in this part of the State. I hope that due allowance will be made for its imperfections, as this district is very large and considerable time is required to collect the desired information.

Yours truly,

A. P. CAMPTON.

APPLE.

The apple is grown throughout the whole of the northwestern part of the State, from the low lands along the coast to an altitude of near four thousand feet in the Coast Range. This portion of the State appears to be particularly adapted to the growth of this fruit; the tree grows very strong and the fruit is all that can be desired.

The apple varies in appearance, flavor, and keeping quality, according to the locality in which it is grown. The Rhode Island Greening of lower Eel River Valley is of medium size and a good keeper, while those grown from forty to fifty miles up the river are exceedingly large and handsome, but have poor keeping qualities, being but little more than a fall apple. The Newtown Pippin does well in some localities, while in others it is not a success.

The Yellow Bellflower is extensively grown in this district, and is considered to be one of the strongest growers and most prolific that we have. The fruit is very large and of good quality.

The Baldwin is a profitable apple; it is a late keeper, rather well colored, and bears good crops. The Smith Cider is a strong-growing tree and bears abundant crops; the fruit is well colored, and of medium size on uplands, yet it is exceedingly large and handsome when grown on river bottoms where the soil retains its moisture later. Rawle's Janet is also a variety that is a success; the tree grows strong and bears very heavy crops each year.

The Stark is being planted in large numbers, and promises to be a good apple for this locality; the tree is a strong grower; fruit very good.

The early varieties grown are: Golden Queen, Early Harvest, and Red Astrachan, all of which succeed well throughout this district.

The fall varieties are: Gravenstein, Maiden's Blush, King of Tompkins County, Washington Strawberry, Pennock (or Pomme Roye), and Golden Russet, all of which varieties do well in this district, each in the locality best suited to it.

The winter varieties are: Yellow Bellflower, Rhode Island Greening, Baldwin, Smith's Cider, Stark, Hoover, Vandevere, Virginia Greening, Rawle's Janet, and Ben Davis. These are the leading varieties grown, but we may have many others that have been planted of late years and have not as yet been fully tested, which I will speak of under the head of new varieties, though most of them are old; yet they are new to this portion of the State, and therefore I will speak of them as new.

Localities.

Along the course of the Smith, Klamath, Trinity, Mad, Van Duzen, and Eel Rivers are grown as handsome and fine flavored apples as can be found on the Pacific Coast. Many varieties of late keepers retain their flavor and keep sound as late as July and August.

New Varieties.

Under this head I will mention, first of all, the Arkansas Pippin, which I think will stand at the head of all the new varieties as the leading apple to be planted in the future for profit. It seems to combine all the qualifications which are required to make a first quality apple for the market.

(1) It is very large and handsome; (2) it is the most beautiful tint of red streak that I have ever seen, coloring on the under side almost as well as on the side exposed to the sun; (3) its rich flavor and good keeping qualities should commend it to any one desiring to procure an apple of the finest quality.

The tree is an early bearer, often bearing fruit the second year after being planted, thus adding another good point to the many already mentioned.

The Lawver is being introduced in this section, and promises well; also the Arkansas Black, New Jersey Black, Early and Late Russian, Russian Emperor, and many others.

The fruit grower will soon be able to select the best apple to be planted in each locality, thus rendering the apple orchards more profitable in the future than they have been in the past. The great drawback to the apple orchards of this section has been that they contained too many varieties which were of no practical value, thus causing great loss to the producer.

Propagation.

The seed of the apple is planted in drills, and grown until one year old; then it is taken up and collar grafted at a point about two inches above where the roots branch out, using the whole of the root of the seedling apple for each scion, thus insuring a good root for every tree.

The grafts are then planted about six or eight inches apart in rows three feet wide, giving ample room for thorough cultivation, where they grow until one or two years old; they are then taken up and planted in orchards.

CRABAPPLE.

The Siberian and most of the other common varieties are grown here, all of which grow strong and produce good crops. Many of the larger varieties produce such heavy crops that it is difficult to keep the branches from breaking when loaded with fruit.

WILD CRABAPPLE.

We have but one variety, which I take to be *Pyrus rivularis* (Oregon crabapple). The tree grows from fifteen feet to forty feet high, often from ten to sixteen inches in diameter; it also grows in the form of a bush in dense thickets. It has sharp-pointed, dry limbs, like thorns, all along the branches and trunk of the small trees, thus rendering it almost impossible to penetrate one of the thickets.

The fruit is orbicular; color, yellow just before it is ripe, and bright red when fully ripe; oblong, half an inch or more in length, and exceedingly tart. It is found throughout the whole of northwestern California. In Humboldt County it is very plentiful, and was used by the early settlers as a stock on which to graft the apple. There are many trees in the county which are now growing on the wild crab root.

PEAR.

The pear grows well in this part of the State, and many varieties are cultivated, but the Bartlett takes the lead as a marketable fruit. It grows large and fine, and always finds a ready sale. The best pears are grown from ten to thirty miles from the coast and along the course of the rivers.

The Winter Nelis is not a success in many parts of this district, on account of its being troubled with fungus, causing the fruit to be small and illy shaped, and in a measure destroying the outer skin; yet there are some localities where it is grown successfully. While Eel River, Mad River, and many other sections of the county produce a fine pear, yet particular attention is called to Camp Grant, South Fork, and Blocksburgs as being particularly adapted to the growth of that fruit. Nowhere in this northwest, can be found a locality better suited to the growth and development of the pear than the districts just mentioned.

Among the varieties grown are Bartlett, Clapp's Favorite, Keiffer's Hybrid, P. Barry, Winter Nelis, and others.

The pear is worked on seedling pear stock by budding and grafting, in the same manner that the apple is worked on the apple.

QUINCE.

The quince is but sparingly grown in this district, there being so little profit to the orchardist in growing such fruit; yet this district can, and does, produce quinces of the very first quality. It is a good grower, and produces fruit in abundance.

The varieties grown are as follows: Orange, Pear-shaped, and many others.

The mode of propagation is principally from suckers or slips.

PLUM.

The plum tree, in this portion of the State, finds a climate and soil peculiarly suited to its nature. Its growth is luxuriant, and it produces annually large quantities of excellent fruit. It will grow on any dry land, from the river bottoms to the hilltops, but is best adapted to a good, rich, moderately dry loam.

The chief varieties grown for the market are: Prune d'Agen, Silver, Italian, Hungarian, German, and Coe's Golden Drop.

Prune d'Agen (syn., French prune).—This variety stands at the head of the list as a drying prune in this locality, and when properly tended never fails to reward the husbandman for the labor bestowed upon its cultivation. Its only fault is that it produces too much fruit, and is liable to impair the health and vigor of the tree by such overproduction; this can, however, be remedied by thinning the fruit.

Italian Prune (Fellenberg).—This is also a good drying prune, yet it is not so sweet as the French. The tree produces well, and bears very evenly. The fruit is large and fine, and is very nearly all of the same color; the tree grows strong, with a widespreading head and very rich foliage.

German Prune.—This variety is grown in many localities; it grows well and bears abundantly, but it is not cultivated to any great extent in this district, there being other varieties which are more profitable.

Silver Prune.—A great many of this variety have been sold in Humboldt County, and are now from four to five years old, but the tree has not given entire satisfaction. This may be owing to the stock on which it was worked. The tree bears well and the fruit is large and fine, yet the life of the tree has proved to be short, many dying before they were five years old. As a drying prune the Silver has proved very good; it makes a very attractive fruit and has a rather pleasant flavor.

Hungarian.—The Hungarian prune makes a very strong-growing tree, and the fruit is exceedingly large and fine. In this district it is used principally for fresh fruit and canning, but is not considered a very profitable variety to grow.

Plums of every variety grow to perfection, and are found in nearly every garden and orchard throughout the northwestern portions of the State, and are so plentiful that many varieties have but little market value in our local markets.

Propagation.

The plum is propagated by budding upon plum and peach stock only; the apricot and almond have been discarded on account of their not properly uniting with the plum, and also on account of their not being suited to the different kinds of soil in which they would be planted in this district.

The Myrobolan plum is the only plum stock used, and as an all around stock on which to bud the French and other prunes, it is conceded to be the best, and is adapted to a greater variety of soils than any stock that has yet been tried in this locality. It will stand more wet than any other root that can be found, yet at the same time it will grow well in rather dry soil, thus making it the most valuable stock on which to grow the prune.

The peach root is used in some localities as a stock on which to bud the prune or plum. Many thousand trees in this district are growing on the peach root, and where the soil is suitable for the peach the tree grows well, but if the soil is a heavy, compact clay, the peach root is not a success.

The plum is propagated in the following manner: The pits of the Myrobolan plum or the peach are planted in nursery rows, where they grow for the first year. The following August they are budded at or just

above the ground with the varieties desired, and when the bud has grown one year it is generally from three to six feet high, and is then ready to be taken up and planted in orchards.

CHERRY.

The cherry is grown throughout the whole of northwestern California; it is to be found in the door-yard, garden, and orchard in all the rural districts. It is one of the fruits particularly adapted to this climate; it appears to do equally as well on the hilltops and hillsides as it does on the river bottoms. The growth of the tree is not so strong on the high land, but it bears just as plentifully and produces as fine fruit.

The varieties grown are: Black Tartarian, Black Bigarreau, Yellow Spanish, Royal Ann, Elton, English Morello, Monstrous de Mazel, Early Rivers, Olivet, May Duke, Late Duke, and many others.

The Black Tartarian is considered by many to be the best cherry to grow for profit in this locality; it is a large, smooth, shining black cherry when ripe, very attractive in appearance, and of excellent flavor. It will be unnecessary to mention how the different varieties grow and produce, for almost any variety does well here.

This fruit is grown without irrigation, there being sufficient rainfall during the winter months to keep the ground moist and in good condition during the dry season, thus causing the tree to grow strong and the fruit to fully develop. Cherries grown without irrigation have a much better flavor than those that are watered, therefore this portion of the State has the name of producing the finest flavored cherries to be found in the market.

Cherries are grown from three weeks to a month earlier along the Trinity and South Fork of Eel River than they can be grown in the lower Eel River Valley.

The cherry is propagated by budding on seedlings of the common black Mazzard, and also the Cerasus Mahaleb; for standard trees we are using the former, and for dwarf, the latter.

After the seedlings have been planted in nursery rows, they are generally ready for budding in the following August. The bud is inserted as near the ground as possible, and from it springs a strong, straight shoot, thus insuring a good, smooth trunk for every tree.

PEACH.

This delicious fruit is cultivated in many parts of this district, principally along the course of Mad, Klamath, Trinity, and Eel Rivers. In these localities the peach can be grown with profit, and the fruit produced will compare favorably with that from the most favored fruit districts of the State.

The best peaches are grown several miles from the coast, where sheltered from the northwest wind by trees or intervening hills.

The varieties grown are: Alexander, Briggs' May, Early and Late Crawfords, Early York, Hale's Early, Muir, and others. Mention is only made of the varieties that succeed well here, and those that are principally grown, yet there may be others, when tried, that will do equally as well.

As regards propagation, the seed of the peach is sown in nursery rows, where they grow for the first year; they are then budded the following August with the variety desired. The bud is always inserted under the bark of the young seedling, at or near the ground, thus insuring a strong, healthy trunk for each tree.

APRICOT.

This fruit is not extensively grown in this part of the State. Its propagation has not been thorougly understood. It has been worked upon its own root, or upon the peach, causing the life of the tree to be short and unsatisfactory, when planted on heavy land.

If the apricot is worked upon plum, I can see no reason why it should not produce good fruit, when planted on the clay loam of this district, whereas now they are only grown on sandy or light soil. There are many localities in this portion of the State where this fruit is grown. Those grown twenty to thirty miles from the coast are large, fine, and highly flavored; yet this fruit has not been tested enough in the different localities to say what its future may be.

NECTARINE.

This fruit is very little cultivated in this district, the principal portion of it being grown along Eel River, twenty or thirty miles from the sea. The few nectarines that come from main Eel River and the South Fork are very fine in appearance, and, no doubt, they can be grown in those localities successfully.

PERSIMMON.

The persimmon has not yet been planted here to any great extent. Few trees have been planted, and those few have been very poorly cared for. A portion of these have done fairly well, and several that are known of have produced fruit of fair size and quality. The persimmon has not been fairly tested here. Various Japanese varieties are grown.

GRAPE.

The grape is not extensively cultivated in this district, and although there are thousands of acres on which it could be grown successfully, yet its culture has been neglected, owing to the lack of transportation facilities. In many localities it has been tested sufficiently to form an idea of what it could do if planted in large vineyards. Along the South Fork of Eel River it succeeds well, and the following varieties are grown: Flame-colored Tokay, Mission, Stillward's Sweetwater, Muscatelle, and Black Hamburg. These varieties mature well, and produce large and handsome bunches of grapes.

The Klamath and Trinity Rivers are also favorable localities for its culture. Grapes grown along these streams are of excellent quality; the vine grows well and is very prolific.

CURRANT.

This little fruit is at home in Northern California. The cherry currant has been grown throughout the Eel River Valley for a great many

years. The bush grows thriftily and bears heavy crops, the fruit being large and fine.

Fay's Prolific is the best variety for planting in the valleys, being a strong grower and a good bearer.

The White York and White Grape are good varieties, and do well in this district. Both are prolific bearers, and the fruit is all that could be desired.

The mode of propagation is very simple: In the fall or spring, take cuttings about a foot long and plant them in moist soil, and they will readily take root. The following season they are ready to plant where the bush is desired to grow.

FIG.

The fig tree thrives here, but does not fruit well near the sea, but in favorable localities, back from the coast, it is grown. The only variety planted has been the common black fig, but if some of the better varieties were planted in favorable localities no doubt the result would be encouraging.

The fig has not been tested sufficiently for the fruit grower to tell what it may do in the future, or what locality would be best adapted to its growth and development.

GOOSEBERRY.

This berrry is a success in this part of the State; it produces well in almost any portion of it. There are many varieties cultivated, but it would not be well to attempt to mention all of them. However, mention will be made of a few of the leading varieties grown.

The large English is grown by many, but in this locality it is liable to mold or mildew, which renders it much less valuable than it otherwise would be.

The large French is a very profitable berry to grow, its greatest diameter being three quarters of an inch or more, and it is thought that it will prove a desirable berry for this vicinity.

The Rochester Seedling and the Industry are two more of the standard gooseberries of this locality, and produce abundant crops.

The gooseberry is propagated by cutting off straight young shoots and planting them in moist soil, five or six inches deep and six or eight inches apart; they are allowed to remain in this position until thoroughly rooted, and are then taken up and planted wherever desired.

STRAWBERRY.

The strawberry is quite extensively grown for the local market, and has proved to be one of the most valuable berries cultivated in this district. Its growth is strong and vigorous, and it produces well. The varieties grown are the Sharpless, Perry, and others.

The Sharpless is an exceedingly large and handsome berry, with rather a pleasant flavor, and is a prolific bearer.

The Perry is also a good berry for this locality, and is considerably grown.

Among the new varieties are the Gaudy and Mammoth. The Gaudy is an excellent berry, and the most prolific of the late varieties. It fruits well, and is a very good bearer. The Mammoth is one of the best early varieties, the berry being good, and it is a profitable kind to cultivate.

There are many varieties of wild strawberries that are indigenous to this portion of the State. They grow among the wild grasses on the hillsides and in the valleys. They are all very pleasant in flavor, and in that respect many of them surpass the cultivated sorts, yet most of the wild berries are quite small, and only a few of them obtain any considerable size.

The strawberry is propagated from runners or sets that run out from the old plant. These are planted in rows from eighteen inches to three feet apart, the ground between is thoroughly cultivated, and after one year the plant is in full bearing.

BLACKBERRY.

The varieties cultivated are the Kittatinny, Lawton, Wilson's Early, and Erie.

The Kittatinny is a very strong grower and good bearer, the berry being large and of good flavor. The Wilson is the earliest, and is a very fine, soft, sweet berry when ripe, and produces well in this locality.

The Erie is a new variety; very late, ripening in September, and approaching in flavor the wild berry nearer than any of the cultivated varieties. The berries are large and fine.

WILD BLACKBERRY.

This berry is indigenous to this portion of the State. I believe that there can nowhere be found a locality that can excel the Eel River Valley in the production of this wild berry. It grows and bears abundantly from the shores of the Pacific Ocean to an altitude of two thousand feet above the level of the sea.

For canning, preserves, and as a dessert dish, the wild blackberry of Humboldt County stands at the head of the fruits, both wild and cultivated. It has that peculiar tart flavor that can be found in no other fruit, and which renders it so invaluable to every household as a dessert dish.

The blackberry grows long and spreading, the vines from it often exceeding fifteen or twenty feet in one year. The fruit is jet black when ripe, about half an inch in diameter, and from half an inch to an inch and a quarter long, growing in clusters of from three to seven, attached to prickly peduncles by slender, prickly pedicels. It is very prolific, and ripens from the middle of June to the end of July.

RASPBERRY.

The raspberry is cultivated in almost every garden in this vicinity, and never fails to produce a large crop of berries each year. It is so common that it finds but little sale in the local markets.

The varieties grown are Cuthbert, Golden Queen, and others; all succeed well.

The raspberry is propagated by suckers or offsets springing up from the main root; these are divided into single canes or plants, and are

planted in rows from three to four feet apart. The best soil for the raspberry is a rich, deep, moist loam, and yet it does well on hillsides and at considerable elevation.

The black raspberry grows wild over a large portion of Northern California, in the mountains drained by the waters of New and Trinity Rivers, at an elevation of from three to four thousand feet. The berry is of medium size and of very good flavor, and there is no reason why it should not be a good variety to cultivate. It generally grows on rocky ground, and often in the cracks and crevices of rocks that contain some earth and decayed vegetation.

HUCKLEBERRY.

This berry is indigenous to this part of the State. In shape it is globular; the color blue black, and about three lines in diameter, growing on a bush from three to ten feet high.

It has a very pleasant flavor, and is chiefly valued for canning. It is found on the hills along the coast and in the redwood forests of Mendocino, Humboldt, and Del Norte Counties. It is nowhere cultivated in this district.

SALMON BERRY.

The salmon berry (*Rubus spectabilis*) is indigenous to this portion of the State. It is generally found in shady woods, where it grows from five to ten feet high. The stem of the young shoot is green and armed with straight, stout prickles; the bark becomes brown and shelly as the bush grows old. The leaves are trifoliate, the fruit large and ovate; in color, red or yellow.

It is found on the bottom lands of all the rivers and small streams throughout the northwestern part of the State, and also in the redwood forests along the coast.

MULBERRY.

The mulberry tree does well in Northern California. It is a good grower, and the berry is large. It is generally grown as an ornamental tree.

The varieties are the Black English and Everbearing.

NUTS.

English Walnut.

The English walnut tree succeeds well in this district, but bears nuts only in favorable localities. Along upper Eel River the tree bears well; while in the lower Eel River Valley it bears very light, or not at all.

Almond.

The almond tree bears only in favorable localities, although the tree thrives well over most of Northern California.

Black Walnut.

The black walnut of the Eastern States grows luxuriantly, and bears well when sixteen years old. It will grow and produce in almost any part of northwestern California.

Peanut.

The peanut can be cultivated in almost any part of this district where the soil is suitable to its cultivation. It produces well.

Hazelnut.

This nut is native to this portion of the State, and can be found from the valley lands to the mountain tops. It is very productive and hardy, rarely, or ever, failing to produce a good crop annually. The bush is from three to eight feet high, and the nuts generally grow in pairs, sometimes three or four in a cluster, half an inch or more in diameter, incased in a thick, prickly hull, from which they are easily separated when ripe. It is found along the coast, from Mendocino to Oregon.

Chestnut.

A Japanese chestnut sent to J. O. Dinsmore, of the lower Eel River Valley, by the San Francisco "Bulletin," and one or two others, are the only specimens that have come under notice. The tree of Mr. Dinsmore is a decided success. It is five years old, and has borne nuts for two years, and is now full of nuts not yet fully matured. This is probably all that could be asked of the chestnut in any locality. The tree is about twelve feet high, and is strong and healthy.

PARASITES, FERTILIZING, SOUR ORANGE STOCK, FUMIGATING, NEW SCALE INSECT, ETC.

San Francisco, Cal., September 22, 1890.

B. M. Lelong, *Esq.*, *Secretary State Board of Horticulture:*

Dear Sir: As instructed, I visited the San Gabriel District, where the new scale parasite has made its appearance, and carefully investigated its importance to the citrus fruit growers; I also give some notes upon fertilizers, sour orange stock, and fumigation, all of which is herewith submitted.

Very respectfully,

ALEXANDER CRAW.

CITRUS SCALE INSECT.

(*Aspidiotus citrinus*, Coquillett.)

The yellow (previously known as red) scale, found prevalent throughout the San Gabriel Valley, is entirely different from the one found in the Santa Ana Valley; the latter, however, is more destructive and most to be feared. These scales are so nearly alike that the casual observer would take them to be the same insect. In 1880 Mr. B. M. Lelong *first* called public attention to their difference, habits, color, etc.

"There are two scale insects within this State which attack citrus trees. In 1880 Professor Comstock visited this State and carried on a series of experiments upon the red scale in Los Angeles. The scale upon which he conducted his experiments he identified as the *Aspidiotus aurantii* of Maskell, and which is the same scale as that found throughout the Santa Ana Valley and Los Angeles City.

"This scale was introduced into Los Angeles County on some lemon trees imported from Australia, and which were planted at the old Keller homestead, on Alameda Street. It was introduced into the Santa Ana Valley on some orange trees, also imported from Australia, which were planted in the Huntington orchard at Orange. From those trees this scale spread. In San Gabriel a scale insect made its appearance on some trees that were also imported from Australia and planted in the Rose orchard. At that time orange and lemon trees were only imported from Australia.

"My attention was called to this latter scale after it began to make its presence felt. Upon examination I concluded that it was a different insect. In 1880 I communicated these facts to Mr. Alexander Craw, of Los Angeles, a very careful observer, who visited the orchard and fully agreed with me in my conclusions. In 1881 the late Mr. Cooke, then Horticultural Officer, visited Los Angeles, and I took him to San Gabriel; and after careful examination he also pronounced it different.

"It has been said that 'there may be two forms of the same insect.'

If this be true, why are their attacks on the tree so different? Mr. Klee, in his report as Inspector of Fruit Pests (Biennial Reports State Board of Horticulture, 1885–6 and 1887–8), mentions the fact that the two insects are different, but described the one prevalent throughout the Santa Ana Valley and Los Angeles City as an 'Australian type,' and the one prevalent throughout the San Gabriel Valley as a 'Japanese type.' The trees that arrive from Japan are generally infested by this latter species, but previous to 1880 *no* orange trees were ever imported from Japan. The trees upon which both of these scales came were imported direct from Australia, and beyond this we know but little; but all indications point towards Australia as being the home of both these scales.

"In 1880 I had the management of a large orange grove in Orange, where I carried on a series of experiments covering a period of three years. In 1883 I moved to San Gabriel, where I carried on a series of experiments covering a period of two years. I was thus able to notice the difference between the two insects.

"From observations made, I feel satisfied that there are *no* 'two forms,' but that the red scale found throughout the Santa Ana Valley, and the red scale found in the San Gabriel Valley, are two distinct species. Why? First, because the red scale that is found throughout the Santa Ana Valley attacks the limbs, leaves, fruit, and the trunk of the trees. The one at San Gabriel only attacks the leaves and the fruit. Secondly, in the former the limbs die back; in the latter they do not. Thirdly, the color of the scale of the former is vermilion red; the color of the latter, dirty yellow, and much smaller. The young scale of the former, as soon as a covering begins to form over the insect, is also of a vermilion red, while that of the latter does not differ from the color of the mature scale."*

A few weeks ago Prof. D. W. Coquillett made a complete and careful microscopic examination, and found structural differences that place it as a distinct species, and named it *Aspidiotus citrinus*. The question of differences is now a settled fact, and it is indeed pleasing to know that this has been decided, as the very high authority to whom this subject has been referred pronounced them identical, and thus deterred others from carrying on further investigations.

YELLOW SCALE PARASITE.†

(Genus *Coccophagus*, New Sp.)

This minute chalcid fly, of the genus *Coccophagus*, was first discovered preying upon the red scale by Professor Coquillett, in the summer of 1887:

"It is still a question whether these chalcid flies are the true parasites of the scales from which they were bred, since they may have originally preyed upon some of our native species. It is to be hoped, however, that these little parasites will increase to such an extent as will enable them to keep these destructive insects within due limits."‡

After having made a careful and complete investigation I find that they have accomplished, to a great extent, what Professor Coquillett then hoped they would.

The yellow scale (*Aspidiotus citrinus*, Coquillett) is no longer a pest in the San Gabriel Valley, no more so than the cottony cushion scale (*Icerya purchasi*, Maskell); the former due to its being checked by this minute parasite, and the latter by the Australian ladybird (*Vedalia cardinalis*). This yellow scale parasite is rapidly spreading. I found it several miles from the orchard where it was originally discovered, traveling eastward as far as Duarte, and westward to Alhambra.

Fruit growers should undertake the colonization of this parasite upon the red scale (*Aspidiotus aurantii*, Maskell), found prevalent throughout the Santa Ana Valley and Los Angeles City.

The most noticeable improvement derived from the work of this parasite was observed in the groves at the Sierra Madre Villa, where, two years ago, the trees presented a sickly and stunted appearance, the foliage sparse and mottled. Now this is all changed, the foliage being deep green and abundant, and these orchards have a good crop of fruit.

Since the Australian ladybird (*Vedalia cardinalis*) has destroyed the cottony cushion scale (*Icerya purchasi*), and the *Coccophagus* has reduced the number of yellow scales throughout the San Gabriel Valley, the orchards present a most thrifty and healthy appearance. This wonderful effect is also noticeable in the very extensive groves of the Messrs. A. B. & A. S. Chapman, Col. J. R. Dobbins, and others. This is very encouraging, as two years ago, on account of the attacks of the "white" and "red" scales upon citrus trees, many growers became so discouraged that after a long and expensive warfare against these pests many acres of citrus trees were dug up and cut into firewood.

As a result of the improved state of affairs, orange planting has had a veritable boom this season, the local supply of trees not being sufficient to supply the demand, and most of the nursery stock is engaged for next season's planting.

NOTES UPON FERTILIZERS.

The rich and productive soils of California have been favorably commented upon by Eastern and European agricultural and horticultural writers, and until recently the fruit growers of the State have considered it a useless expenditure of money and loss of time to even apply to the soil the manure that has been produced upon the farm; but upon the trees reaching maturity and producing carloads of luscious fruit, it became evident that something had to be done to replace all this drain of plant food. Several orchardists have been experimenting in this line with most gratifying results. A prominent orange grower of Riverside remarked: "I would mortgage my property to purchase fertilizers;" and judging from the results and experience of other growers, if a reliable fertilizer is used judiciously, the risk of foreclosure would be very small.

Commercial fertilizers have been used with stable or sheep manure. One grower was of the opinion that he would have had better results had the same amount been expended in sheep manure. However, we have to experiment in this line, as the demand will soon exceed the supply, and more particulary so as sheep manure now costs, delivered at the railroad depot at Riverside, 6 cents per cubic foot.

* Special bulletin, "Fruit Culture," June, 1890, by B. M. Lelong.
† Parasitic upon the yellow scale (*Aspidiotus citrinus*, Coquillett).
‡ Professor D. W. Coquillett in "Pacific Fruit Grower," June, 1887.

One of the first orange growers (in Riverside) to see the advantage of manures was Mr. Geo. Crawford, on Magnolia Avenue. A portion (one acre and a half) of his grove has been annually fertilized for six years with a heavy covering of stable manure applied broadcast in winter. The soil from this fertilizing would be, by florists, considered good potting compost. The natural soil in the immediate neighborhood is a sandy loam, thirteen feet deep, and from appearances would be considered rich enough to last a quarter of a century. The trees are seedlings, have been planted fifteen years, and are twenty-four by twenty-eight feet apart. The deep green foliage, vigorous growth, and very heavy crop, demonstrate the truth of the old saying: "Feed the tree and it will feed you." One remarkable feature, and one worthy of note, is the fact that this part of the grove has had an annual increase in crop of 50 per cent, without the mortifying light crop every second season (a peculiarity of seedling orange trees). Mr. Crawford intends pursuing this treatment with this part of his orchard. The other portion he has fertilized with stable and sheep manure, and last season he gave it a dressing of one ton per acre of bone meal, at a cost of $37 per ton. These trees are also in fine condition.

Mr. W. P. Lett, of Riverside, had good results from Mexican guano, one ton per acre applied two years ago at a cost of $36 per ton. His crop is good and the trees healthy. For five years previous he used stable and sheep manure. Mr. P. Klinefelter, of Riverside, is the owner of a thirty-acre grove; soil heavy loam, eleven feet deep. He gave his place a dressing of twenty thousand pounds of Mexican guano. At the time of this dressing some of the trees were showing yellow foliage, and after applying the fertilizers the trees changed to deep green.

Mr. C. G. Hurd has used Mexican guano upon his place for two years. His trees look well and have a good crop; but he believes he would have had better results from the same amount of money, $47 50 per acre, expended in sheep or stable manure.

Mr. Geo. H. Fullerton and Mr. B. B. Barney both report great improvement in trees and crop from a liberal application of Mexican guano. Mr. D. H. Burnham, of Riverside, reports that four years ago his lemon trees were cut back, and the following season he dressed with half a ton per acre of Haas' fertilizer, at a cost of $19 per acre; before its use his trees looked yellow; now they are a deep green. The two following years he used the same amount. He believes that his trees have been much benefited by it, yet others using this fertilizer have not had such good results; so he is not inclined to give it his unqualified approval.

The question is, Would the results have been as satisfactory if double the quantity had been used? as it is not a fair test to compare $19 worth with $35 or $40 worth of sheep or other manure. A portion of his vineyard that he considered necessary to fertilize in order to bring it up to the condition of the balance, he dressed with half a ton of Haas' fertilizer per acre, and had double the amount of grapes and larger berries than from the other portion not fertilized. The orchards of Messrs. A. B. & A. S. Chapman, of San Gabriel, two years ago were very seriously infested with white scale (*Icerya purchasi*). Mr. Chapman adhered firmly to the belief that the trees could be made to throw off considerable of the scales, or be in better condition to resist their attacks, if the proper fertilizers be applied. In 1887 the orchard was irrigated by the basin system, and lime and sheep manure added to the water, which

then became liquid manure. He also applied in the fall of 1888 one ton per acre of superphosphate, at a cost of $25 per ton; and in 1889 he applied to thirty acres of the orchard nine tons of sulphate of ammonia in two dressings—one in July the other in August. The trees very soon changed from yellow to dark green, and have made a good growth.

Two seasons ago the orchard only produced six hundred boxes of fruit; this year's crop is estimated by Mr. Chapman at ten thousand boxes. I am satisfied from the appearance of the trees and the advanced condition of the fruit that he has underestimated his crop. The soil is a light sandy loam.

Bone meal is one of the most valuable and durable fertilizers, and will be extensively used the coming winter by the orange growers.

SOUR ORANGE STOCK.

In the limited time at my disposal it has been impossible to make a thorough investigation of "sour orange" as to its adaptability for a stock in California.

I visited the orchard planted by D. C. Hayward, at Orange, and found it subdivided into city lots, and owned by parties that could give no information about the trees that surround their houses.

Mr. C. H. Young, who was foreman for Hayward from 1877 until 1883, is positive that no trees were planted in that grove in orchard form upon sour orange stock. But in 1882 Mr. Hayward obtained from Florida one hundred pounds of "sour orange" seed. This was planted in seed beds, and the seedlings afterwards transplanted in nursery rows. The trees were budded and sold.

I also visited the Bliss orchard in Riverside, and saw twelve orange trees eleven years old, said to be budded upon sour stock. If this is a fact, they compare favorably with trees of thirteen years' growth. The soil is mesa, or upland, sandy loam, like the southern portion of Riverside, and requires irrigation in summer. The property has changed hands, but I am informed that Mr. Bliss received the small "sour" seedlings from Florida, and afterwards budded them. Younger trees that I have examined in nursery and orchard, after the first season appear to adapt themselves to the climate and soil and make fine trees.

FUMIGATION.

Fumigation by hydrocyanic acid gas for the destruction of red scale (*Aspidiotus aurantii*), in the Santa Ana Valley, is now carried on with most gratifying results, both in regard to killing the scales and the effect upon the trees. The orchards visited that had been treated were in splendid condition, and after careful examination of the trees I was unable to find any live scales.

The Navel orange grove of Mr. Charles L. Leslie, of Orange, in July last was very seriously infested with red scale, and had all the appearances of having been scorched by fire. In August he treated them with gas, and the trees, in less than two months, have made over one foot of growth, and have very little appearance of having been almost defoliated. The trees are ten feet high and six to eight feet through the branches.

In the preparation of the gas he used two and one fourth ounces of C. P. cyanide of potassium, two and one fourth ounces of sulphuric acid, and three ounces of water. He put the ingredients into an earthenware vessel and allowed the tent to remain over the tree for forty minutes; and with four tents two men treated from fifty-five to sixty trees per night.

Mr. H. Hamilton and Mr. Frank Collins have also had good results from the use of this gas in their groves.

The treating of fruit trees in their growing period, especially the peach, is of course difficult with almost any remedy. There is no doubt but that this gas treatment will be effective on fruit trees for the destruction of the San José scale (so called), as well as it has been on citrus trees; therefore it should be experimented with; but before it is used on a large scale, the results should prove that it does not injure the tree or foliage.

From the success that Prof. D. W. Coquillett and I had in our experiments with this gas in the fall of 1886, I would advise the use of it for the destruction of the pernicious scale (*Aspidiotus perniciosus*, Comstock), for where properly applied and a good quality of cyanide is used, no scale can escape its deadly fumes. The expense will be greater for the first treatment, but the effect will be more lasting, and as it will not be necessary to repeat the operation for two or perhaps three years, the saving in labor will be quite an item.

FRUIT CULTURE IN FOREIGN COUNTRIES.

The Department of State at Washington, D. C., on September 28, 1889, at our request issued a circular letter of instructions to the consular officers of the United States, requesting them to furnish us with such information in response thereto as could be acquired upon the cultivation, preparation, etc., of the fruits grown in their districts, especially the olive, the orange, the lemon, and the fig. The consular officers have filed with the department elaborate and exhaustive reports, from which the following extracts are herewith appended, through the kindness of the Chief of Bureau of Statistics, Mr. Michael Scanlan.

FIG CULTURE.

VENEZUELA.

LAGUAYRA.

The fig is rarely met with here, although the soil and climate seem well adapted to its culture. One may occasionally see a fig tree, planted, it would seem, more for ornament or shade than for its fruit, notwithstanding the fact that the tree yields two or three crops per year.

WINFIELD S. BIRD,
Consul, Laguayra.

WEST INDIES.

BERMUDA.

REPORT BY CONSUL BECKWITH, OF HAMILTON.

Figs are grown on the island, but the same insect which has destroyed all the peaches has attacked the figs, also the guavas, so in a short time these fruits, like the peach, will be a dead letter, for scarcely anything is done to destroy the insect, and as we have no winter they increase the whole year, the fruit falling on the ground and being allowed to rot there. At one time olive plants were imported here by the country, but no care was given them. They have since dwindled away, only a few trees here and there remaining, but the fruit is put to no use. A little more energy and enterprise are needed in the island to advance various branches of agriculture and fruit culture, which at present bring no profit.

HENRY W. BECKWITH,
Consul, Hamilton.

TRINIDAD.

J. H. HART, GOVERNMENT BOTANIST, TO CONSUL SAWYER.

Only here and there a plant exists which ripens fruit fairly, but the produce is carried off when nearly mature by the frugivorous bats.

CUBA.

REPORT BY CONSUL-GENERAL WILLIAMS, OF HAVANA.

Figs grow here, but their cultivation is limited to private gardens. The trees do not obtain the size observed in the gardens of Norfolk, Va., Charleston, S. C., Savannah, Ga., or New Orleans, La. Neither does the fruit seem to be equal in flavor to that grown in those places. It is rarely ever seen for sale in the market houses fresh from the trees. Dried figs in considerable quantities are imported from Malaga, Spain, where great attention is given to their cultivation.

RAMON O. WILLIAMS,
Consul-General, Havana.

GUADELOUPE.

The few fig trees found on the island are always sickly and covered with aphis, or lice, and ants.

FELIX ELARDEAN,
Director at Botanical Garden at Basse-terre, to Consul Bartlett.

CONTINENT OF ASIA.

ASIA MINOR.

REPORT OF CONSUL EMMETT, OF SMYRNA.

There are several climatic influences which cannot be foreseen or guarded against, and yet have great effect upon the success of the crop; as, for instance, a greater rainfall than the average tends to darken the fruit when ripe; a high wind blowing for several days from the north while the fruit is maturing has the tendency to make the stems wither and fruit fall prematurely, etc.

There are as many uncertainties and surmises about the fig crop of Smyrna before gathering, as there are in reference to the peach crop in the United States.

As regards the cuttings which the honorable Secretary suggests my obtaining, I beg to say that I am informed that it is too late this season to take the same with any chance of their growing when they arrive in the United States.

Some provision for defraying the expenses, and further directions as to quantity and to whom to be sent, would be requisite before making a shipment of cuttings.

A box of figs grown and packed in California reached here this autumn, and was inspected and universally praised by many dealers. In some instances it was impossible to persuade the parties that said figs were

grown outside of the Aidin District; in fact, some went so far as to designate the orchard. Those who grasped the full importance of this American enterprise predicted that Turkey's supremacy in the fig trade was waning. Some console themselves with the opinion that the American fig will not continue to be good—as the trees (grown from Smyrna cuttings) grow older the fruit will have thick skins and become tough; in fact, become native American figs.

This deterioration of the fruit is very common here, and has been well known for a long time. The transplanting of trees from their own orchard, even for a short distance, makes them give fruit of entirely a different flavor and nature.

It has been suggested to me that if some grower will grow seedlings from the fruit of young trees grown from Smyrna cuttings, the chances of American fig growers will be greatly enhanced, and, perhaps, in time eclipse one of the staple articles of this country.

Varieties.—The best variety for drying and packing is known under the name of Lop. There are two kinds of figs for table use when ripe, but which will not bear drying and packing, viz.: "Zardajik" and "Cheker Inzir."

Situation.—The trees that produce the varieties above named are grown in the Aidin District.

Distance from sea, thirty to one hundred miles; elevation above sea level, two hundred and fifty to five hundred feet. Much exposure to sun is required.

The trees thrive in all descriptions of land, provided they should be protected against the north wind.

Soil.—Rich black vegetable mold is best.

Climatic Influences.—A temperate climate is the main thing; the thermometer should never fall below the freezing point during winter; frost during spring kills the trees.

Temperature.—Minimum, 40 degrees; maximum, 110 degrees; average, 80 degrees Fahrenheit.

Rainfall.—Yearly average, twenty-four inches. Rain during winter strengthens the trees; during summer it injures the crop.

Irrigation.—Good fig orchards are never irrigated; newly planted young trees need watering during the first two years of their growth.

Cultivation.—Fig orchards are plowed four or five times a year, beginning from November.

Fertilizers.—Manure is made use of when the soil is poor.

Pruning.—When the trees grow old, they need pruning during winter.

Picking and Curing.—When perfectly ripe the fruit falls by itself. If not quite dry, it is spread in the sun. There is no fixed time for picking, as the fruit when ripe falls. The fruit is gathered from the ground, and put in black hair bags; it is then loaded on camels, and carried to the nearest railroad station, put in the freight cars, and conveyed to Smyrna; loaded again on camels, it finds its way to the fig market, whence it is sent to the packing houses to undergo the final process of sorting, shaping (flattening out or squaring), and putting in boxes or bags, and is then fit for shipment abroad. No chemical solution is employed; the packers wet their hands with plain sea water, which hastens considerably the sugaring of the figs.

Planting and Propagating.—Distance planted apart, twenty-five feet. The trees propagated by cuttings. There are small and large orchards.

Maturity.—The trees remain fruitful from eighty to one hundred years, and even longer.

Insect Pests.—A kind of bug, known under the name "Basra," is very injurious to the fruit, which it covers with dark yellow and black spots. No one knows how to free the trees and fruit of this pest. The only beneficial insect is the one which comes out of the male fruit, and impregnates the female figs, and the ants which feed on the bug, called "Basra."

W. C. EMMETT,
Consul, Smyrna.

PALESTINE.

REPORT BY CONSUL GILLMAN, OF JERUSALEM.

Varieties.—There is no exportation of the figs grown in Palestine, and scarcely any care is given to the cultivation of the trees. There are said to be as many as twelve varieties of the fig in this country, and, with few exceptions, they are all good for eating. The best known and most easily distinguished varieties are as follows: (1) The large green fig, early in fruiting, known as Dafouri; (2) Small green, later fig, called Ghoudri (greenish); (3) Large purple fig named Gharroubi (carob, from its resemblance to the color of the pod of the carob); (4) Small purple fig, named also Gharroubi; (5) Yellow fig, white inside, known as Biadi (white); (6) Yellow fig, crimson inside, called Karawi (crimson), resembling the Smyrna fig of commerce; (7) Black fig named Swadi (black).

While, as already mentioned, all these are good for eating in the fresh state, Nos. 1, 2, 3, 5, and 6 are the best for this purpose. Equally, though, all the varieties are used for drying. Nos. 5, 6, and 7 are most suitable for the purpose.

Situation.—The trees flourish all over Palestine, from the seacoast up into the hill country, at an elevation of three thousand feet or more. They generally have a full exposure to the sun, but seem to do well in all situations. They frequently attain an enormous size, even on the most rocky hillsides; and whether the land is hilly, rolling, or level, appears to make no great difference to them. The soil is generally clay, or sand and clay mixed, with clay subsoil.

Climate.—At Jaffa, and on the plains, the minimum temperature is 32 degrees Fahrenheit, the maximum reaching 107 degrees Fahrenheit; the average temperature in the daytime being about 70½ degrees, and at night, 55½ degrees Fahrenheit. In the mountains it is considerably colder; though, in general, there are only a few days in January in which it freezes. At Jerusalem the average annual rainfall amounts to twenty-five inches. The growth of the trees and fruit is favorably affected by abundant rains.

Irrigation.—The trees do not require irrigation, and, except when growing in orange groves, are never watered. With systematic irrigation and cultivation, such as received by the orange groves at Jaffa, the fruit is improved.

Cultivation.—As already mentioned, but little cultivation is bestowed on the trees. At most they receive a spring and autumn plowing.

Fertilizers.—Fertilizers are seldom used except when in connection with the orange or lemon trees; and the kind preferred is generally horse manure, or the dung of the mule or camel.

Pruning.—Pruning is not practiced with any system, nor to any appreciable extent. It is considered best to spare the lower branches, and when cuttings for propagation are made they are taken from above.

Picking and Curing.—The fruit is picked when fully ripe. For eating, the morning is deemed the best time of day for picking; but there is little choice observed in the matter. In general, the fig of this country is of inferior size, doubtless in consequence of being given such little attention, and being only used for home consumption. The fruit is dried by being spread in the sun, usually on the roofs of houses, or sometimes on the ground. When partially dried the fig is pressed flat in the hands. Subsequently the nearly dried fruit is strung on strings; and it is often sold in this shape or when placed in sacks.

Planting and Propagating.—The distance at which the trees are planted apart varies from six to ten, or even twenty feet.

Though the fig can be grown from seed, the usual method of propagation is by cuttings, or rather branches slipped off the parent tree.

The size of the orchards is in general not large, though sometimes consisting of several acres. There are only a few hundred fig trees dispersed over the vineyards and gardens at Jaffa; but at Bethlehem, Hebron, and around Jerusalem, orchards of fair size devoted to the fig may be found.

Maturity.—The tree here attains to the age of one hundred years, and with proper care and culture continues fruitful to the last. If neglected too much, it ceases to be productive; though on attention being renewed, it again responds with crops. The trees begin to bear at the third year, and are in full bearing when five years of age.

Insect Pests.—But little has been observed as to insect pests, beneficial insects, or the parasites of the injurious ones. The fig seems to be unusually free from such. A fig is occasionally found containing a worm, which appears to be the larva of one of the smaller moths; but the species has not been determined.

Cuttings.—The rooted cutting or the young tree would be, in all probability, the best method of procuring desirable varieties. I understand that many thousands of young trees have been successfully transported from Smyrna to California, giving full satisfaction.

HENRY GILLMAN,
Consul, Jerusalem.

SYRIA.

BEIRUT AND VICINITY.*

FIRST REPORT BY CONSUL BISSINGER.

Varieties.—The best fig for drying is the green variety. The best variety for eating when ripe is the red variety with elongated stem, called "Bookraty." Also a rounder red variety called "Seedany." Other varieties worthy of culture and for profit are the black variety, and one which ripens in the fall.

Situation.—The trees that produce the varieties above named are grown on plains and on the hills, and from the shore to a distance of twenty-five miles inland to an elevation of two thousand five hundred

* The several reports for Syria were forwarded by Consul Bissinger, being prepared from statistics supplied by parties in the several districts reported.

feet. Constant exposure to the sun is needed. Hilly and rolling lands with white clayey soil are the best.

Irrigation.—No irrigation needed.

Cultivation.—Plow the land in the spring.

Fertilizers.—None put about trees, as it is injurious.

Pruning.—Pruning is not practiced.

Picking and Curing.—The figs are picked when fully ripe in the early morning. Little curing is done in this country; simply dried in the sun, either whole or split; no solution used.

Planting and Propagating.—Distance planted apart, about twenty to twenty-five feet; propagated by slips. The orchards are small.

Trees attain an age of from fifty to sixty years, and are fruitful from four years till they decay.

Insects and worms are treated simply by covering the trunk of the tree with a coating of bitumen.

Slips can be put into earth and conveyed from place to place.

I cannot secure any printed matter, such as reports, methods, or statistics issued by the Government or otherwise; none issued.

SECOND REPORT.

Rain.—Moderate rainfall; about thirty to forty inches on an average yearly. The abundance of rain is beneficial to old trees as well as to the fruit. October and November rains benefit the trees, and March and April rains benefit the fruit.

Irrigation.—Irrigation is only necessary the first and second years after planting. In light soil, watering is necessary twenty days after the rains are over, and in heavy soil one month thereafter.

Cultivation.—Plowing is necessary once or twice after the first rains in November, and is then to be discontinued until the first of February, after which it is to be repeated four times, or every fortnight, after the rains. As soon as the fruits appear, no more plowing is necessary.

Fertilizers.—The fertilizing substances are: A donkey load of sand around each tree once a year, about the early part of December, if the soil is red, and a small quantity of cows' or other manure if the soil is white (*i. e.*, clayey). This treatment increases the growth of the trees and the quantity of the fruit.

Pruning.—Pruning is effected at the end of January by removing the weak and dead branches. To prune the low branches of fig trees increases their growth and production.

Picking.—Gathering, or picking, takes place when the fruit is fully ripe. When for sale, it is effected either in the evening or before sunrise; and if for drying, it must be after sunrise, so as to be dry from dew, which would spoil the color of dried figs.

Curing.—After the figs are gathered, they are split open in the morning and placed in an exposed position to the sun for three days, until they contract and assume a red or yellowish tint. They are then gathered from the drying floor, and after being fully flattened out, are spread in equal layers in a basket until completely filled up. A heavy weight is then placed on the top of the basket. As to figs dried in a heap, they should be gathered when perfectly dry (in other words, when withered on the tree), and spread as they are on the drying floor for four or five days, at the expiration of which they are picked up and pressed flat between the fingers. This species of dried figs may also be placed in hot water for ten minutes, then left to dry well in the air before packing up in boxes. This bathing process imparts a good color to the figs and preserves them from worms. Dried figs are never placed in any solution.

Plants and Propagation.—The distance between each tree should be at least nine feet. The larger the distance the better the trees grow.

Fig trees are propagated either by suckers or shoots (which grow at the foot of the mother tree), or by slips from the trees.

(1) The way of transplanting by suckers is to dig a hole in the ground about fifteen to twenty inches in diameter and depth in which to place the same, after which the soil is to be so arranged as to be on a level with the surrounding ground, or even a little lower, to retain the water. Watering is necessary just after planting. Some people resort to the practice of putting in the hole of the newly planted sucker a handful of barley to serve as nourishment for the roots. A sucker planted with barley never fails to take root and to thrive.

(2) To propagate by slips it is necessary that a hole be dug in the ground having an average length of twenty-seven inches by thirteen in depth. In this hole the slip, which should be about twenty-seven inches long, is placed obliquely, so as to leave about two inches of it above the ground. The planting of suckers must take place between the first of December and the end of January, and the planting of slips should begin with February and end with March. Water is needed, as stated in answer 6, for the lands that had not been previously tilled and sown. As to the rich lands which had been plowed, they should be irrigated once a month, or once every forty-five days.

There are some large and some small fig orchards, but generally their size is limited.

Fig trees live from five to thirty years, some even longer, and produce fruit until they die off.

The insects are worms produced by excess of water and manure and want of proper pruning. The way to treat them is to put only a little manure or none at all, to prune the trees well, and to make a passage for the water, so as not to allow it to gather around the trees. Birds also attack fig trees, such as the sparrow and the becafico. A scare-crow is most always successful in frightening away these birds.

THIRD REPORT.

Varieties.—The best variety for drying is the Abyad, white inside, green outside; and for eating when ripe, the Bookraty, red inside, green outside. The Asfoory and Bookraty are also cultivated. The Smyrna District is the principal one, Syria coming next, in which fig trees are grown.

Situation.—No matter where fig trees are planted, moderate altitude is the best. Fig trees are benefited by being exposed to the sun.

Soil.—The white clayey soil is preferable. It should be manured once every three years.

Climate.—Minimum, 40 degrees Fahrenheit; maximum, 90 degrees Fahrenheit; average, 65 degrees Fahrenheit. The more abundant the rains the better the trees and fruits prosper.

Irrigation.—Fig trees need no irrigation.

Cultivation.—After the soil gets dry it should be plowed three times during springtime.

Fertilizers.—The soil should be manured once every three years, and plowed as stated above.

Pruning.—After the fruits have been gathered, the dead branches only are cut away.

Picking and Curing.—When the fruit is ripe the morning is the best time for picking. If they are to be transported from place to place, figs must be gathered before they are fully ripe and placed in boxes, but cannot be sent to any distant place. When figs are to be dried, they must be gathered when fully ripe, then spread on a lofty spot for from ten to fifteen days and nights. In this way they can be preserved in boxes during the whole year.

Planting and Propagating.—The trees are planted about thirteen feet, and propagated by slips. The orchards are generally small.

Maturity.—Fig trees attain thirty to forty years of age, and produce fruit from the fourth or fifth year.

Insect Pests.—There are some insects which infest the soil and invade the trunk of the tree, and sometimes cause them to decay, but they do not injure the fruit. Trees so attacked are treated by introducing an iron wire into the affected holes until the insect is reached and destroyed.

Slips.—Slips are to be secured in March.

No printed matter, reports, or statistics exist or are issued by the Government.

SIDON.

Varieties.—The "green" varieties for drying are the Bookraty and Abiad, for eating when ripe. Other varieties cultivated are the black and one which ripens in the fall.

Situation.—Both in plains and hills; best kinds within thirty miles of coast; best growth from five hundred to two thousand feet above sea level; constant exposure to the sun; hilly lands the best; clayey and chalky soil the best.

Climate.—Thirty degrees Fahrenheit to 90 degrees Fahrenheit; rainfall about thirty inches, on an average, annually; an abundance of rain is beneficial.

Irrigation.—Never irrigated at all.

Cultivation.—Spring plowing.

Fertilizers.—None applied. Figs become wormy in rich earth.

Pruning.—Dead branches only are removed.

Picking.—When ripe, and in the morning.

Curing.—Dried in sun only. No solution of any kind used.

Planting and Propagating.—The trees are thirty-two to thirty-five feet apart; propagated by slips; the orchards are generally small.

Maturity—The trees attain to about fifty years, and bear from four years till they die.

Insect Pests.—Principally worms. The remedy is to cover the trunk of the tree with a coating of bitumen.

Cuttings.—Cuttings are secured either by suckers which grow at the foot of tree, or cuttings from the tree itself.

TRIPOLI.

Varieties.—The best variety for drying is the Bayadi (white inside); the best variety for eating is the Bookraty; the other varieties known in this country are the Bookraty, the Bayadi, the Asfoory, the Aswad, the Hammary, and the Shataway.

Situation.—Fig trees grow in the plains as well as in the mountains; the more they are exposed to the sun the better they prosper; they are found in rolling and level land, which is alike adapted for their growth. It is customary in this country to plant fig trees in either white clayey soil or in a blackish soil (the latter not being good for other kinds of trees). In red soil the fig trees grow still better, but the taste of the fruit is less delicious than if grown in a white or blackish soil.

Climate.—Temperature varies from 30 degrees Fahrenheit to 90 degrees Fahrenheit; average, 60 degrees Fahrenheit; rainfall averages twenty-six to forty inches per annum, according to locality.

Irrigation.—Most of the fig trees in this country are found on non-irrigated lands. The fruit of irrigated fig trees is affected by worms and liable to rot.

Cultivation.—Lands upon which fig trees are planted should be plowed three times in the spring.

Fertilizers.—Manure is the fertilizer known, but it is not used for fig trees, for the reason that it causes the fruit to be invaded by worms and to rot.

Pruning.—Dead branches only need to be removed.

Picking.—Figs for drying are picked when fully ripe any time in the course of a sunny day, so as to be well dried by the rays of the sun, and thus prevent their contracting a sour taste.

Curing.—Figs, after being gathered, are spread in the sun for from ten to fifteen days. When they become dry they are placed in a basket and plunged for two minutes in a large copper kettle full of boiling water, in which a small quantity of the fennel plant has been deposited, to impart a nice aroma to the figs. After this process of "bathing," the figs are dried again, and then stored away. Figs are gathered and dried as they ripen, during August, September, and October.

Planting and Propagating.—Distance planted apart, twelve to fifteen feet, according to the quality of the soil. Fig trees are propagated by cuttings from the branch of a large tree having three or four sprays, which is to be placed in a hole dug for the purpose, then covered with earth, allowing one of the sprays only to project, at a height of about two inches above ground. This should take place in the spring, *i. e.*, from the beginning of March to the end of April. Orchards are generally small.

Maturity.—The age of fig trees depends on the quality of the soil and the care bestowed upon them. If good care is taken of a fig tree it lives up to one hundred years.

Disease.—The branches of fig trees are sometimes liable to a disease that manifests itself in the shape of slight swellings, called snails. The remedy adopted is to make small cuts in the tree, which causes the disease to subside.

Cuttings.—No plantations of young fig trees exist in this country. The way to plant fig trees is to secure cuttings from large trees and plant them as stated above.

ERHARD BISSINGER,
Consul, Beirut.

INDIA.

REPORT PREPARED FOR VICE-CONSUL BODE, OF BOMBAY, BY MR. G. MARSHALL WOODROW, LECTURER ON BOTANY AND AGRICULTURE AT THE COLLEGE OF SCIENCE, POONAH.

Varieties.—Figs are not dried in India to any considerable extent, as the local consumption absorbs the supply. The retail price of ripe figs is about 2 annas per pound (say 6 cents) at Poonah, within fourteen miles of extensive gardens. Varieties of figs are not named in India except with the name of the village they are grown at, and such a name is not distinctive. The variety grown in the Deccan is inverted conical, green at the stalk, and gradually deepening to brown at the broad end. Good examples weigh one seventh of a pound.

Situation.—The village of Khed Shivapoor is an important center of fig culture. It stands fourteen miles south of Poonah, which city lies in north latitude 18° 28′ east, longitude 74° 10′. The altitude of Khed Shivapoor is about two thousand two hundred feet above mean sea level, but the fig thrives at Baroda as low as one hundred feet above the sea level. The orchards are fully exposed to the sun. The land of the orchards is nearly level, but they are situated on the slope of a range of hills three thousand five hundred feet in altitude, at a height of two thousand two hundred feet, and about fifty miles from the sea.

Soil and Subsoil.—The soil is calcareous loam; the subsoil, at a depth of about two feet, marl (a mixture of lime and clay), overlying disintegrated trap.

Temperature.—Average, about 75 degrees; minimum, 48 degrees; maximum, 95 degrees. The village is shut in on the northeast and west by hills, which keep out hot winds.

Rainfall is about fifty inches annually, falling chiefly from June till October. The setting in of rain makes the trees ripen the young growth that was made during April and May in the hottest and driest season, and determines the ripening of fruit.

Irrigation.—Irrigation is effected from wells, about twenty-five feet in depth, by a leathern bucket drawn up by oxen at a cost of 10 P. (say 2.5 cents) per one thousand gallons. Two inches of water on the surface of the orchard, per month, from the end of October till the fruit is ripe; the low quantity of water given keeps the fruit sweet. One inch of water is given twice monthly.

Cultivation.—Cultivation consists of plowing or hoeing once yearly after the fruit is gathered.

Fertilizers.—Fifty pounds per tree of well decayed village sweepings are applied at the end of the dry season, in May, after the crop is gathered.

Pruning.—After the young tree has been made to send up five to seven shoots from near the base by stopping the first strong shoots sent out by the cutting, little, if any, real pruning is given. Weak, decayed, or broken branches are cut out to the base, and such as have gone too high for a man's hand to reach are stopped, and if branches are plentiful, cut out, when all the fruit is gathered from them, but the less pruning that is necessary the better. In a few instances the trees are grown as standards; a straight stem is led up about six feet, and from the top of this branches are encouraged to spread horizontally.

Picking.—The picking is done when the fruit is full grown and shows a slight yellowing at the stalk. Early in the morning is preferred, because fruit picked at that time and kept in the shade retains a delicious coolness. For local use each fig is wrapped in a leaf when it has attained this stage, to protect it from birds, and left on the tree a week longer. This improves the quality greatly, but prohibits carriage to a a distance. No boxing or curing is done in India. The skin of the variety grown is much too delicate, and I have not been successful with European varieties.

Planting and Propagating.—Propagation is effected by cuttings of one-year old wood planted in a moist, shady place during February. The trees are set out ten to twelve feet apart.

Size of Orchards.—The orchards are two to three acres in extent only, because the position on the slope of a hill does not afford larger spaces sufficiently level, and a well rarely waters more.

Maturity.—The trees attain fifteen years, and are fruitful about twelve years.

Insect Pests.—Red spider (*Tetranychus telarius*), or some nearly allied insect, is a serious enemy. No futile attempts are made against it by the cultivators. They think sacrifices to idols effectual. Much yet remains to be done in the entomology of the fig.

Cuttings.—I have never sent cuttings as far as America, but I think that if cut in February, packed in moist sand in a tin box and sent by post, a few would survive the journey. Whether it would be profitable is doubtful, as I am of opinion the fig of the Deccan is synonymous with Brown Turkey, which you probably have in cultivation. I will be glad to send you cuttings if wanted.

Publications.—The Government of India does not issue statistics regarding figs.

G. MARSHALL WOODROW,
Poonah.

AUSTRALASIA.

REPORT BY CONSUL GRIFFIN, OF SYDNEY.

The fig is not cultivated to any great extent in the Australian colonies. The tree will grow and bear excellent fruit all over the country, but its cultivation cannot be called an industry in any part of Australasia. Figs are not dried or prepared in any way for export. There are growers who have experimented with drying figs, but I have never heard of locally dried figs being offered for sale. The figs that find their way to the Sydney market are in a green state. Baron Fred. von Mueller, Government botanist for Victoria, in his work entitled "Select Extra-Tropical Plants," strongly urges the extensive planting of the fig through favorable portions of desert waste for shade and fruit, and in warm districts where the fruit could be dried with particular ease. He directs attention to the ease with which small cuttings of the fig tree were sent by horse post in the early history of these colonies from Port Phillip (Melbourne) to the Central Australian mission stations, a distance as far as from St. Petersburg to the Black Sea, or from San Francisco to the upper Missouri. Baron von Mueller mentions two main varieties which have been successfully introduced into Australia. One includes the purple, white, and golden fig trees, producing two crops a year, but are not suitable for drying. The other main variety embraces the Marseillaise, Bellonne, Barnisote, and the Aubique. These produce but one crop a year, and supply the greatest quantity of figs for drying. The Marseillaise and Bellonne are usually regarded as the best varieties. The Barnisote and Aubique are dried with fire heat and are usually consumed fresh. The ordinary drying is effected usually by the sun. Mr. Angus McKay gives the Black Province and Black Italian as the best varieties for drying in Australia, but says very little drying is done here.

The White and Yellow Ischia are favorite varieties. Then there are the Morocco, and the White and Brown Turkey. Different names are given to the same variety of figs, and as no systematic attempt has been made to classify them, there is some confusion in the nomenclature, and it is almost impossible to say which is the best. The fig grows on the sea-coast, and also many miles inland. It has been found to do fairly well at an elevation of two thousand five hundred feet above the level of the sea. Excellent figs are, I am informed, grown in the Forbes and Parkes Districts of New South Wales, but the finest figs I have seen were grown at Tumut, also in this colony, where the soil is of a dark rich loam to a depth of about ten feet. Figs also grow at Port Stephen, where the average annual rainfall is about sixty-two inches. Mr. Angus McKay says the fig thrives best in hilly country, and as to soil, it seems that they do very well in poor sandy soil; where the temperature is 100 degrees figs are produced, and where it is not less than 20 degrees above zero. When the rainfall is not less than twelve inches, or more than thirty inches, they appear to succeed best. When the rainfall is heavy, the trees run to wood. When cultivated here both plowing and digging are practiced; the trees are usually twenty feet apart each way, and are propagated principally from cuttings. The only insect yet observed consists of a small beetle. The tree fruits in the third year. Caprification is said to be practiced in New Zealand; but it is not done, so far as I have been able to learn, in Australia, and Baron von Mueller says it is unnecessary, and, in some instances, injurious and objectionable.

G. W. GRIFFIN,
Consul, Sydney, N. S. W.

FIJI.

Figs are not cultivated. The very few experimental trees that have been planted have proved a decided failure. The fruit has not been grown in these islands. A blight, black in appearance, strikes the tree before it comes into bearing, which, if it does not kill the tree, so retards its growth that it never bears any fruit.

ANDREW A. St. JOHN,
Commercial Agent, Levuka.

CONTINENT OF EUROPE.

FRANCE.

REPORT BY CONSUL TRAIL, OF MARSEILLES.

The fig tree (*Ficus carica*) that is cultivated in France was brought from Greece many centuries ago, and is now, like the olive, common to the whole of the south of France and of the adjoining countries, more especially eastward.

It grows in a wild state in almost any place and position. On many an old wall small fig trees are to be seen, and on many a roadside bank it is the tree most frequently to be found. In country farm yards, innkeepers' gardens, stableyards, the fig tree is invariably present, and very often as a solitary specimen. It would be difficult to find a garden of any description in southern France without a fig tree.

Varieties.—The varieties are innumerable, and it would be hard to give a list of all the different ones, as they vary according to soil exposure, treatment, and climate.

The chief varieties cultivated in this district are the following:

The Marseillaise, or Athens fig, a white fig of very nice, delicate taste, both when eaten fresh from the tree and when dried. This variety is considered the best in the south of France, and many people prefer it even to the Smyrna fig.

The Mouissonne, a dark fig with a fine skin, very good when eaten ripe and fresh, and good for drying.

The Barnisotte, one that is almost only eaten fresh.

There are several other varieties that could be mentioned, but they are all more or less similar to the above three kinds.

Soil.—The fig tree grows in almost any soil common to its climate, but dry ground suits it best. Along certain dry and even arid strips of land bordering on the Mediterranean, fig trees flourish and produce fruit in abundance.

Climate.—The same climate that suits the olive tree is favorable to the fig (*i. e.*, a warm climate, where excess of heat and cold is scarce). With special reference to this district it is worthy of note that on the right side of the Rhone figs do not develop very well; the fruit remains small, and is not good for drying. Whereas, on the left side, and from the Rhone till the Italian frontier, figs attain a far higher degree of quality; they are larger, sweeter, more delicate, and are excellent for drying. The explanation of this fact is, that the plains on the right side of the Rhone are not sheltered by hills, as on the other side.

Situation.—Sheltered hillsides are very favorable to fig culture; exposure to cold winds is not conducive to good results.

Rainfall.—The winter rains generally give sufficient moisture to the soil for the whole year. Fig trees that are intended to produce fruit for drying ought not to be watered artificially. Too much moisture lessens the quality and the richness of the fruit, and frequently renders drying difficult.

Tree Planting.—When planting fig trees care should be taken to select a deep soil, or in any case to dig as deep as possible and mix some fertilizer (manure, old leaves, etc.) well into the earth, on which the roots will rest. During the first two years it is always advisable, in districts that are subject to frosts, to cover or bind the trees with straw for the winter. After the second year the young trees are generally strong enough to stand the winter uncovered. The ground should be well dug up at least once in winter and once in spring.

Fertilizers.—Fertilizers should be dug into the ground once a year, during spring, for young trees, and once every two years for older trees. Fig trees, once well rooted and well established in a place, require very little fertilizing, and this can even be dispensed with if the soil be well dug occasionally.

Pruning.—Pruning should be done once a year, but only lightly (*i. e.*, one should only thin out dead and useless branches in the body and crown of the tree, and cut away all young shoots that spring up at the foot of the stem). The latter point is important, as the fig tree being very voracious, young ungrafted shoots would only uselessly exhaust the soil and weaken the original tree. For this reason, too, it is well to keep fig trees apart from other trees, for not only does the fig tree weaken its neighbors, but its neighbors weaken it as well.

Maturity.—The fig tree produces fruit pretty regularly every year. Some varieties give two crops, the first of which begins about the twentieth of June and lasts until about the twentieth of July, the figs of which, called "Flower" figs, are not good for drying, and the second at the end of September. Several black and gray figs come under this variety.

The other kinds, of one crop only, begin to ripen about the middle of August, and continue ripening successively throughout August and September; these are the best for drying, and to this class the Marseillaise belongs.

With reference to those that give two crops, it is interesting to note that the figs of the first are borne by the branches of the previous year only, and that those of the second crop are borne by the young branches of the same year. This accounts for the latter ripening successively, as each fresh leaf that opens out bears a fig in its axil.

Picking and Curing.—Figs, either for immediate consumption or for drying, ought not to be gathered before they are quite ripe. The signs of ripeness are complete softening of the figs, slight bursting of the skin, a tear or drop of gum oozing out of the center.

Figs must be gathered by hand, and in plucking them off the branches care should be taken to pick them with the short stalk that attaches them to the branch.

The state of the weather and the time of day are points to be taken into consideration when gathering figs for drying. It is true that in this district it is seldom that the weather is not fine during August and September. However, fine days should always be selected, and picking should not commence until the morning dew has disappeared from off the fruit. As soon as the figs are picked they must be laid in rows on wicker or basket-work hurdles or boards, and well exposed, but in a sheltered position and raised from the ground, to the full force of the sun. The figs should not be placed too close together, and they must be turned round every day about midday, when the sun is hottest, so that every day a fresh surface is exposed to the direct rays of the sun. The hurdles or boards, without touching or disturbing the figs, must be taken indoors every evening and placed in dry, airy rooms till the morning, when they are brought out again in the same way. No dampness

nor moisture must be allowed to get to the figs whilst drying, and if the weather be uncertain one should be near at hand and take them in at the first sign of rain.

In fine weather six days suffice to dry figs, and this is generally the case with the first batches in August and beginning of September. But as the days grow shorter and the sun becomes less powerful, more time is required, and the process of drying lasts from ten to fifteen days. Wet weather is exceedingly detrimentel to drying, as it is a very difficult and uncertain operation to dry figs indoors by artificial heat. Artificially dried figs are never as good as sun-dried ones.

The quicker the drying takes place the better the figs are, and the exact stage of complete dryness can generally be ascertained by the firmness of a fig taken between two fingers and rolled. The interior seeds lose their red color when the fig is quite dry, and this is one of the signs that the process is completed.

They can then be classified according to size, appearance, and quality, and packed in baskets of flat wicker, or boxes, ready for storing or for shipment. They are usually packed in rows and layers, pressed down one by one with the thumb, in such a way that the stalk is in the center underneath, and then each layer should be pressed down with the aid of a small board, slightly, until the basket or box is full.

Prices.—Fresh ripe figs sell very readily at the time of the crops, especially the early ones, for a few cents a pound. No exact price can be given, as the value varies from 3 to 7 or 8 cents a pound, according to time, quantity, and quality of crop, also place where they are sold. In unfavorable seasons for drying, and in late crops, quantities are made into jam, and are sometimes even boiled into other fruit jams, such as raspberry and strawberry, to which the fig, when boiled, assimilates itself in appearance.

But the chief trade is done in dried figs, and the prices of these vary according to quality, quantity, and time of year. The grower dries his own figs and usually sells them in bulk to the dealer, who then sorts them and sells them again separately as per their respective qualities.

The Marseillaise fig brings from 75 centimes to 1.50 francs per kilogram (from 8 to 16 cents per pound), and frequently even more in retail. Other varieties sell cheaper; ordinary dark and blue figs generally bring from 30 to 40 centimes per kilogram (from 3 to 4 cents per pound). Very common small figs, dried, are sold in some districts in large quantities, packed in sacks, for distilling purposes, but this applies more generally to Italy and Spain. This kind of fig is also sometimes used, baked or roasted and ground into coarse powder, to adulterate coffee with.

Insect Pests.—The fig tree, well cared for, is very rarely attacked by either disease or injurious insects; in some regions these are unknown. In some cases a kind of a louse attaches itself to the branches and spreads over the whole tree, if not detected in time and rubbed off carefully by means of a coarse piece of cloth. If, however, it has not been detected in time, and the parasite has already covered and killed certain branches, these branches must simply be sawn off.

Reproduction.—Like the olive, the fig tree grows to a good old age. Reproduction takes place, naturally, by seedlings, but as this process is slow and uncertain, it is generally done by cuttings, which are selected from good healthy trees and planted in deep soil. They must be grafted in about the second year, and bear fruit in their third year, after transplantation to their definite ground. If the grafting takes well, fruit is even produced before the third year.

CHAS. B. TRAIL,
Consul, Marseilles.

CORSICA.*

REPORT BY CONSULAR AGENT DAMIANI, OF BASTIA.

Varieties.—(Common fig tree, *Ficus carica.*) The varieties cultivated in this locality are, for drying, the White (*Bourgassotte Blanche*); Neapolitaine, very good quality, very good to dry, yields small number of flowers; for eating when ripe the Verdale; the Marseillaise; Athens fig, the kind best adapted; Dunmine, very good for drying; Franciscana, for drying and eating. Black (*Bourgassotte noir*), very good fresh figs; Niello noir, the earliest figs; colored (*Figue latte*), excellent fresh or dry; Observantine, very numerous flowers; Bellone, excellent fresh or dry.

Situation.—The fig tree is abundant in Corsica, particularly on the littoral, especially on well exposed hillsides, on the rocks at the foot of the mountains close to the sea, on dry ground. The roots being very long, it is cultivated in deep, calcareous soil. It grows from the sea level to eight meters of altitude. The trees grown on the plains and shoals produce figs which dry and have not the requisite flavor and whiteness. Although the fig tree grows on dry soil, often in the fissures of rocks and walls, it yields the most abundant and best flavored fruit when cultivated on good, light soil. It is affected by dampness, but yet requires watering in very hot weather.

Cultivation.—The fig tree does not require much attention; the ground has only to be dug once or twice a year and the fig tree thrives. If planted in a warm locality it assumes a goodly shape.

Climate.—It prefers a warm climate, especially in the vicinity of olive trees. Where the thermometer does not fall below 12 degrees Centigrade, it produces leaves and fruit continuously. It does not prosper without manure from farmhouses. It is multiplied by cuttings. Small branches, of two centimeters broad by twenty centimeters long, are the best.

Planting and Propagating.—The slips are put entirely under ground, except the terminal bud. The ground should be dug to a depth of at least forty-five centimeters, and the trees should be about six meters distant from each other. Figs ripen at two seasons—at the end of spring and beginning of summer, and in the autumn for the second figs. The second is the most important.

Picking and Curing.—The gathering is long, because they ripen successively. They wait till the figs are perfectly ripe, and even overripe. Those gathered unripe mature by keeping, but have not the flavor of those matured on the tree. Perfect ripeness is indicated by their being soft, the cracking and falling away of the rind, and by a liquid in the center. The day and hour are important if the figs are to be dried. The dew must have disappeared and the time must be dry. After being gathered, they are taken into the house and placed on planks or on hurdles, exposed to the greatest heat of the sun, and in a sheltered place, and at night in a well aired place. The form and preservation of the fig depends upon the promptitude of the operation of drying. The figs have to be burned over and flattened frequently. Sometimes during the operation of drying rain comes on; the drying then becomes difficult and almost impossible, except by means of the artificial heat of furnaces, which, however managed, injures the quality of the figs and lessens the market value by a third.

* Translated at the Marseilles Consulate.

Yield.—A fig ground of a hectare, containing two hundred and sixty-seven fig trees twenty-five years old, will yield (at the rate of twelve and five tenths kilograms each, three thousand two hundred and fourteen kilograms of dried figs, of the average value of 37 francs the one hundred kilograms, and 30 francs, reckoning losses) about 963 francs. On account of the difficulties in drying, nearly one crop in three is lost, which reduces the average profit to 640 francs.

SIMON DAMIANA,
Consular Agent, Bastia.

SOUTHERN FRANCE.

REPORT BY VICE-CONSUL MARTIN, OF MARSEILLES.

The fig tree is common in southern France, and specimens of the several varieties known in the country are to be found in almost every ground lot, but it is not the object of special culture. The preparation of figs requires too much time and care, and the price could not repay hired labor. The figs must be culled one by one, when perfectly ripe; great care must be taken not to bruise the fruit or sever the peduncle. The figs are then laid on cane hurdles, exposed to the sun, and turned over every now and then until perfectly dried, that is, for a period of ten or fifteen days. As the least exposure to moisture would turn the figs black and reduce the value by one half, these hurdles have to be taken in every evening, to be again taken out every morning. The difficulties of the operation deter most farmers from undertaking it, except those that own small farms where everything must be turned to account, and that cultivate them themselves with no other help than that of their families. The small quantities thus prepared are gathered at the end of the season by commercial travelers, who pay from 1.50 to 2 francs per kilogram for Marseillaise figs (which are the most esteemed variety), and generally mix them with figs imported from Italy, Spain, Algeria, and the East. It is, in consequence, impossible to form any idea of the importance of the production, or of the proceeds. In 1882 the importation of figs from the above named countries amounted to nine million nine hundred and sixty-four thousand seven hundred and forty-three kilograms, whereas, the exportation was not even given separately, for it was included in the official returns with that of other dried fruit not elsewhere specified, amounting in all to three hundred and ninety-seven thousand two hundred and sixty-nine kilograms.

The climate of this consular district does not agree with orange and lemon trees, which are not seen in the open field except at a short distance from Nice.

J. S. MARTIN, Jr.,
Vice and Deputy Consul, Marseilles.

ITALY.

REPORT BY CONSUL—GENERAL RICHMOND, OF ROME.

In Italy many varieties of the *Ficus carica* are cultivated. The widest spread of these varieties may be divided into two groups, as follows: The *Fico gentile* and the *Fico portoghese*, which are the earliest; the *Verdini* and *Brogiotti neri*, the *Brogiotti bianchi*, the *Brianzosi*, the *Datteri*, or *Dottati*, which are thick skinned. All these varieties bear fruit only once a year. The *Fico albo* and the *Fico San Pietro* bear fruit twice a year. A fig tree of medium size will yield generally from forty-four to sixty kilograms of fruit. Usually the fig is planted in company with other fruit trees (olive, almond, and others); but fig orchards, where figs alone are grown, may be found (at Lecce, for instance), and in such cases the trees must be planted at such a distance apart that when they reach their fullest development they may not come in contact one with the other; (1) because the fig needs a great deal of sun; and (2) because, otherwise, if the partial and easily located infection called rizoctonia should show itself it would spread rapidly through all the orchard. In many places it is the custom to alternate the fig, almond, and olive, so that each fig tree may be isolated.

In Tuscany the figs called Dottati are preferred for drying. They are peeled and dried in the sun, and then, with a slight sprinkling of anise seed, are rolled into disks or small loaves. In other cases the rind is not removed, but the fig is split in two, flavored with anise or fennel seed, dried in the sun, and so sent to market.

The common purple or black figs are dried in the oven or in the sun, just as they come from the tree. At Lecce, Reggio, Calabria, Cosenza, and Cotanzaro this system is adopted. They also make a fig paste with walnuts, almonds, cinnamon, etc. It is customary to drop a little honey on them while drying.

There are coming into use stoves with hot-air chambers, especially adapted for drying figs as well as other fruits.

LEWIS RICHMOND,
Consul-General, Rome.

CATANIA.

REPORT BY CONSUL WOODCOCK, OF CATANIA.

Of the fig tree there are several varieties; some yield a large fruit, others small. The fruit also varies in its degree of sweetness; also in color from white to black. The fruit of some varieties ripen sooner than that of others. The trees grow well in poor or rich soil, and bear abundantly in our mild climate (mountain side, if not too high), or hot climate (of the valleys). The soil for the fig must be dry. It will not flourish in wet ground.

The favorite varieties here are the Sangiovannaro, the Sottuno, the Melinciano, and the Ottato. The Ottato has smooth leaves; the peduncle of the flower and fruit is longer, and the fruit is sweeter than of other varieties. The fruit of the Ottato is best for drying.

The fig is here propagated from the suckers that spring up from the roots; cuttings from the tree also are used in propagation. Cuttings in this climate should be set in the months of February and March. In

orchards the distance to be maintained between the trees is eight meters (twenty-six feet). The fig is long lived, because it is constantly being renewed by shoots that put up from the roots, taking the place of the main trunk when it becomes old and decayed. The soil must be worked in the spring; also, in November following. The best varieties are grafted, also budded upon the stock of the wild fig. Grafting and budding are also done upon healthy trees of the best varieties. The time for pruning is in March, or when in blossom in June. All dead and diseased branches should be cut away. But little pruning is necessary. Too much is injurious.

Figs here are dried in the following manner: The fruit must be gathered when partially ripe. It must not be what is termed "dead ripe;" in other words, it must be more green than ripe. When gathered, give the fruit a plunge bath in boiling water, removing them from the water quickly. Then place the fruit in a shady place. The next morning at sunrise spread the same upon a platform (not upon the ground, because of its dampness), that it may be flooded with sunlight. Here shallow willow-work baskets are used for holding the fruit while drying. These are never placed upon the ground, but in an elevated position. At going down of the sun the fruit must be covered to protect it from the night dews or unexpected showers of rain. Continue thus for several days until the fruit becomes dried.

When dried, place the fruit in layers in small boxes or baskets, artistically and neatly arranging the same. Press the fruit down firmly by hand, and continue the layers of fruit until the vessel is full. The boxes (or baskets) must be securely covered and kept in a dry place.

The culture of the fig is not a specialty in this part of Sicily; but little of the fruit is exported from this district, and none from Catania to the United States.

The raisin grape is not cultivated here. The grapes grown in this part are manufactured into wine.

ALBERT WOODCOCK,
Consul, Catania.

MESSINA.

REPORT BY CONSUL JONES.

Varieties.—The best varieties for drying are the *Fico albo*, or white fig (round), and the *Fico petrociano*, or purple fig (oblong). The best varieties for eating, when ripe, are the Brogiotto, the Adottato, the Graziano, the Catalano, the Palermitano, the Verunio (winter fig), and the Lardaio.

Tree Planting.—The above named varieties are grown throughout this province. They are not planted by themselves, but are scattered through the vineyards, groves, orchards, and pasture lands.

Distance from Sea.—The fig thrives ten miles from the seashore. The Brogiotto and the Petrociano do better near the sea than any other varieties. The Graziano is illy adapted to low levels and sea breezes.

Elevation.—The fig does well at an elevation of two thousand feet above the sea level.

Exposure to Sun.—All exposures suit the fig. A northern exposure is the least desirable.

Position.—Hillsides suit the fig best. At but a slight elevation above the sea the fruit is insipid, and soon spoils. The finest trees are to be met with at an elevation of from nine hundred to one thousand two hundred feet above the sea. Upland fruit has the highest flavor, and the best keeping qualities.

Soil, etc.—The fig delights in a friable, dry, and somewhat cold soil, composed in special of the detritus of calcareous rocks. It shuns wet and marshy soils. The best soils for figs for drying are hillsides of disintegrated calcareous rocks of the Tertiary and Quaternary periods. Soils in which sulphur abounds are excellent for the fig.

Climatic Influences.—Spring frosts and autumnal fogs are disastrous to the fig; the former kill the young buds, and the latter cause the leaves to fall off, which prevents the fruit from ripening.

Temperature.—The fig requires a temperature of from 28 degrees to 95 degrees Fahrenheit; average temperature, 66 degrees Fahrenheit.

Rainfall.—The fig requires from twenty-two to twenty-eight inches of rain annually. It suffers greatly during protracted droughts. Spring and summer rains are always of benefit to the fig. September rains are most injurious; they are heavy, and so charged with nitrogenous salts that they cause the nearly ripe fruit to split.

Irrigation.—Irrigation is not required by the fig. When grown in orange and lemon groves which are subject to irrigation, the fig produces a large crop, but its fruit is inferior in quality, and is lacking in keeping qualities.

Cultivation.—The fig might well be called the pariah amongst plants. It is rarely worked; occasionally the soil is stirred around the base of the tree (in November). When grown with orange and lemon trees, vines, etc., being worked when they are worked, it comes into bearing early and dies early.

Fertilizers.—In this district the fig is not even fertilized with its own leaves, which are gathered and fed green to cattle. Stable manure does not suit the fig; ashes and rags are better adapted to it.

Pruning.—The fig is never pruned, as pruning causes the wood to rot; dead branches only are removed.

Picking and Curing.—Figs for drying are left on the trees until they are overripe and soft. The season for gathering depends upon the time of flowering. The varieties that produce two crops a year, such as the *Fico albo* and the *Fico petrociano*, bear their first crop in June and July, and their second crop in September and October. The fruit of the one-crop varieties, the Brogiotto, Graziano, Catalano, ripen in September and October.

Figs for market are gathered at sunrise or at sunset. Figs for drying are gathered at noon.

A small plot of land, near the farmer's house, is carefully swept and inclosed by a temporary brush fence. In this space large flat trays, made of reed cane, are laid on the ground, and the figs to be dried are spread out upon them. The figs are turned over daily at noon until they are thoroughly dried. They are left out at night unless it rains. Some figs are dried whole, others are cut in two. When dried the figs are strung on pieces of split cane twenty-four inches in length. If a fig does not split open when pressed between the first finger and thumb, it is thoroughly dried and ready for exportation.

Should it rain on figs put out to dry, they are put in an oven and dried. Figs dried in an oven are inferior to those dried in the sun. These figs are never dipped in any kind of solution whatever. They are cured simply as above stated. The exporter, not the grower, boxes this fruit.

Planting and Propagating.—Properly speaking, there are no fig plantations. Figs should be planted from twenty-four to thirty-six feet apart; dwarf varieties from fifteen to twenty-four feet.

The best varieties are propagated by budding. The fig is also propagated from cuttings—the cuttings are set out in winter; no manure is used. Old fig trees are cut down, and the most vigorous shoot sent up by their roots takes their place.

Maturity.—Very few trees live forty years. The fig begins to bear the year it is set out, and goes on bearing as long as it lives. At twenty years it produces its maximum crop.

Insect Pests.—The *Coccus ligniperda*, a large night moth, destroys nearly every tree that it attacks. The homopter (*Columnea testudinata*) covers the trees with little pustules (fig tree scale or mange) as it feeds on the tender twigs, leaves, and fruit. Remedies: Bleed the tree or sprinkle it with a mixture of kerosene and water—nine tenths water to one tenth kerosene.

The *Halterophora hispanica* eats into the pulp. Remedy: Smoke the tree during July and August with sulphur fumes.

There are no parasites of the injurious insects of sufficient importance to mention.

WALLACE S. JONES,
Consul, Messina.

NAPLES.

REPORT BY CONSUL CAMPHAUSEN.

Varieties.—The name of the best variety for drying is the Dottato, and for eating when ripe, the Twiano. The other varieties worthy of culture and for profit are the Samese, the Nerolello, and the Paradiso.

Situation.—The trees that produce the varieties above mentioned are grown in the Province of Naples. The Twiano is largely cultivated on the plains of Sorrento, where it attains a height of from thirty to forty feet and eighteen inches in diameter. Some trees reach a height of fifty feet, and yield about nine hundred pounds of green fruit per year, which matures between August and the first half of October. Some of these trees grow about two thousand two hundred feet above the level of the sea in Mojano, near Sorrento; but fig trees grow generally on land varying from three hundred to six hundred feet above the level of the sea. Figs are also largely cultivated in Basilicata and Calabria.

Climatic Influences.—Rain is very beneficial to the trees and also to the fruit. What was said regarding the climatic influences regarding lemons and oranges, applies also to figs. During the months of June, July, August, and part of September, there is generally no rain at all, but the atmosphere is moist and vegetation hardly ever suffers from drought.

Irrigation.—Fig trees do not require any irrigation; neither are the orchards cultivated nor fertilized.

Pruning.—Every two years in the month of January, in the usual manner.

Picking and Curing.—They are picked from July to September, when they begin to soften and the skins burst. After they are picked they are cut in two and dried in the sun, and finally put in boxes. They are not dipped in any solution. The treatment is very simple, about like the drying of apples in the United States.

Planting and Propagating.—The trees are planted about thirty feet, and propagated from sprouts, slips, or graftings. (All trees in this district are propagated from sprouts.) The orchards are of all sizes. They (fig trees) are usually planted among other trees.

Maturity.—Sometimes one hundred years, bearing all the time.

Insect Pests.—The *Cocciniglia*, which must be looked for and destroyed by hand. There are no beneficial insects.

Cuttings.—Cuttings may be secured by writing to Dammann & Co., at San Giovanni a Teduccio, near Naples.

EDWARD CAMPHAUSEN,
Consul, Naples.

PALERMO.

REPORT BY CONSUL CARROLL.

The introduction of the fig tree into Italy is so remote that it is difficult to even approximate the period thereof. Pliny refers to a tree which existed long anterior to the founding of Rome, under which the citizens of that city were wont to assemble to discuss the topics of the day, years thereafter. Tradition ascribes this tree to have been that under which Remus and Romulus were found, and in commemoration thereof it was preserved.

The fig tree grows spontaneously in the arid wastes of Greece, Asia, and northern Africa. The fig is not, properly speaking, a fruit, but the receptacle of vast quantities of flowers, occupying the interior thereof, which, upon the completion of fecundation, mature seeds; the receptacle growing and thickening, acquires all the qualities of one of the best fruits.

In countries where the thermometer does not fall below 59 degrees Fahrenheit, the growth and maturing of the fig proceed without any appreciable interruption; but in colder countries, upon the advent of the first frost, the fig tree loses its leaves, and those seed receptacles which, under favorable circumstances, would have continued to develop, harden and remain inert until the following spring, when, with the return of warm weather, they resume their growth, being the first to mature in the summer. The figs thus resulting are denominated "fig flowers," in order to distinguish them from those which first appear in spring and mature later.

In hot countries the fig tree grows to large proportions, and in isolated and favorable localities it assumes a beautiful form, without need of modification or pruning. Its branches project themselves regularly toward the earth from year to year, and finally reaching and entering it they throw out new roots, thus forming additional sources of propagation.

The tree prospers best in a deep, rich, moist, calcareous soil, but in a warm climate it will grow in almost any soil.

The fig tree is propagated from the seed, slips, and roots, as well as by grafting, but the former method is rarely resorted to on account of the slowness thereof, and only under peculiar circumstances.

A good method to propagate the fig on a large scale is to amputate a young tree at a point of about two inches from the ground, and as a

result, and soon thereafter, a myriad of sprouts or branches present themselves, which, in due time may be bent, and the ends thereof buried in the ground to the depth of a few inches.

After the branches in question take root they should be amputated close to a joint, thus detaching them from the parent tree, each of which then being a separate tree, may be planted at pleasure.

There are many varieties of figs, differing in size and color, the white growing larger, and, in a fresh state, not standing transportation.

The fig in most favor here is that known as the "Indian fig." It is a native of South America, and is the dried fig of Italian commerce. It only prospers, however, in southern countries, and in calcareous ground without too much moisture, etc.

PHILIP CARROLL,
Consul, Palermo.

SICILY.

REPORT BY CONSUL LAMANTIA, OF CATANIA.

Varieties.—The name of the best variety for drying is the Dottato, an excellent quality of fig largely cultivated. Figs with fine peel and small seeds are also worthy of culture and best for drying.

The names of best varieties for eating, when ripe, are the Sangiovannaro, the Datternolo (an early fruit), and the Natalino (a late fruit).

The other varieties worthy of culture and for profit are the Melanzana, the Olivuzza (a small fruit), and the Ficazzana (a very large fig).

In reference to the latter, I desire to mention it, for the reason that it is an extraordinary large black fruit, bearing twice a year, viz.: about the end of June; and the second crop, larger than the first one, commences in August and lasts till the end of October. This fig, however, is not for drying purposes, but simply for eating when fresh. The fig is so large that six generally weigh about two pounds.

Situation.—The trees producing said varieties grow around Mount Etna, as well as in the low lands of this province, from three hundred to six thousand meters from the seashore, and from five hundred to six hundred meters above sea level. When exposed to sun, on level ground, they yield more fruits, but those on hilly, rolling land produce them sweeter. The same grow also by the seacoast, and either in poor or rich soils. The soil must be rather dry, for in wet ground the fig tree does not flourish well.

Climate.—The minimum temperature is 5 centigrades in January; the maximum, 35 in August, and 17 average in May.

The sweetest drying figs are grown in mild climate land, while those in warm regions are fit for eating when fresh. Rainfall in this province is known to be at an average of twenty-five to thirty inches per year. Rain favors these fruits greatly when they are small, before maturity; but when full ripe it hurts them badly, making them lose their natural, sweet flavor.

Irrigation.—Irrigation is never resorted to, the rainfall being sufficient.

Cultivation.—Cultivation is very simple, and it does not require much labor to be done. A good digging in summer and winter time is more than sufficient. The planting is seldom done by rows, and the trees are generally spread out through vineyards and olive groves, where they grow and bear well.

Fertilizers.—This plant, as a rule, is never manured in Sicily; but in arid lands it is always better to remove from time to time the ground, in order to give its base some fresh air.

Pruning.—Pruning is done by cutting off all the dead branches, and the best time to do so is in the months of March and June, or when the pitch is dry. In hot climates, however, pruning is not necessary, for the reason that the plant is one of those which, left to itself, yields always many fruits.

Picking.—Picking is done when the fruit is fully ripe, and generally not before the sun is up, so that the fruit is dried from the night dew. The process of drying is very simple, and is as follows:

Curing.—When the figs are thus gathered they are cut in two, and so set on planks and exposed to the hot sun's rays for drying. Every once in awhile they are capsized, to be dried on both sides. In the evening, however, they are taken into houses, or are well covered, to protect them from the night dew, dampness, or rain. After four or five days, when they are sticky dry, they are pressed by hand, facing one another together on the pulp sides, and then they are passed through with a big needle and twine and formed in *reste* (traces) of about two feet long. Others, dried in the same way, are passed through small sticks and formed in *chiappe* (square tables) of about one and one half feet each way. After this has been done, the figs so dried and prepared are dipped for a few minutes in hot water, to prevent them from fermentation, and exposed to the sun again for drying.

The small figs, however, are picked, dried, and cured in the same way—but not cut open—and pressed and packed, with some laurel leaves, in boxes containing twenty-five pounds, and in round or square baskets for shipping, many of which are exported to the United States.

Planting and Propagating.—The distance planted apart is from twenty to thirty feet. They are not planted in rows, but are generally scattered in vineyards and olive groves, where they grow and produce well. Propagation is generally done by *succhioni* (suckers) springing from the roots, or by *talee* (cuttings). Seeding propagation is seldom used, as it is difficult, and trees so obtained take a long time to bear. The orchards are small ones in some localities, while in others are pretty large and give favorable production.

Maturity.—The fig tree lives very long and is almost perennial, for the reason that shoots springing from the roots take the place of the old trunks on decaying.

Insect Pests.—The insects injuring the fruit and tree are: The Bostrico (*Bostricus fici*), the Cocciniglia (*Ceroplastes caricæ*), and the Psylla (*Psylla fici*).

The Bostrico is a very small insect, which digs a gallery in the trunk, under the bark, causing the tree to rot and die. Said insects, during the fall and winter, abide in lethargy under the bark of the tree; and in summer, after they have joined together with the females, go on the branches to deposit their eggs.

The "cochineal" is known from the remotest times. At first blushing it appears like a small piece of whitish wax, and, in fact, this insect, from its chemical composition, is of a wax nature, and, like the other cochineals, the females protect under them their eggs, and when dead their corpses act as a covering. The fig tree, badly attacked by the said insect, follows the same phenomenon as the olive tree and acid fruit trees in similar conditions. The leaves become covered with a sort of black smoke, owing to a very small microbus (fumago) generating from the sticky substance which forms the so called melata (sugar and gum) perspired from the leaves, on account of the cochineal's presence, although they stay on the branches and not on the leaves. The damages brought the fig tree by the cochineals it is useless to speak of, as they are identical to those caused by other cochineal and aphis. To destroy the same, it is necessary to cut all the branches off, when badly attacked, and burn them.

The Psylla is quite different from the olive Psylla. It generally lives on the leaves, sucking their humors and causing the tree to become quite a skeleton. Besides destroying them, the branches thrive ill, the fruits fail, and the tree remains damaged. The insect is a little larger than the olive's Psylla, with greenish body and large, transparent wings. The larva seems to have no waxen secretion, from the fact that no such substance is seen on the leaves like soft cotton.

VINCENT LAMANTIA,
Consul, Catania.

PORTUGAL.

THE AZORES.

A considerable quantity of figs is produced, but they are consumed in a fresh state, with the exception of a small proportion converted into an ordinary brandy for home consumption. Scarcely any are dried, the climate being unfavorable to the operation.

S. W. DABNEY,
Consul, Fayal.

SPAIN.

MALAGA.

REPORT BY CONSUL MARSTON.

Varieties.—The names of the best varieties for drying and eating when green are the *Hijo Verdijo*, thin skin, white, and very sweet when green and ripe; the *Hijo Blanco*, a white fig with harder skin; and the *Hijo Panetejo*, brown in color, inclined to purple. All the above are good to eat either fresh, or as they say here, "green," or can be dried as figs. The quality is in accordance with the order in which they are given, the first being considered the best, the second the second best, and the third inferior.

The trees that produce the varieties of above named figs are grown throughout all the provinces of Pralaja, Granada, Almeria, Sevilla, and all other provinces of southern Spain.

Situation.—Distance from sea, two kilometers; elevation above sea level, one hundred feet. The more sun the better. Hilly land is the best. Sandy subsoil is best.

Climatic Influences.—Temperature, 45 degrees, 90 degrees, and 78 degrees Fahrenheit. No record of rainfall to be had here. The trees require no more water than falls naturally in rain.

Irrigation.—No irrigation for figs.

Cultivation.—Dig around the roots in the latter part of November or December, to the depth of eighteen inches, and use stable manure.

Fertilizers.—None used here.

Pruning.—In the month of December, by cutting the ends of all projecting branches.

Picking.—In the month of August, when fully ripe, and when the sun is shining brightest.

Curing and Packing.—When the figs are quite ripe they are picked only on fine days, during sunshine, and are cured in the same way that raisins are dried. The sun furnishes all the heat required. It is enough to construct simple divisions, made of either brick or stone, exposed to its rays, in an inclined position, say ten yards long and two yards wide. The divisions or apartments are built up at one end with a sort of triangular masonry, which, from afar, gives them the appearance of a range of uniform tombs. The triangle is so constructed that the sun, during clear days, never fails to shine upon the contents, the interior of these divisions or compartments being filled with fine gravel, which attracts the heat.

Immediately after picking the figs are placed in these divisions, and are exposed to the heat of the burning Andalusian sun of August. Never, it appears, have they dreamed of ascertaining the degree of heat thus obtained, but the experienced cultivator affirms that they do, during the heat of August, attain a temperature of 145 degrees Fahrenheit.

At nightfall a very simple method of covering is applied to guard the figs from the heavy dews or rain, either of sail cloth or heavy canvas, so arranged that it covers entirely the figs that are drying within, and being supplied with rings on the two sides, slide up and down as a curtain at a moment's notice. In many places planks or boards are used for covering, giving the appearance of a sort of roof. The figs, during the process of drying, which occupies from ten to fifteen days, are turned over and over, in order that they may dry and color uniformly. When completely dried, they are then packed in boxes, or frails, the latter made of the palm leaf dried, nailed or sewed up, and are then ready for shipment. They are not dipped in any solution.

Planting and Propagating.—Planted apart about five yards, and propagated by planting a branch when the tree is beginning to bud. The orchards are mostly large.

Maturity.—The tree begins to yield in six years, and lives seventy-five to one hundred years.

Insect Pests.—There are no insect pests or parasites.

H. C. MARSTON,
Consul, Malaga.

TURKEY.

REPORT BY CONSUL-GENERAL HEAP, OF CONSTANTINOPLE.

Production.—The fruit of the fig tree may be reckoned among the staple foods of man for ages before cereals were cultivated by any settled agricultural population. In the temperate regions, where it thrives best, it fills the place of the banana of tropical climates, and yields fruit during several months of the year. In Asia Minor, where the tree is found wild, and where the best figs of commerce are grown, it is extremely fruitful.

The best figs for drying come from the valleys of the Meander and the Kaistros, to the south of Smyrna, where the trees are planted with

great regularity and care, and the ground is dug and hoed from four to six times during the summer. When the figs reach Smyrna they are sorted by women and packed in boxes by men. They are best when newly packed, and as months go by get drier and harder in the warehouse. No one who has not eaten them in the Levant, packed in the ornamental drums in which they are sold for local consumption, knows what the best figs are like. The cardboards of the fig boxes are supplied chiefly by Belgium and Austria.

Two seasons ago fifty-four thousand camel loads of four hundredweight each had reached Smyrna by the twenty-second of October of that year; and the production increases annually. Fifteen years before that time not more than half that amount was recorded for the whole season.

England, Germany, and the United States take the greatest part of the figs exported. France, where the smaller and much inferior figs of the Mediterranean are consumed, takes little of the finer kind of the figs of Smyrna.

The improved facilities of transport which have so much increased the stock brought to market, have also brought down prices. Taking averages, prices ranged about ten years ago from \$4 08 the kintal (one hundred and twelve pounds) for Aidin figs, to \$8 75 for Elémés, while the very best, the Ekinis, sometimes brought \$19 22 the kintal, or nearly 16½ cents per pound. Now small parcels of excellent quality bring about \$6 60 the kintal.

Although throughout the world there are to be found about one hundred different species of figs, only some five or six kinds are cultivated in this country. Of these, the best description are called Elémé, and are grown most largely and in the greatest perfection in the districts around Smyrna; but considerable quantities are also grown in other parts of Asia Minor. The fruit is of various colors, from deep purple to yellow or nearly white. The tree usually bears two crops, one in the early summer, from the buds of the previous year, and the other in the autumn, from those of the spring growth. The last forms the chief harvest.

Yield.—The trees are propagated by seeds and suckers, and frequently by layers and cuttings. When young they require care in pruning, and the immature fruit formed late in the summer should be removed to strengthen the shoots.

The *Ficus carica*, which yields the well known figs of commerce, is a bush or small tree, rarely more than eighteen or twenty feet in height, with broad, rough, deciduous leaves very deeply lobed in the cultivated variety, but in the wild plant nearly entire. After the young tree attains maturity it receives but little care beyond being occasionally lopped in places, and being well manured in the fall of the year. The fruit begins to ripen at the end of June, and the summer yield, which gives employment to a large population, comes to market in immense quantities in September and October. The trees sometimes give a third crop, which ripens after the leaves have fallen.

Curing.—When ripe, the figs are picked and spread out to dry in the sun, the sugar which they contain in abundance being thus rendered available for their preservation, those of better quality being much pulled and extended by hand during the process. Thus prepared, the fruit is packed closely in barrels, rush baskets, or wooden boxes, for commerce. Recently the practice of preserving fresh undried figs has been adopted, but the amount used in that form is as yet insignificant compared with the quantities that are preserved by drying.

Observations.—Figs, especially when fresh, are largely used by the local population as an article of food. The trade in this fruit is of long standing and of very considerable importance in this country. During the year 1880–81 Smyrna District exported six thousand nine hundred and ninety-one and one half tons, worth at the port of shipment $1,646,-998 89. The exportations were principally to England, Germany, the United States, and France. In one fortnight no fewer than one hundred and ninety-five thousand barrels, cases, bags, boxes, drums, and baskets of figs and raisins were shipped from Smyrna alone. The export trade of figs at the other Turkish ports is unimportant in comparison with Smyrna. Figs are grown largely in the other provinces of Turkey, but the quantity exported is small compared with Smyrna. They produce but little more than is sufficient to meet the local demand; but if railroads existed in the interior, the production would be immensely increased.

It is probably not generally known that a considerable quantity of the inferior kinds of figs find their way to the Austrian "chicory coffee makers" and the French brandy distillers. Much liquor labeled "fine champagne," "cognac," etc., owes its origin to the refuse of the Smyrna fig market.

G. H. HEAP,
Consul-General, Constantinople.

DARDANELLES.

REPORT BY CONSULAR AGENT CALVERT.

Varieties.—Figs are not dried here. The best variety for eating when ripe is the Syah Ingir (black fig).

Trees.—Very few trees of other kinds are cultivated. The trees producing the figs are grown in Thracian Chersonese, Dardanelles Coast, and elsewhere. They are planted from the sea inland, but not above one thousand five hundred feet, and open to all exposures.

Soils, etc.—All soils and position, rocky ground with sunny exposure, produces the best flavored fruit. Alluvial, light, and stony soil in general; hard subsoil is best suited to the fig.

Climatic Influences.—Rarely above 90 degrees or below 5 degrees Fahrenheit.

Rainfall.—Thirty inches per annum. Much rain is apt to cause the fruit when ripening to split and decay.

Irrigation.—Irrigation is not practiced.

Cultivation.—No method of cultivation practiced.

Fertilizers.—No fertilizers are applied.

Pruning.—No pruning. Suckers are removed.

Picking.—When the fruit matures the early morning is the best time for picking.

Planting and Propagating.—Trees are planted from fifteen to thirty feet. The ordinary method of propagation is to take a cutting (or branch *torn off* preferred) three to four feet in length, with terminal bud. A trench about twenty inches deep is made, the branch is layered with the end projecting four to eight inches above ground. If the summer be dry, a little water is given the first year. Suckers and spray-wood are

not generally planted (unless to be grafted like the wild fig), as they produce fruit inferior to that of the parent tree.

Orchards.—All sizes.

Maturity.—Fifty to a hundred years. Fruitful till decay. The stem, when it decays, is almost alwas replaced by its offshoots.

Caprification.—A contested question is that of caprification. The prevailing idea is, the parasite of the *Ficus carica*, or wild fig (called by the natives the male fig), fertilizes the cultivated tree. The *Blastophaga grossorum* and *Cynips sycamori* are now recognized to be the apterous male and winged female of the same insect. So rooted is the idea, that in a year of scarcity the puff figs are sold at $2 and $3 per pound, to suspend on the cultivated fig tree. A series of observations have been made to test the theory in different countries. I was requested by Sir S. Saunders, of the Entomological Society of London, to contribute by the examination of the fig trees in these parts. Like all the other observers, I found the parasites and their ichneumonidæ in abundance in the wild fruit, but failed to discover any trace of these insects in the cultivated fruit at any stage of its development.

Insect Pests.—A kind of blow-fly sometimes attacks the fruit when mature, especially when damaged by rain.

The matter relating to the parasites was published in the "Entomological Monthly Journal" (London). No Government statistics exist.

FRANK CALVERT,
Consular Agent, Dardanelles.

CONTINENT OF AMERICA.

MEXICO.

LA PAZ.

REPORT BY CONSUL VIOSCA.

The Spanish or Moorish black fig is the best for preservation and for palate taste, and is very juicy once dry. The best varieties for eating, when ripe, are the Bordeaux and Smyrna white fig, but the early black Moorish (*breva*) is superior. Dried figs are an important export industry in this country, and their growth is found in every watering place or valley in this country. Trees are generally planted in limish and sandy soil, and whenever the soil is too rich, ashes of any kind mixed in the soil is its best fertilizer. Never use manure or guano; it is the worst enemy of the fig tree; the fruit becomes tasteless, and besides attracts the insect pest called *Conchita* (turtle shell).

In pruning time, which is in October, the tree is simply cleaned out of dry branches or young ground-root shoots.

Picking and drying takes place in May and June, before the first rain falls. Early figs in April and part of May.

In this country the fruit is simply spread on the top of the house's roof or on mats, with full sun exposure all day, and at midnight it is taken into the houses.

JAMES VIOSCA,
Consul, La Paz.

ECUADOR.

The only kind of fig grown in Ecuador is the purple.

Though the fruit does well it is grown only in a small way. The trees should be subjected to treatment similar to that of the orange and lemon, in which respect the requirement is lived up to in Ecuador, all being neglected. A tree in full bearing will yield about one hundred pounds of fruit.

None of the fruit is dried in Ecuador. All that is grown is consumed fresh or made into sweetmeats.

HORATIO N. BEACH,
Consul, Guayaquil.

CONTINENT OF AFRICA.

MOROCCO.

REPORT BY CONSUL MATHEWS, OF TANGIER.

Varieties.—There are various kinds of figs—white, red, and black—which are dried for commercial purposes. Of the white variety there is the White Burgasot, of excellent flavor both fresh as well as dried. It does not produce the early large fig, but only second season figs.

The Marseillaise, or Athens Fig.—Fruit very sweet and small, round in shape; it ripens in August, and is the variety most preferred for drying.

The Blanquette Fig.—A middling variety, which resists cold weather better than any other varieties, and can prosper north of the regions of the olive; is also of second season, and is preferred while ripe before drying.

Of the red varieties the best for drying are the following: The *Date fig*, the most preferred for drying purposes; it ripens in August. The *Jerusalem fig*, matures in September; very fine and large. The *Rose Blanche*, very large, and is only used for drying. *Sultana*, or *Tunisian*, a large, choice variety similar to the Smyrna.

There are numerous varieties of black figs, bearing a different name in the various countries where they are grown.

Morocco produces a large variety of most delicious figs. They are called by the Arabs "Kermuse" in general, although each variety has its name. There are figs of various colors, some of which are white, yellow, black, purple, and others green. The Jews extract "aguardiente," an ardent spirit, from figs. In Spain they prepare a savory wine from which they extract spirits, which they flavor and term "anisette."

Suffren has given a description and figure of three hundred and sixty varieties of figs cultivated in Spain, France, and Italy. Most of the fig trees yield two crops during the year; the first, producing the large fig, matures in June, and the second in August, September, and October. The fig tree grows on any soil, provided it is free of stagnant water retained on the surface over the roots. It prefers a light loam of a calcareous nature; should this retain its moisture the trees would grow taller; in dry soils the fruit is smaller.

Planting and Propagating.—The fig is propagated from seed, shoots, suckers, slips, stakes, layers, and by grafting. From seed is only practiced by some to discover new varieties. In raising from slips or

stakes, these should be chosen from vigorous branches of the shoots of the previous year, and about twenty-six inches in length. The proper time is either in February or November. A hole is opened about two and one half feet deep; good manure and a little lime should be well mixed with the soil which is dug out of the hole. The slip or branch is then laid horizontally, leaving out the last eye perpendicularly, which on shooting out will form the tree. Budding or grafting is seldom practiced in fig trees. The distance between trees should be sixteen feet. During the heat of summer of the first two years the young plants should be watered.

Fertilizing.—Manuring the trees will greatly increase their crops. They require no pruning, only removing dry branches and new shoots from the trunk. When the tree obtains age it requires no cultivation. It is well to cover with straw the branches of the trees while from one to three years old, in the winter in cold climates, to protect the eyes from frost, after which the trees become hardier as advancing in age. There are male and female trees; the male is the wild, or goat fig.

Male and Female Fig.—There should be amongst the fig orchards some of the masculine species, as those trees producing the small variety of fig, and which yield so abundantly, require the proximity of the male sort to come to full maturity and size, otherwise the fruit drops before coming to maturity. In the absence of male trees in an orchard where these varieties are growing, the male figs, which are very small, and unfit to eat, are brought and hung to the branches of the feminines. The wild fig produces a multitude of small insects of the genus *Cynips*, which, settling on the fruits of the cultivated trees, convey the pollen with which they are infected. This is a practice from time immemorial.

Maturity.—The fig trees commence to yield fruit when they are three years old, and come into full bearing when they are twenty years of age. From one hectare of land the yield generally is about four thousand kilograms of dried figs, at value of $5 per one hundred kilograms; total, $200.

Yield.—As an example of the great yield of the fig tree, I may cite some trees at San Pedro del Pinatar, Spain, which produced each as much as $12 of early figs, besides one hundred and fifty pounds of dried, sold for $3, and seven quintals of second size figs, sold for $9 50, which makes the yield of each of these trees, in full bearing, annually, to the amount of $20 50.

Curing the Fig.—The fruit must be gathered when quite ripe, when they commence to dry on the tree, on a clear sunny day, after the dew has dissipated. They are exposed to the sun in lattice work made of canes or slips of boards, or in rough straw mats placed from the ground, allowing, if possible, the air to circulate under. The figs, after a few days, are pressed one by one into shape, to facilitate their curing. After sunset the fruit is removed to a dry and well ventilated place for the night. This operation is followed until the figs are perfectly cured. When they are selected, the various sizes are spread on sheets for a few days in a ventilated place, the windows of which must be closed when the atmosphere is damp; and, lastly, the figs are pressed downwards on a table, to give them a round shape; then they are packed in boxes lined with paper. The boxes must be kept in a dry and ventilated room. The common figs are packed and pressed in mats.

FELIX A. MATHEWS,
Consul, Tangier.

CRYSTALLIZATION OF FRUIT IN FRANCE.

MARSEILLES.

REPORT BY CONSUL MASON.

The business of preserving fruits by the crystallizing process is peculiar to southeastern France, and is practiced on a large scale at Apt, in the Department of Vaucluse, at Clermont, in Auvergne, as well as at Marseilles, Grasse, Avignon, and other places of less importance.

The product is exported largely to England, the United States, and various other countries, including Algiers, the East and West Indies, and even South America, where the profusion of fresh fruits would seem, at first thought, to render such an expensive import almost superfluous.

The kinds of fruit preserved by this process are mainly pears, cherries, apricots, pineapples, plums, figs, citrons, oranges, melons, and a kind of dwarf orange called "chinois," which grows to some extent in the District of Nice, but is imported here mainly from Italy and Corsica. Peaches are used for this purpose only to a limited extent in the region of Marseilles, the "freestone" varieties being too costly and the supply too small for profitable use on a large scale.

The crystallizing process is in principle simple and nearly uniform for all the above kinds of fruit, but it requires a certain skill and delicacy of manipulation which can only be obtained by experience, and which it is difficult to precisely define.

The essential thing to be done is to extract the juice of the fruit and replace it in the pulp with liquid sugar, which, upon hardening, not only preserves the fruit from fermentation and decay, but retains it in its original form and consistency. For this purpose it is necessary that the fruit should be fresh, clear of all decay or other blemish, and of precisely the correct degree of ripeness. This last is an important and difficult requirement, as the proper degree of ripeness for crystallizing varies with the different varieties, and is so precise as to exclude from use for this purpose much of the fruit sold during the season in open market, and which has not been gathered, assorted, and transported with sufficient care.

Supply of Fruit.

In the neigborhood of Apt and Avignon, where this method of preserving forms a leading industry, fruit growers are carefully instructed in this respect, and deliver their crop to the confectioners in the best condition. Contrary to what is popularly believed, native fruits are rarely or never really cheap in southern France, except sometimes for a brief period, when, by reason of some exigency of weather or sanitary trouble, the supply of apricots, figs, or melons may temporarily exceed the demand.

Oranges, which come from Spain and Italy, and citrons, from Corsica and Algiers, are, in favorable seasons, plentiful and reasonably cheap; but apples, pears, cherries, peaches, plums, and berries are always costly in the market of Marseilles. At this time, the end of October, ordinary apples command, at retail, from 4 to 8 cents per pound, and the average

price paid by confectioners for the various fresh fruits used in crystallizing varies from 8 to 10 cents per pound.

At Apt and Clermont, which are small towns in the midst of fruit-growing districts, prices are somewhat less than this. Refined sugar, the other principal material, costs $9 65 per one hundred pounds. If moist or inferior sugars are used, this item of expense may be slightly reduced, but the saving thus effected is more than lost by the inferior quality of the product. This is exemplified by the Corsican citron preserved at Leghorn.

It will be borne in mind that the preserved fruits under consideration are of two kinds, "*fruits glacés*," glazed, and "*fruits crystallisés*," but this difference relates simply to the exterior coating of sugar, which results from the final stage of the process. Until that finishing process is reached, the method of preparing glazed and crystallized fruits is identical, and the value of the product is the same.

The Process of Crystallizing.

The fruit is first carefully assorted in respect to size and uniform degrees of ripeness.

Pears, pineapples, and quinces are pared, citrons are cut into quarters and soaked a month in sea water, and the "pits" of apricots, cherries, and peaches are carefully removed.

Even this preparatory process requires a certain degree of skill, since the stone must be removed with as little injury as possible to the form and solidity of the fruit. This work is done mainly by women, who earn thereby 50 cents per day.

Thus prepared, the fruit is immersed in boiling water, which quickly penetrates the pulp, dissolving and diluting the juice, which is thereby nearly eliminated, when the fruit is subsequently taken from the water and drained, leaving only the solid portion of the pulp intact.

This process of "blanching" must also be done with exact nicety, the period of immersion in the hot water being determined by the size and ripeness of the fruit. If immersed too long the pulp is either overcooked or is left too dry and woody. If taken out too soon the juices left in the pulp prevent perfect absorption of the sugar afterwards, and, by eventually causing fermentation, destroy the value of the product. In this, as in other stages of the process, the only guide is experience. A skillful workman can tell by the color and appearance of the pulp when it is properly "blanched," and this knowledge invariably commands employment and liberal compensation.

After being thus scalded some fruits, apricots, for example, are again assorted into two or three classes, according to the degree of softness that has been produced, for the reason that if kept together they would take up the sugar differently, some losing their form entirely, while others would remain sufficiently impregnated. For these different grades, sugar syrups of different degrees of density are required, the softer the fruit the stronger the syrup required for its preservation.

For the same reason, each of the different varieties of fruit requires a syrup of corresponding strength.

Pears, citrons, and pineapples, which remain hard and firm, take best a syrup having a density of from 18 degrees to 25 degrees, while apricots, plums, and figs are treated with syrups which gauge from 30 degrees to 40 degrees by the aerometer.

The requisite syrup having been prepared by dissolving the sugar in pure water, the fruit is immersed in it and left at rest for a certain period in large earthernware pans, glazed inside, and having a capacity of about eight gallons.

The syrup penetrates the pulp, and gradually withdraws and replaces the remaining fruity juice, which, as it exudes and mingles with the transparent liquid, produces a certain filmy, or clouded appearance, which marks the commencement of fermentation. When this has reached a certain stage, the vessel containing the syrup and fruit is placed over the fire and heated to 212 degrees Fahrenheit. This corrects the fermentation and raises all impurities to the surface, whence, if necessary, they can be removed by skimming. If the syrup is of proper density, this process of impregnating the fruit with sugar will be complete in about six weeks, during which time it is usually necessary to perform this heating process, as above described, three times. The impregnation of the fruit with sugar being thus complete, it is taken out, washed in pure water to remove the flaky particles that adhere, and is then submitted to one of two finishing processes, as follows:

If the fruit is to be "glacéd," that is, covered with an ice or transparent coating, it is dipped in a thick, viscid syrup of sugar and left to dry and harden rapidly in the open air. If it is to be "crystallized," it is dipped into the same syrup, but is then cooled and dried slowly in a kiln or chamber warmed to a temperature of 90 degrees Fahrenheit.

This slow cooling causes the thick syrup with which the fruit is covered to crystallize and assume the usual granulated appearance. The work is now finished. If properly done, the fruit thus preserved will bear transportation to any climate, and will keep firm and unchanged for years. It is packed in light wooden or cardboard boxes, and may be shipped in cases containing several hundred pounds each.

Uses of the Spent Syrup.

During the process of impregnating the fruit with sugar, the syrup in which it is immersed is gradually deteriorated by losing its sugar and absorbing the juices of the fruit. It is finally utilized in the preparation of "confiture d'Apt," which is made of the soft, over-cooked, and *irregular pieces of fruits of all kinds* mixed in irregular proportion and preserved in the spent syrup, which is boiled down to the required consistency. This branch of manufacture, like many others, gives opportunities for sharp practice, particularly in the use of glucose in place of pure sugar, and of certain chemicals, notably salicylic acid, which there is reason to believe is employed to some extent by certain confectioners to shorten, and thereby cheapen, the process of preservation.

Salicine, the basis of this acid, is a flaky substance derived from the bark of certain species of willow. It is used in medicine as a febrifuge, two grains per day being regarded a safe allowance for adults. Salicylic acid is made by the action of sulphuric acid, bichromate of potash, and water upon salicine. In just what degree salicylic acid is deleterious to health I am not informed, but it is the opinion of good judges that its use in the preservation of fruits and wines should be prohibited by law. It is a powerful antiseptic, and is for this reason used in the mixing of wines, and, as already indicated, in the fruit crystallizing process, to arrest and prevent the acetous fermentation of the juice, which would otherwise spoil fruits which have been imperfectly prepared.

As has been shown above, the process of eliminating the natural juices of fruit and replacing them with sugar by immersion in syrup requires about six weeks. By the use of salicylic acid, which penetrates the pulp and exerts upon the juices an antiseptic influence which prevents fermentation, this process can be reduced to a few days only. Time, labor, and sugar are thereby saved, but naturally at the expense of quality in the finished product.

Cost and Market Values.

The net cost of preserving fruit by this process varies, of course, with the price of sugar, labor, interest on investment, etc.; and this is moreover a point upon which confectioners are not disposed to be communicative.

But with the facts at our disposal, the question of costs can be closely approximated. Sugar costs here this season, as already stated, 9.65 cents per pound, and fruit in condition for crystallizing, on an average 8 cents per pound. The labor of women to pare, stone, and otherwise prepare the fruit costs 50 cents per day; that of men sufficiently skilled in the processes of scalding and preserving, to work under the direction of a foreman, commands from 80 cents to $1 per day. In most establishments the proprietor or a member of the firm is the superintendent, who personally directs the work.

Most leading confectioners and caterers of Marseilles manufacture their own crystallized and "glacé" fruits, which they sell at retail from 50 to 75 cents per pound.

The wholesale trade prices of quantities for export are much less, as will be shown by the following exhibit of the average values, as declared for export to the United States and other countries, of the several fruits during the season of 1884, which was a year of abundant fruit harvest, and the present summer and autumn, when all fresh fruits, except cherries and figs, have been more expensive by reason of a short and inferior supply:

Articles.	1884. Per lb.	1885. Per lb.
Apricots	$0 27½	$0 29
Chinois—Green	24½	23
Ripe	24	25½
Cherries	23	23
Figs (Marseilles)	21	20
Pears—Red	24	25½
White	24	24
Plums—Green Gage	24½	29
Yellow, mirabelles	25	26
Pineapples (from West Indies)	33	33
Citron	13	22
Melons	24½	25½
Strawberries	29	29
Mixed fruits	25½	30

This would give an average of about 24 cents per pound for 1884, and 26 cents for 1885.

Deduct from these values, say 20 per cent for manufacturers' profit, and we reach from 19 to 20 cents per pound as the average cost of production.

Add to these values the cost of importation and a duty of 35 per cent ad valorem, and the crystallized fruits of Provence become a rather expensive sweetmeat to American consumers.

The Industry in the United States.

But there would seem to be no good reason why this dainty and profitable industry could not be established with immediate and complete success in the United States, where most ordinary fruits grow in profuse abundance and with finer flavor than is developed by the same varieties in any part of Europe. Sugar is equally cheap, and fuel far less expensive in our country than it is here. From the foregoing account it will be seen that the process of crystallizing fruits, as well as the requisite apparatus, are exceedingly plain and simple. But the most profusely furnished kitchen, abundant raw material, and a library of books on cookery will not enable a novice to prepare a well cooked dinner.

There is so much in the art of crystallizing fruit which can only be learned by experience, that in order to begin the experiment with certainty of success, American pioneers in this manufacture should employ competent French workmen to superintend the construction of their plant, instruct the operatives, and superintend the whole process of preserving and packing during the infancy of the business.

The extent to which the crystallized fruits of this country are imported by the United States would seem to indicate that here is an opportunity for a new and profitable enterprise.

FRANK H. MASON,
Consul, Marseilles.

COGNAC.

REPORT BY CONSUL IRISH.

I have extended my inquiries, as far as practicable, for this portion of France, and am enabled to state that the actual processes of crystallizing fruits have been generally abandoned throughout the country, on account of the expense attending thereon, and the general scarcity and usually high price of fruit.

However, there are, in all the towns of this region, such as Cognac, Angoulême, Saintes, Rochefort, La Rochelle, and Limoges, persons who are familiar with the business, who deal in crystallized fruit, and who have formerly engaged in its manufacture. The testimony on the subject is to the effect that the process of crystallization is now largely and almost entirely confined to a few points, namely: Clermont-Ferrand, in the Department of Puy-de-Dome, in the Consular District of St. Etienne, and Carcassonne, Department of Aude, in the extreme south of France, and in the bounds of the Cette agency of Marseilles.

A reasonable amount of manufacture is done at Paris, and also at Bar-le-Duc, Department of Meuse, where the production is chiefly confined to the preserving of currants, gooseberries, and such like fruit.

Clermont-Ferrand is the most important place for this industry in France, and as fruit is usually abundant and cheap in that locality, they are enabled to furnish the dealers throughout all this region to much better advantage than the dealers themselves can manufacture it.

As a consequence of the confinement of the work to localities beyond my bounds, it will be seen that I have not the data for its cost and extent of production.

Neither are the manufacturers usually disposed to furnish detailed information concerning their business, and many obstacles lie in the way of an investigation.

I am enabled, however, to furnish a tolerably clear statement of the various processes of the work, which, as a whole, is quite uniformly practical whenever the labor is performed.

Whitening Fruits.

Much precaution is necessary to be taken to well preserve the fruit, whether it be dry or watery, in order to obtain good results.

Success depends largely upon the first act of bleaching. The bleaching, or whitening, of the fruit must be regulated according to the quality and maturity of it; the water must not boil; must simmer only.

It is well to choose each kind of fruit a few days before being ripe; it should be hard or firm and gathered in dry weather in the morning, and whitened as much as possible the same day, for if too ripe it will fall in marmalade; if not enough it cannot be properly preserved, the pores will become closed, and the sugar cannot penetrate. The fruit will become hard, acid, black, and moldy. It is necessary to place the fruit in a considerable quantity of water to whiten it, that the water cover it at least eight inches, in order that there be no necessity to increase the quantity during the process. In such a case added water should be of the same temperature. Cover the fruit with an osier screen or linen cloth, and put about four inches from the bottom of the vessel a copper colander, to prevent injury from the fire. Stir the fruit from time to time lightly with a skimmer, to aid the riper portions to rise. Usually the fruit is whitened with the naked fire, but it is much easier to do it with steam, because in that case it is not exposed to the danger of scorching, and the degree of heat for the various kinds of fruit is easier regulated.

Each kind of fruit is whitened in a different manner. Stone fruit is placed in cold water over a slow fire, and removed with a skimmer as soon as it rises to the top of the water. The condition of the cooking is ascertained by the use of a pin, which must easily penetrate, or by softly pressing with the fingers. When it is found to be sufficiently soft, it is taken out and put in cold water. If there is a great quantity of fruit to be whitened, the same water may be used again, especially for plums and green fruit.

Plums that are whitened in the first water not being so nice and transparent as those whitened in the second, the poorest, and ripest, and ill turned may be whitened first, to acidulate the water. Some confectioners employ lemon juice, virjuice, pyroligenous acid, alum, marine salt, epsom salt, etc., to preserve the whiteness of the fruit, and blue vitriol, vinegar, or salt, to turn it green. It is dangerous, however, to use the blue vitriol—too great a quantity causing the water to turn bluish, the fruit will then become black. If used, put not more than three grains to a quart of water; and when the fruit is whitened, put it in water for twenty-four hours, changing four or five times.

To be assured the water or fruit does not contain any part of the vitriol, plunge a well polished bar of iron into the water; if it is not covered with a copper tint, there is no danger.

When plums or other fruit are to be whitened, if the water is to be used again, let it cool before using until it becomes lukewarm, and leave the fruit in it awhile before heating; this is why the use of steam is so helpful.

Fruit with a tough skin requires longer to whiten, and time according to its quality; hence, the following notices of the time required to preserve each kind of fruit.

Sugaring Fruit.

After the whitening process is completed, great care is still required to properly preserve them in sugar. If the fruit is too firm or hard, or not ripe enough, on being removed from the whitening process it must be put in sugar reduced to a syrup of 23 degrees; the water contained in the fruit will be eliminated, and the syrup reduced to 20 degrees; it will be necessary the next day, for the first operation, to increase it to 25 degrees. Cover the fruit and boil it, pour it out gently into an earthen dish, and place it in the cellar in a cool and dry spot to avoid fermenting. Continue cooking it from day to day, making it one or two degrees thicker. Cover when boiling.

Ordinarily this process is repeated from five to eight times, thickening to 36 degrees or more, according to the maturity of the fruit. If the fruit is soft or too ripe, it will be necessary to cook the sugar more to harden it, and preserve it from falling into marmalade. Reduce the sugar to 28 degrees for the first shape or condition, increasing 2 degrees each day for each shape. It is sometimes necessary to give two shapes each day, morning and evening. In that case increase the sugar only 1 degree each time, and only simmer the fruit; afterwards put it in the cellar. If it is desired to preserve the fruit very clear and white, it is necessary to change the syrup in the middle of the shape. In such case it is necessary to thicken the syrup with apple jelly or glucose, to prevent its candying. When the fruit is sufficiently preserved, it is left in a cool and dry place from eight to fifteen days, in order that all the water may escape and it become impregnated with the sugar.

It is necessary that the fruit be well drained at each shape or stage of the process, because if reduced syrup remains at the bottom of the vessel into which the fruit has been poured, and a covered boiling or simmering has been neglected, it will contribute to its fermentation.

A spigot at the base of the vessel for the purpose of draining the syrup is very useful in the case of apricots, chestnuts, strawberries, raspberries, and all tender fruit. The quantity of sugar necessary to preserve each sort of fruit is not indicated, as the fruit will take only the amount of syrup necessary for it; it is only necessary that it bathes in the syrup.

Preparing Particular Fruits.

I present herewith instructions for preserving a number of the more important kinds of fruit:

Apricots, whole.—Choose the white apricots, from high trees, or grown in a garden, along the wall. They will be recognized in opening by the meat forming species of rays around the stone.

It is necessary to take them some days before their maturity, when they begin to turn yellow, and the stone is easily detached, and they are firm.

Make a little incision at the head with the point of a knife. Hold the fruit in the left hand with the thumb and forefinger; then pushing the knife at the place of the stem, the stone goes out at the top or head. Proportion the apricots in water slightly alumed, or acidulated with lemon juice. Prick them in the green parts which are not ripe enough; then whiten them on a slow fire; stir them from time to time to aid the ripest to rise to the surface; try them on the skimmer with the fingers or a pin, and put them in fresh water as soon as whitened. When they have become cooled, after having changed the water several times, put them in sugar warmed to 20 degrees, and make them simmer or slightly boil, if they are not too ripe. The next day put them in sugar at 22 degrees, boil them, covered, if the fruit is firm, or simmer them if the fruit is tender; continue thus each day for five or six days or processes, increasing 2 degrees each time until 36 degrees; then let them remain for fifteen days, as heretofore indicated.

When the fruits are a little large, turn them with a thin and suitable knife, that the sides may correspond; with a toothed knife, the sides are better and neater. Cherries, oranges, nuts, pears, etc., are turned in the same manner.

Stuffed Apricots.—Take whole, preserved apricots, and introduce in each a plum or other small preserved fruit separated from the stone, which replace by lemon or lime.

They are equally stuffed with the marmalade of apricots, pineapples, strawberries, apple jelly, currants, cherries, raspberries, etc., and a peeled almond is put in the middle.

Apricots in Quarters.—Choose apricots already yellow, without being ripe, firm, and with the stone easily detached. Peel them, or turn them, and prick them lightly with a pin, and immediately throw them in fresh fountain water lightly alumed. Whiten them and put them in the syrup like the whole ones. When they are preserved, drain them, put them in a stewing dish with syrup at 20 degrees, and add the juice of a fine orange. The apricots are iced and candied, drained, and placed with preserved fruit in boxes. Increase the syrup at each process, so that the fruit is bathed in it.

Pineapples.—Choose the pineapples before they are entirely ripe, remove with care the first pellicle, leaving half of the middle of the crown; prick them with a large needle to the heart in several places. Whiten and preserve them like apricots.

Cherries.—Take fine cherries with considerable acidity, take off the stems, push out the stones with a quill, and place them reversed side by side on a strainer. Afterwards put them in an earthen dish in layers, with equal parts of powdered sugar, until the next day. It is necessary to decant them several times to dissolve the sugar. Heat them slowly and proceed as with syrup.

Quinces in Quarters.—Choose quinces of a fine yellow, and well ripe and sound. Take off the down with a linen cloth, prick them to the heart with a large needle, put them in a proportional quantity of alumed water, place them afterwards over a quick fire, boil for time, and when tender throw them into fresh fountain or river water in preference to well water (as such contains less calcareous salt, and is softer). Fountain water is preferable for preserving all fruit, especially white fruit. Peel them, and take out the cores, cutting them in equal quarters; put them again in alumed water, and continue whitening them until the head of a pin passes easily through the quarters and the hole closes up again. Quinces are also whitened in the following manner: the fruit is just peeled, and a lemon rubbed over each slice to prevent its becoming red; then put in alumed or acidulated water, then they are whitened. The former process is preferable. They are preserved like apricots, having care to cover them with a white linen cloth at the surface of the water, and to cover each vessel into which they are poured with linen or white paper, to hinder the fruit from reddening. It is necessary to take these precautions for all white fruit. When it happens that water reddens in whitening them, it is necessary to change the alumed or acidulated water.

Lemons.—Choose fine lemons well united, turn them, make a hole with a punch at the right of the stem, put them successively in fresh water. Whiten them, empty them like oranges, preserve them, and ice them the same.

Quarters of Lemons.—Take fine lemons, well ripened, united, and without spots; separate the largest part of the white, after having cut them in equal quarters. Whiten these skins like citrons, and preserve them and ice them the same.

Citrons.—Choose fine citrons uniformly ripened. Test them with a piece of glass to raise only the surface of the rind. Make a hole with a punch a little larger than for lemons. Whiten them with much water. When they are half whitened, empty them with a coffee spoon, put them in fresh water, and finish them and whiten them like lemons, and preserve them the same. Citrons in quarters are emptied only when they are whitened. Leave them forty-eight hours in fresh water, changing it two or three times a day to remove the bitterness of the rind.

Raspberries.—Choose fine red raspberries, not too ripe, that you examine carefully. Put them in an earthen dish, about nine pounds in each; cook with an equal part of sugar *au soufflé;* empty, decanting four or five times during an hour, into a similar dish; put them on a slow fire, bringing them to a boil again; put in the cellar until the next day, draining slowly so as not to crush them; and cook in sugar at 28 degrees, covered while boiling. The next day cook them at 30 degrees, the third day at 32 degrees, afterwards drain them so as to dry and candy them. I need not specify their numerous uses.

Strawberries.—Choose them firm, without being quite ripe, and preserve them the same as raspberries and cherries.

Oranges.—Choose very fine oranges, very firm, and with a thick skin. Turn them, making all sorts of designs, and put them in fresh water. Whiten them, and empty like lemons and citrons. They are preserved and iced the same.

Oranges in Quarters.—Choose similar oranges. Make four separations in the orange without detaching the quarters. Whiten as heretofore shown, and when they are well preserved divide the quarters for the various uses. The skins and peels are preserved and iced the same, and are used to perfume sweetmeats, etc.

Plums.—Choose fine fresh plums, not too ripe, but commencing to turn yellow. The plums of Metz are superior to all others in France for preserves. They are very transparent, and once preserved have a very delicious taste. Prick them to the stone with five or six pins fastened in a cork. Put them in a proportional quantity of fresh water lightly alumed. Let me here refer to a former statement about using water more than once in whitening plums. Care must be taken to put the fruit only in lukewarm water to commence to whiten it, and to leave it in some minutes before increasing the heat. The plums are whitened and preserved the same as apricots.

Pears.—Choose fine pears, like the butter pears of England, or Rheims, or Bergamots, and when not too ripe, when the pips are black, and when in paring them they are white under the skin. Put them, with a good deal of water, on a quick fire, or with steam, until they are softened, then remove them and put them in fresh, cold water. Pare them as lightly and promptly as possible, prick them from the head to the core, cut and scrape the end of the stem, and throw them into a quantity of fresh water, alumed and acidulated. Put them again on the fire, cooking them until the head of a pin enters easily, and the hole closes on withdrawing it; then put them again into fresh water, lightly alumed or sharpened with lemon juice. Preserve them with the same precautions as quinces and apricots. As the pears are easily candied, the sugar must be thickened with apple jelly or glucose.

Peaches.—Choose fine peaches, before their maturity, and quite firm; whiten them and preserve them whole, or in quarters, like apricots, being careful not to boil them, for it is a very tender fruit and liable to fall into marmalade.

Green Gages.—Take Green Gages of a good size without being ripe or colored, of a fine green rind, firm, the stone being detached easily. Cut the end of the stems, and prick them in divers places, notably near the stem, with a little bodkin. Put them in a basin full of water on the fire, or with steam, so that they may have ample room. As soon as they become yellow, remove them from the fire, and throw in a pinch of salt, vinegar, and spinach, or verjuice. Blue vitriol is also employed, but in small quantity; to make them green again let them remain quiet for some hours, then put them on a slow fire without boiling, stirring them from time to time until they again become green; then increase the heat, and as they rise to the top of the water, remove them and put them in fresh water, removing it several times until they become thoroughly cool. They are preserved with sugar like other plums.

Chestnuts.—Which grow very large in this country, and are as much sought for as an article of food. Take the fine chestnuts of Lyons or Lucques, rend off the outside with the point of a knife, being careful not to touch the meats, and put them in a proportional quantity of fresh water. When they are all prepared, put them on a quick fire, or with steam, with a large quantity of water. Boil them until the skin can be removed, and they become tender, of which assure yourself with a pin; then remove them from the fire, and change the warm water, diluting the second water with a little flour to preserve the whiteness of the chestnuts. Peel them as promptly as possible to prevent their becoming too tender, and also not to break them, for this fruit is one of the most difficult to preserve, and all possible precautions must be taken. Put them in a proportional quantity of hot sugar reduced to 20 degrees; keep them warm over a slow fire, covering each dish with linen or white paper. The dishes must be provided with faucets to drain them more easily. Proceed to preserve them with the same care as with apricots; they may be iced with vanilla. Some confectioners do not give them the *shape* or *fashion* for fear of spoiling them, for they separate easily at the least contact with too strong heat. They keep them continually warm in a drying stove or slow oven. With steam or a hot water bath, they decant them from time to time, or stir them; the syrup can be reduced to 32 degrees. This means is very difficult, and only a small quantity can be made at a time.

Iced Fruits.

The preserved fruits are iced to dry them. They are drained, then passed through lukewarm water to wash them, then put an hour or two in a drying stove in an earthen dish. Sugar cooked to the grade *au petit soufflé* is put with them, and they are made to take a covered boiling, are skimmed, the basin taken from the fire, and placed on a table in an inclining position, where the sugar is massed on the border of the basin with a spatula. When the sugar commences to whiten, turn one or several of the fruits in the whitened portion, remove them with a fork, and spread them on a grate or strainer placed over a dish or mold to candy.

When the fruit is small, and the sugar commences to grain, mix the whole together, raise the fruit quickly with a skimmer, and put it on a strainer. When the fruits are soft it is necessary to cook a little harder, and mass the sugar more than for hard or dry fruits and rinds.

This ice is now kept for use, and when wanted a little sugar is added each time. When thick or gelatinous, it is cooked and massed more, or replaced.

Candied Fruits.

Drain the preserved fruits, wash them in lukewarm water, and put them on a strainer on the stove to dry. When they are dry put them side by side, and put them between two strainers made for the purpose, and place them thus in a mold to candy.

Take sugar cooked *au petit soufflé* at 36 degrees to 37 degrees, and pour it slowly over the fruits from above, and then place the mold in a drying stove, heat to 40 degrees, drain when sufficiently candied, ordinarily at the end of five or six hours.

Fruits that are dry and firm are also candied cold; the candy is finer and less subject to mass; in that case the sugar is cooked 1 degree or 2 degrees less, is put to candy at night and drained the next morning.

Sugars.

I now, perhaps, have sufficiently presented the processes required by my instructions, but it seems important, to make matters clear, that something be said concerning the various forms of preparations of sugar that are used in the business.

Only clarified sugar is used, and this is reduced to syrups of various densities. The degree of density is ascertained by a *pése syrup*, an aerometer invented by Baumé.

The first condition of cooking which I shall mention is called *la nappé*, and the sugar weighs 20 degrees. When, in dipping the skimmer into boiling sugar, after a turn of the hand the syrup spreads along the skimmer, it has reached this stage.

Petit lissé.—The sugar weighs 25 degrees. Some boilings after *la nappé*, pass the forefinger on the skimmer charged with syrup, and apply it against the thumb. If in spreading these two fingers you see a little thread, which breaks immediately, leaving a drop on the finger, you have *petit lissé*.

Grand lissé.—The sugar weighs 30 degrees. When the thread has more consistency, and spreads more, you have *grand lissé*.

Petit perlé.—The sugar weighs 33 degrees.

Grand perlé.—The sugar weighs 34 degrees and 35 degrees. If at last in spreading the two fingers the thread sustains itself without breaking, you have the *grand perlé*. The attentive workman will distinguish these two cookings by the aspect of the liquid. It produces large, high, round bubbles, going out from the boiling in the form of pearls.

Petit soufflé.—The sugar weighs 37 degrees. It will be recognized when, in blowing through the holes of the skimmer after it has been shaken, the liquid forms little bubbles on the side opposite, which lightly detach. This is the *petit soufflé* employed in icing fruit.

Grand soufflé.—The sugar weighs 38 degrees. After some boilings operate as in *petit soufflé*. If the bubbles are larger, resembling soap bubbles, and maintaining themselves a moment, it is the *grand soufflé*. Or dip your finger in fresh water, plunge it in the sugar, and dip it again in the water, if there remains a little compact sugar at the end of your finger, you have the same thing.

The same means are employed for the cooking of *gros candi*.

Petit boulé.—The sugar weighs 39 degrees. Dip your finger in fresh water, then in the boiling sugar, and then again in the water. If it forms a soft ball which one can turn in the fingers, you have the cooking for bon-bons with liquors.

Grand boulé.—The sugar weighs 40 degrees. After some boilings more renew the preceding operation. If the ball is larger and harder, you have the cooking for preserves which are not clear.

Petit cassé.—After some boilings operate as before. If in cooling the sugar it breaks, if it attaches to the teeth, it is a *petit cassé*.

After the *grand boulé* the degree of the sugar is no more observed. It is then the cooking of the twisted sugars, or *sucrestors*.

Grand cassé.—When, after being further cooked, the sugar produces a little simmering in water, and adheres no longer to the teeth, it is a *grand cassé*. This is the cooking of barley sugar, caramels, burnt almonds, etc. An experienced workman will readily recognize it by the crackling which the sugar makes in the fingers.

J. E. IRISH,
Consul, Cognac.

RHEIMS.

REPORT BY CONSUL FRISBIE.

While crystallized fruits (*fruits glacés*) are kept on sale by all first class grocers and confectioners, and quite extensively used by the people, they are not manufactured to any extent in this district, for the principal reason that the fruit grown here is not of sufficient variety, quality, and quantity for the purpose, and, by reason of its scarcity, it usually commands too high a price to make the business profitable. I have found that the industry of manufacturing crystallized fruits, and other preserving methods, is carried on in southern France, the great center of the industry being at Clermont-Ferrand, in the Department of Puy-de-Dome, about one hundred miles west of Lyons, which is the greatest fruit-producing section of France, and where fruit of many kinds is nearly always plentiful and of the best quality. The dealers in this section usually purchase their crystallized and other preserved fruits from the wholesale houses of Paris, who receive it in large quantities from the section named, and in some considerable quantities from Nice, where it is also quite largely manufactured. It is said that this fruit is not so finely and nicely made at any other place in France as at Clermont-Ferrand and at Nice. There is at Rheims, however, an occasional confectioner of the first class, who finds himself in a position to advantageously manufacture his own fruits, but this is always done on a small scale and only for the needs of his local customers, and never for wholesale nor for export, and which my information teaches me they manufacture according to the following methods, and which are said to be substantially the same as that employed in the large establishments in the south of France.

Crystallized Fruits.

Begin the operation by dipping the fruit into hot, melted sugar for a moment; let it drain and dry. Then wash it lightly in lukewarm water, after which put it into earthenware pans or dishes and place it in a warm (not hot) oven for a couple of hours. Cook some sugar over a slow fire in a copper dish at 105 degrees of heat; put the fruit in the boiling sugar for a few seconds; skim; remove the dish from the fire and place it on a table in an inclined position, and collect the sugar on the side with a spatula. When the sugar begins to whiten roll the fruit in it, one or two at a time; remove it with a fork and place it on galvanized or tinned-wire sieves or grates, over earthenware dishes or candy molds. When the fruit is small, as soon as the sugar begins to granulate mix the whole, fruit and sugar, rapidly together and remove quickly with a coarse skimmer, placing the fruit on a wire sieve as above described. If the fruit is soft, cook it a little more, and stir the sugar longer with the spatula than if it be hard, dry, or of the rinds.

Keep the glazing (sugar) for future use, and, if necessary, renew it by adding more sugar. Should the sugar become pasty, cook and stir it longer, or, better still, replace it with fresh glazing.

Candied Fruits.

First, dip the fruit in hot, melted sugar for a moment, let it drain and dry, after which wash it lightly in lukewarm water; then place it on a sieve to dry in a warm (not hot) oven. When it is dry, cook some sugar over a slow fire to 95 degrees or 100 degrees of heat. Place the fruit side by side between two galvanized-wire sieves or grates in a candy mold; pour the sugar carefully over the fruit and then place the molds in an oven heated to 105 degrees. When the fruit is sufficiently candied, which is usually accomplished in five or six hours, remove and let the fruit drain and dry.

Fruit that is hard or dry may be candied by the cold method, the candy being finer and less liable to granulate. Cook the glazing to between 95 degrees and 100 degrees of heat. Place the fruit in the glazing in the evening and remove it the following morning, when it is allowed to drip and dry.

Carameled Fruit.

Begin by preparing each kind of fruit, according to its nature, to be dipped into the caramel, a substance obtained as follows: Cook about two pounds of clarified sugar, which is preferable to melted sugar, to which add a spoonful of glucose to prevent its granulating, and cook it until it becomes hard and brittle when placed in cold water. Place an earthen or copper dish in an inclined position over a slow fire or over hot coals lightly covered with cinders or ashes so that the sugar does not get cool. Dip the fruit in the sugar and then place it on a sieve or hang it on strings over an oiled marble slab; for small fruit, on wire sieves or grates made for the purpose, and for large fruit, such as oranges, chestnuts, etc., simply place them on the marble.

If the fruit has been prepared on strings, cut the strings and place the carameled fruit on sieves and put it away in a dry place. If the fruit has been done on skewers, especially oranges, remove the skewers before the caramel is completely cold, as otherwise the caramel gets broken and the juice of the fruit escapes. When removed in proper time the hole made in the fruit by the skewer is easily closed up by the warm caramel.

Fruit should only be carameled a few minutes before serving, so as to be nice, fine, and fresh. Carameled fruit can be either served up in fancy structures and forms, or separately. When carameling fruit two or more persons should always be engaged in the operation, as the caramel should be kept hot and never allowed to cool, as if it is reheated it will granulate and redden. To caramel fruit, wooden skewers, string, or galvanized or tinned wire may be used.

In carameling cherries there are three things to be considered, viz.: (1) If fresh, they must be very fresh and sound, and have the stems cut short, that is, about half length; (2) If the cherries have been preserved they must be dried before the operation; (3) If brandy cherries are used they must be allowed to drip, and left a few minutes in a warm oven. They are either tied together or fastened on skewers, then dipped and hung up to dry.

Chestnuts.—Roast the chestnuts slowly so as not to scorch them; remove the shell and inner husk. Put them on skewers and dip them in the caramel. In removing them give them a twirl, so as to spread the caramel evenly over them, and lay them on a slightly oiled marble slab.

Oranges.—Choose the finest and firmest fruit, remove the peel, divide into quarters, remove all the white with a knife, taking care not to cut the skin, as the juice would come out and dissolve the caramel. Put them on skewers on a sieve, and place them in a warm (not hot) oven, to be slightly dried before dipping. Finish as with chestnuts. Oranges should be skewered through the center so as to prevent the juice from running when the skewer is withdrawn.

Preserved Fruits.—All kinds of preserved fruits, such as apricots, small oranges, plums, nuts, pears, dates, prunes, etc., can be carameled by following the foregoing instructions. Only care should be taken that the fruit be first washed in lukewarm water to remove the syrup, and then dried in a warm oven.

Grapes.—Fresh or dry Malaga grapes are frequently used, and grapes of the country in their season. Several grapes are fastened on galvanized wire, and the bunches thus formed are fastened on a wooden skewer; they are then dipped into the caramel, and then placed on small wire sieves, of which the meshes are made of proper size to hold the grapes, and placed as usual above a marble slab.

Small fruits, such as currants, raspberries, strawberries, almonds, filberts, hazelnuts, etc., can be carameled, but care should be taken that the fruit be separated when removed from the sugar.

JOHN L. FRISBIE,
Consul, Rheims.

BORDEAUX.

REPORT BY CONSUL ROOSEVELT.

Having carefully examined the methods employed in crystallizing fruits, I am enabled to report as follows:

All fruits indigenous to France, and a few select fruits from other countries, as also several species of soft-shell nuts, are employed.

The kettles used are generally of copper (much broader than deep, to prevent crushing the fruit), provided with a wire frame placed one or two inches from the bottom to protect the fruit from scorching. When ready for use, they are three fourths filled with water, which is heated to boiling point (95 degrees Centigrade), and covered by a towel or straw cover.

The fruit should be gathered several days before maturity; and, if possible, early in the morning of a dry day. The first important step is the bleaching, or, more properly speaking, the parboiling of such fruits as are to be subjected to this preliminary process. The fruit should be picked and bleached the same day to obtain best results. The pits are carefully removed, and the fruit plunged into very cold water before being transferred to the kettle. During the process of boiling, the fruit is occasionally gently stirred, so that each separate piece may be equally cooked. When the fruit begins to settle at the bottom of the kettle the fire is reduced for ten minutes, then gradually increased until the fruit again rises to the surface, and becomes sufficiently tender to be punctured with a straw. They are then carefully removed from the kettle with a skimmer, and dropped into very cold water, which is renewed several times, or until they are thoroughly cold; they are then placed upon wire frames to dry. The boiling should be accomplished quickly, so as to submit the fruit to as rapid and sudden change of

temperature as possible. The boiling is generally done over an open fire, but the most satisfactory results are obtained when steam is employed, as it is an easier matter to regulate the heat from steam necessary to the different kinds of fruit.

Great care must be taken in the first boiling, since the fruit, if over done, falls to pieces, and if under done the pores are compressed, preventing a thorough permeation of the sugar, and in consequence the fruit becomes tough, dark in color, and soon grows moldy. When the same water is used a second time for the purpose of boiling, it is thoroughly cooled before receiving the fresh fruit. It is then slowly heated, the temperature being maintained at a low point for a considerable time.

When the fruits are not sufficiently soft after the first boiling, they are put into a hot syrup (invariably made of cane sugar) of 25 degrees of density; the water remaining in the fruit is absorbed by the syrup, and is gradually reduced. After the preliminary boiling in water the fruit is submitted to the syrup daily for five or ten days, or until the sugar has thoroughly penetrated the pores. After each boiling the fruit is carefully removed from the syrup and put into a cool place to dry. The syrup for the first boiling is always 25 degrees of density, and is increased 2 degrees each day until it reaches 36 degrees, excepting in cases where it is necessary to submit the fruit to the syrup twice in the same day, then it is only increased one degree, and is not allowed to boil, but only to scald the fruit.

Fruits are crystallized with and without rind, whole, in halves, and in quarters. Pears, apples, quinces, and oranges are generally crystallized peeled. To retain the delicate coloring in such fruit as the apricot, pear, peach, and chestnut, it is necessary to add to every hectoliter of cold water forty or fifty grams of pulverized alum.

Some confectioners employ lemon juice, verjuice, salt, sugar of milk, and epsom salts, to preserve the whiteness of the fruit after boiling, and sulphate of copper, vinegar, or salt, to retain the green color natural to certain fruits.

When the crystallized fruit is destined for warm countries, it receives additional cooking. The fruit, when crystallized, is packed in boxes containing a quarter of a pound to two pounds each.

There are several establishments in Bordeaux devoted to the crystallization of fruits, the most important of which is that of Alexander Droz & Co., to whom I am under obligations for much valuable information. Their average annual sale of crystallized fruits is one hundred and sixty thousand pounds, the half of which is consumed in France. Their annual exportation of cherries alone to England and Russia is twenty-four thousand pounds.

It is estimated that very nearly seven hundred thousand pounds of fruit is crystallized at Bordeaux annually. The average cost per pound (not including the price of the fruit) to the producer is 15 cents, or $15 per hundred weight. The fruits in greatest demand on this market are apricots, cherries, and chestnuts. The separate preparation for each I give in full below.

Apricots.—The apricots should be picked several days before maturity. An incision is made by a knife at the head, and the pit gently forced out; the unripe parts are lightly pricked, and the fruit is then plunged into very cold water containing a little alum or lemon juice. The water is changed frequently before the fruit is transferred to hot syrup of 20 degrees of density, preparatory to boiling. After boiling, the fruit is taken from the syrup and removed to a cool place until the next day. This process is followed for five or six days, each day increasing the density of the syrup 2 degrees, until it reaches 36 degrees. The fruit is only permitted to boil after the first cooking if it continues too firm; if soft, it only simmers. The kettle containing the fruit is removed from the fire, and as the syrup begins to whiten, the fruit is carefully turned in the whitish parts, and then removed from the kettle and placed on a wire frame to dry.

Cherries.—Large cherries should be chosen. After the stems are removed the pits are taken out, the cherries are placed on a dish side by side, with the open side up, and covered with powdered sugar; layer after layer is thus formed until the dish is filled; it is then set aside until the next day. They are frequently stirred, and finally are slowly cooked and crystallized.

Chestnuts.—The large chestnuts of Lyons, France, or Lucques, Italy, are preferred. The outer shell is removed, care being taken not to bruise or break the nut. They are immediately put into cold water, from which they are transferred to a large kettle of boiling water, where they remain until they become tender; they are then taken from the boiling water, freed from the skin surrounding them, which is a delicate operation, and should be accomplished as quickly as possible, as the nut is liable to crumble, and in consequence is difficult to crystallize. Once peeled they are put into syrup of 20 degrees of density, and are kept hot over a slow fire. The kettle is covered with a towel or piece of white *paper until the syrup begins to whiten. The kettle is* then removed, and the same process followed as employed in crystallizing apricots.

GEO. W. ROOSEVELT,
Consul, Bordeaux.

NICE.

REPORT BY CONSUL HATHEWAY, OF NICE.

The art of fruit crystallization, as employed in France, is, in theory, a process by which certain fruits are preserved by withdrawing their juices which lead to fermentation, and substituting a thorough saturation of sugar.

The successful practice of the art depends largely on the judgment and experienced skill of the confectioner, for many conditions, independent of any formula, may operate in favor of or adversely to the desired results.

The nature of the soil from which the fruits have been produced must first be carefully considered. Confectioners here prefer, therefore, to select their fruits among those grown on a dry soil, as such are more palatable, damp land producing those too soft, or of an insufficient firmness of fiber to support the fabrication.

The process also is modified by the variety of fruit used, and its degree of hardness or ripeness; and the exact adaptation of the syrup thereto is also a requisite to complete success. For instance, pineapple demands a density of syrup of only 18 degrees, while other fruits of less consistency require, according to their kind, a syrup up to a maximum of 42 degrees.

Again, some fruit must receive a special preparation. Thus, cedars,

mandarin, and bitter oranges should be soaked first in a bath of sea water, often changed, which gives them consistency and removes a disagreeable flavor which renders them otherwise unfit for use.

All fruits produced here, apples excepted, can be crystallized, but the more "fat" the fruit the less easily the syrup penetrates into its pulp; thus, oranges admit of the process easily, but plums much less readily.

The oranges used for this purpose are gathered at times commencing when the fruit is hardly formed, and has simply the firmness and taste of fruit, and continuing until when nearly ripe and of full size it begins to be somewhat colored.

Process of Crystallizing Fruits.

The fruit is plunged into very hot water for a short period, or until it is white, or has become bleached.

It is then completely drained of water and placed in a syrup of white sugar which has been cooked until a small quantity separated between the thumb and forefinger forms slight filaments, and it is adapted in strength to the hardness, softness, and degree of ripeness of the fruit employed.

In this syrup the fruit remains until the mixture of juice and syrup shows a white clouded appearance, indicating the beginning of fermentation. The whole is then again subjected to heat and raised to the boiling point and then removed.

Such alternate fermentation and boiling is usually three times undergone, the fruit and syrup remaining together from two to five weeks, according to the kind and quality of the same.

Red copper boilers, with iron handles at the sides, and containing about twenty-five pounds, are used in the process.

Beaumé Aerometer.

The aerometer employed to show the amount of sugar which the water contains, is about eight inches in length, formed in ordinary glass, and in weight the same as the volume of water which, when used, it displaces.

One end of this is heavy, that it may stand upright in the liquid; the center has a chamber of rarified air, and the other extremity is a slender tube, on which is marked a graduating scale from the top toward the center of its length, and numbering 50 degrees. The rising of this tube above the liquid shows the density of the syrup.

One of the confections made from this preliminary process is styled "crystallize," the other "glacé."

To crystallize the fruit thus prepared (as in the foregoing description), it is taken from the syrup and dried in a room at a heat of 100 degrees Fahrenheit, when the sugar appears in small crystals on its surface. "Glacé" is prepared by removing the fruit from the syrup and allowing it to dry gradually. The sugar thus forms a glaze on the fruit, which gives it its name.

Production and Cost.

The quantity of fruits thus preserved in this consular district cannot be accurately determined, as there are no statistics of these products. The following data per year may, however, be received as nearly correct:

	Pounds.
Nice	90,000
Cannes	30,000
Mentone	15,000
Monaco	10,000
Whole amount	145,000

The expense of labor and sugar employed in the manufacture of them may be estimated as follows: (1) One and one half pounds of sugar to one pound of fruit, cost price of sugar, 14 cents; (2) Labor, per pound, of production, 5 cents; entire cost of sugar and labor, 19 cents.

One pound of crystallized fruit is sold here at the manufacturers' wholesale sales, at from 28 cents to 50 cents, according to its kind and quality.

I am indebted to the most experienced confectioners of this district for the foregoing information, and especially to the courtesy of M. Vogade, of Nice, and J: Negree, of Cannes.

ALBERT N. HATHEWAY,
Consul, Nice.

Consul Dufais, under date of November 9, 1885, sends the following translation of a letter of the Mayor of Clermont-Ferrand on the subject of crystallized fruits:

CLERMONT-FERRAND, November 7, 1885.

In answer to your letter, twenty-eighth last month, I have the honor to transmit to you the following information, which Mr. Dionis, confectioner, has been pleased to give me:

'The candying (glacéage) of fruit is an operation learned entirely by practice, and which is difficult to describe.

"When the fruit is well drained, boil the sugar briskly, put the drained fruit in it, cover up your pan (a large one) after one boiling, then withdraw it from the fire, work your sugar until entirely melted. Take the fruit out with a skimmer, put them on gridirons in a drying stove. The price of candied fruit varies, according to quality and kind, from 2 to 4 francs per kilogram (about two and one quarter pounds)."

THE DATE PALM IN PERSIA.

REPORT BY MINISTER PRATT.

As a first result of my endeavors to obtain practical information on the subject of the date palm (*Phœnix dactilifera*), with a view to its introduction into the United States, and cultivation along our South Atlantic and Gulf Coast, and in Lower California, I have succeeded in gathering from Persian sources the following:

The date palm is found in countries situated within the zone of 16 and 30 degrees north and south latitude. Except, however, in rare instances it will bear no fruit in localities removed one hundred and twenty or one hundred and thirty-five miles from the sea.

There are two methods employed for propagating the date tree; one by setting the date stone, the other by transplanting the seedling (self-sown).

When it is desired to raise a plant from the stone of the date one per-

fectly ripe and faultless is selected, and both ends are either filed or scraped off with a knife until the inner kernel is laid bare. It is then planted in a mixture of gravel, sand, and camel manure. From twelve to forty days usually elapse before it makes its appearance above ground. It will then put forth long, narrow, thin, and tender leaves, somewhat the shape of a saddler's needle. From the fourth to the seventh year it produces nothing except long, rough, reed-like leaves. It is, however, possible that during this period the tree may, from its leaves, which resemble the shoots of the oleander, bring forth other leaves; but owners of palm gardens pluck off these in order to give the tree a graceful appearance. Under no circumstances, however, do they touch the leaves that shoot out from the crown of the tree. If its head is severed from its body the whole tree withers and dies. Each individual plant is either male or female.

When the tree has attained its full stature a flowering branch is cut from the male palm and applied to the half open flower bowl of the the female, thus giving it the fecundating principle, without which it cannot mature its fruit germs.

In no instance has it been recorded by botanists that one of these trees possessed in itself the different natures of male and female, and for this reason was it that the Arab savants classed the palm as the first of the vegetable kingdom and the last of the animal.

The height of the date palm varies from three to twelve meters. The tree itself will indicate the time of fruit bearing.

When it has arrived at its maturity it will cease its upward growth, and throw out from its head a large mass of long, broad, green leaves, which protect the neck from the glare and heat of the sun. The young seedlings must be removed from the foot of the parent tree in the month of January, and planted and reared according to the foregoing instructions.

In Persia the palm is grown near the ports on the Persian Gulf; also, in the hot districts of Kerman, Khûrzistan, and in the Oasis of Jandak.

E. SPENCER PRATT,
Teheran.

THE CITRON OF COMMERCE.

ITALY.

ROME.

REPORT BY CONSUL-GENERAL ALDEN.

The citron tree, or shrub, will grow wherever lemon or orange trees grow. It flourishes, however, only in a sandy soil and in the immediate neighborhood of the sea. It is most successful in sheltered situations on the shores of bays. As might therefore be expected, it is largely grown on the Ligurian Coast, which is sheltered by mountains from the north wind, and also in the southern Mediterranean provinces of Italy, and in Sicily. The French island of Corsica is probably the most prolific citron-producing district of the Mediterranean Basin. The present Corsican crop is estimated to be nearly five million five hundred and ten thousand pounds. Great care is needed in the cultivation of citron. The fruit when full grown is large and weighs from one to three pounds, and will, unless the branches are carefully propped up, either break them or bend them to the ground.

The average crop per acre of citron can hardly be ascertained, as the size of a crop depends upon so many conditions—such as the climate and soil. If we assume that each shrub or tree is planted three yards from every other, which by many growers is regarded as the best arrangement, we should have one thousand one hundred and ten shrubs to the hectare. If the average product of each shrub be assumed to be fourteen citrons, we should have a total product of fifteen thousand four hundred citrons to the hectare, equivalent to six thousand two hundred and thirty-one citrons to the acre; or, assuming the average weight of the fruit to be one and one half pounds, about nine thousand three hundred and forty-six pounds to the acre.

The cost of production varies so greatly in different localities and at different times, that no trustworthy and generally useful answer to the question of cost can be given. In the neighborhood of Genoa, however, it is roughly estimated at about $68 per acre.

More citron is imported into than is exported from Italy. The following table shows the imports and exports of citron for three years:

Year.	Imports—Pounds.	Exports—Pounds.
1882	3,896,701	513,019
1883	3,996,791	341,719
1884	2,743,454	262,572

The greater part of the imports of citron comes from France, and nearly all from the Island of Corsica.

Citron is chiefly prepared for the market at Leghorn, which is the most important citron port in the Mediterranean. The fruit is first put into a salt pickle, in which it is allowed to lie for three months. This pickling in the case of the Corsican fruit is done to a limited extent by the Corsican citron grower, but, as a rule, it is done after the Corsican fruit reaches Leghorn. The next process consists in dividing the fruit into halves and quarters, and packing them into sugar syrup. The syrup when first used is weak, but its strength is gradually increased by additions. Four weeks is the ordinary period during which the fruit remains packed in sugar, after which it is ready for the market.

The market price everywhere fluctuates greatly. During the present year the price at Leghorn has varied from $14 47 to $22 19 per fifty kilograms, or 110.20 pounds. To some extent, so it is said, these fluctuations were due to the speculative condition of the market in New York, where the price has varied greatly.

WILLIAM L. ALDEN,
Consul-General, Rome.

LEGHORN.

REPORT BY CONSUL SARTORI.

Cultivation.

The citrons which are subsequently converted into the candied citron of commerce are grown chiefly in Greece, Calabria, and the islands of Sicily and Corsica. Most of those which come to this port (Leghorn) are from Corsica, where, it is claimed, the finest qualities are produced. The citron tree is of the same family as the orange and lemon, and is propagated by cuttings, which begin to bear fruit the third year after being planted. It bears one crop of fruit yearly, which matures and is gathered during September and October. The trees are pruned every year, the branches being made to grow as much as possible in the shape of a hollow circle. They are also manured yearly, generally with stable dung. In summer it is essential that they should be kept well watered; otherwise, if there should be a drought, the trees suffer, and the fruit will drop off or will not attain its full size. The citron tree is more susceptible to damage from frost and cold winds than the orange or lemon, hence sheltered situations with a favorable exposure are sought for planting them, and hedges of brushwood disposed so as to protect them from the winds. The fruit resembles a huge lemon, and is often so large and heavy that it must be supported on the tree.

They are shipped to the factories for candying, sometimes in sacks, but usually in large hogsheads filled with brine. On being taken out of these hogsheads or sacks they are placed in tubs containing fresh brine and left for about a month. The brine is then renewed, and the fruit may remain in it until required for use, even for a period of four or five months.

Candying Citron.

When the citrons are to be candied they are taken out of these tubs and boiled in fresh water until sufficiently soft, which is ascertained by testing them with a fork. This usually takes about one and one quarter hours, and they are then cut into pieces, the seeds carefully removed, and they are immersed in cold water and left for twenty-four hours, and become a green color. After this they are placed in large earthen jars with hot syrup, which should entirely cover them, and remain about three weeks. During this time the proportion of sugar in the syrup is gradually increased. They are then put into boilers, with crystallized sugar dissolved in a little water, and cooked; then allowed to cool for twenty-four hours, and boiled again until they can absorb no more sugar, and then taken out of the boilers and placed on a wire netting to dry. They are now ready for packing, and placed in small wooden boxes containing about twenty-five pounds each, and these in their turn are packed in cases (half cases they are termed in the trade) which contain ten of them. The proportion of sugar used in the process of candying is 80 per cent—that is, eighty pounds of sugar to one hundred pounds of citron—and the kind used is generally Egyptian crystallized sugar, which costs at the factories 11.85 cents per pound. The Government allows a drawback at the above rate—that is, eighty pounds of sugar to one hundred pounds of fruit—on such as is subsequently exported. As the duty is 5.7 cents per pound, it being returned, makes the cost of the sugar used in candying the fruit afterwards exported, 6.15 cents per pound.

There are nine factories for candying citrons in Leghorn, employing about three hundred men, and producing annually four million four hundred thousand pounds. In 1884 the United States took of these one million nine hundred and twenty-one thousand three hundred and forty-one pounds, valued at $214,652 23, and up to the present date in 1885 they have taken one million eight hundred and nineteen thousand seven hundred and sixty-four pounds, valued at $261,566 61, a decrease in the quantity and an increase in the valuation. The remainder is sent principally to Holland, for distribution through northern Europe and England.

The price paid by the merchants here varies according to the supply, 5¾ to 6¼ cents per pound being about the average cost of the fruit in brine at the factories.

The article is handled almost entirely by speculators, and the prices of the candied fruit show great variations. While during the early autumn the prices ranged from 16½ to 18½ cents, it can now readily be purchased for 13 cents per pound.

VICTOR A. SARTORI,
Consul, Leghorn.

MESSINA.

REPORT BY CONSUL JONES.

The Citron Tree.

Formerly in the Province of Messina the citron (*Citrus medica*) was extensively grown in hedges, as dividing lines between neighbors, but within the last twenty years this tree has been nearly exterminated in this vicinity by the diseases known as *gomma* (bleeding) and *cagna* (foot-rot).

The citron was the first of the citrus family introduced into Europe. In its bearing and general appearance it is the most strongly characterized of the genus. The tree is low, with a full head; it is strong shooting; its shoots are tender and straggling; its leaf is large, thick, oblong, wingless, and toothed. Changes occur at short intervals in the vitality of the tree. It frequently happens that healthy shoots live but one or two years; hence, the necessity of cutting off the vertical shoots to prevent sudden disturbances in the head of the tree that would exhaust its strength. The diseases of the citron are constitutional, and prematurely destroy its life. The most promising subjects suddenly cease growing, and become chlorotic; the branches gradually turn yellow, and are often covered with scabs, from which exudes coagulated sap resembling gum; the sores assume a cankerous appearance, and the tree dies. The citron's dying out to such a great extent in this province was due principally to its propagation by cuttings. It has been found that where the citron was budded on an orange seedling, and more especially on a sour orange, it acquired a stronger constitution, and did not grow in such a straggling manner. The citron blooms at all seasons of the year. The flowers are white inside and purplish outside. Black ants destroy many of the blossoms. Once set the fruit grows rapidly. Citrons often weigh from six to eight pounds. The fruit presents a bumpy appearance; its base is full and flat; its perfume is delicious. It is necessary to prop up the branches of vigorous trees, as unassisted they could not support their heavy fruit. Good culture doubtless would improve the nature of the citron and perfect its development, but it cannot prolong its life, which is very short compared with that of the citrus family generally.*

Citron trees receive the same attention as the orange and lemon trees among which they grow. From March to October these trees are worked five times. Irrigation is found indispensable. During the summer—the dry season—the trees are watered twice a week. The average cost of cultivating an acre in orange or lemon trees is $50 a year. The distance between these trees is from fourteen to twenty feet, according to the soil and the location.

Shipment of Citrons.

The citrons now exported from Messina are brought from Reggio, in Calabria. They are shipped in brine, and are prepared as follows: The citrons are cut in halves, thrown into casks, and salted—one hundred pounds of salt to the cask. The casks are then filled up with sea water, and turned on their side. The citrons are left to soak from fifteen to twenty days. The casks are then opened and the citrons weighed; seven hundred and seventy pounds of citron are allowed to the cask; sea water and a little salt are added, and the cask is ready for exportation. A small auger-hole in the bung permits the gas produced by fermentation to escape. The casks are of chestnut. They cost $3 apiece, and contain one hundred and five gallons. It costs $1 a cask to cut and salt the citrons, and $1 a cask to pack them, cooperage included.

Prices and Exports.

A citron tree bears from thirty-five to fifty citrons, which are worth to the grower from 5 to 10 cents apiece. First quality citrons weigh one pound and upwards. Last year citrons on the tree sold for $20 the two hundred and twenty pounds. November 1, 1885, they brought $17 the two hundred and twenty pounds; December 1, 1885, they fell to $12 50. Salted citrons, November 1, 1885, were quoted at $64 the cask; December 1, 1885, at $59. November and December are the great shipping months; the fruit is then half grown and half ripe.

The Custom House statistics show, for the year ending December 31, 1884, that four hundred and fifty-five thousand four hundred pounds of citron in brine, valued at $16,560, were exported from Messina. No preserved fruit is shipped from this port. England, France, Genoa, and Leghorn are the principal markets for the "citron of commerce."

WALLACE S. JONES,
Consul, Messina.

* For the above details I am indebted to the comprehensive work of Prof. F. Alfonso, "Coltura degli Agrumi."

NAPLES.

REPORT BY CONSUL CAMPHAUSEN.

Cultivation.

The cultivation of the citron begins with the sowing of the seed of the bitter orange, being the same seed from the fruit of which marmalade is made.

After four or five years, when the seed has produced plants or small trees, they are transplanted, at the time of blossoming, in regular rows, at a distance of twenty-five centimeters.

When they have a diameter of eight centimeters they are grafted with small citron branches. The grafting is indispensable to give long life to the trees and hasten the production of the fruit.

Three years after the grafting the tree is transplanted into a ditch one and one quarter meters wide and one and one half meters deep, at a distance of four meters from one another. In planting the trees in the ditch particular care should be taken not to injure any part of the roots.

The leaves are taken from the trees and the branches cut back to the length of twenty centimeters. The ditch is filled with earth to a depth not exceeding twenty-five centimeters, left sufficiently loose to allow the roots to spread with ease, and prevent smothering the plants. If the plants do not sprout at once the earth on the roots is loosened and moistened.

For fertilizing, old horse manure, or other old manure, is to be applied. No fresh manure ought to be used, because it would be injurious and have a tendency to kill the plants. Manure should be used only in the winter, between October and March, and be placed at a distance of ten or fifteen centimeters from the roots. Around the tree a deepening, in the shape of a basin, should be formed, and, unless the ground be moist or damp, the plants require frequent applications of water during the summer.

In Sorrento the planting is done from March to June, according to the state of the temperature; grafting during the same months. The rest of the cultivation is the same as for the orange and lemon. Hoeing, and pruning of useless limbs, are done in May. The tree requires great protection against severe cold or very warm winds, as well as against hailstorms. In order to give it as much protection as possible, hedges are planted and coverings of straw matting, or something similar, provided, having regard to the situation of the tree and the means within reach of the cultivators. The plant is much more tender and delicate than the lemon.

The tree blossoms between March and May, and up to the months of September and October, at which time the fruit is ripe. In about two years' time the grafts will begin to bear fruit, and after six years, if the ground and climate suit, the tree will bear from forty to fifty kilograms of fruit a year, and when in full age up to two quintals, and perhaps more.

The greatest part of the expense in the cultivation is caused by covering the tree to protect it against the winds. In milder climates this expense is not incurred, and the only outlay is for manuring and hoeing. These expenses vary according to the price of labor in the different

localities. When the ground is of the right kind—that is, loose and moist—the climate mild, there is a great profit made in the culture of the citron.

The exact amount of the profit cannot be given, as it varies according to the price obtained for the fruit, which is subject to great fluctuations, ranging from 15 to 100 lire per quintal on the ground. This year, for instance, garden citrons have sold at from 30 to 70 francs or lire a quintal on the ground. Some years when Corsica, where the citron is cultivated to a very large extent, gave large crops, the fruit sold for 15 lire a quintal, while at other times, when the crop was small, 100 lire a quintal was paid.

Packing and Preserving.

This fruit is packed the same as lemons, wrapped in paper and boxed or barreled.

The fruit is not candied for exportation in this neighborhood, but sent to Leghorn or Genoa, to large factories for this industry.

The information received on the subject of preserving the fruit is as follows:

The citron is cut in two or four pieces; it is then placed on the fire and boiled until the inside can be easily taken out with a spoon, then soaked in cold water for four or five days, and the water changed twice a day until the citron has lost its bitter taste. To every kilogram of fruit one kilogram of sugar and one liter of water is added, and placed over a slow fire and left standing for two days.

Then one hundred grams of sugar to every kilogram of fruit is added, and the boiling process repeated, left again for two days, and then again repeated at intervals until the syrup is thick. The fruit is then dried in an oven or before the fire, and can be exported in wooden boxes.

According to another authority, the fresh citron is divided, the pulp taken out, and the rinds are then steeped in brine for several weeks. They are then boiled in syrup until the rinds are quite cooked; they are next dried and boxed, as above described.

Others, again, after taking the rind out of the brine, boil it in water for two days, changing the water two or three times per day and beginning each time with cold water; then one kilogram of sugar to one half kilogram of water is taken; put into the quantity of syrup thus made one kilogram of the rind, as above prepared. Each day, for six or seven days, bring the fruit now in the syrup to a heat in which you can just bear your hand, adding fifty grams of sugar each time. Let the fruit in this syrup become cold, and, as above, add fifty grams. Make another syrup of one kilogram of sugar to one half kilogram of water; boil for one half hour; then take the fruit out of the first syrup and put in the last prepared, which should be exceedingly hot, and boil the fruit ten minutes, stirring it at the same time. Thus the last syrup is absorbed by the fruit, and it becomes dry.

The citrons, both fresh and in brine, are exported in immense quantities from Messina, Palermo, and other places, to foreign countries, but chiefly to the English markets.

EDWARD CAMPHAUSEN,
Consul, Naples.

CUBA.

REPORT BY CONSUL PIERCE.

In the District of Matanzas the citron, though not indigenous to Cuba, is to some extent cultivated here, but not as an article of commerce. Scarcely any attention is paid to its cultivation, and, like a great many other useful products, it is almost entirely neglected, owing to the prior preference for the staple product, which up to this day is the sugar cane.

It may be surprising that an article so universally growing in the island should not appear as an article of export, but to one well and thoroughly informed as to the tendency of the agricultural class here, it is not surprising. Nearly every farm house, garden, or plantation has a few citron trees growing. The soil is eminently adapted to its cultivation, and, in the production of it it is flourishing and florescent; but as small cultivations have been entirely abandoned in preference to the sugar cane, there has been neither foreign exportation nor an interior commerce in the article—at least, in this district.

The citron is used to a limited extent here as a tonic and for preserves. In its use as a tonic or medicinal article, only the outside bark or peel is used. The interior is used as a refreshment and for preserves.

The citron is grown on a bush about nine feet high. From the time of planting, in about two years, fruit may be expected.

It will grow in any ground, but rich earth is naturally preferable. As the fruit has never been attentively cultivated here, it is almost impossible to digest the many opinions given by the isolated cultivators who have given it any attention; but I have given what I deem a fair synopsis of the various data obtained, and will add that it is deemed and classified as hardy as the orange.

Propagation may be done by planting the seeds (but production is later in this way) or by cuttings; or, as in the case of the banyan tree, by intertwining branches, which readily take root.

FRANK H. PIERCE,
Consul, Matanzas.

MADEIRA.

Acting Consul J. Hutchinson writes from Funchal, under date of December 3, 1883:

"The cultivation of the fruit on the island is on so small a scale that it is impossible to obtain any definite information. There are a few trees in two or three districts, on the lands of small holders, who never think of making any calculation as to the cost of culture, yield, or profits.

"The fruit is sent into town in small parcels for sale to the shippers. The present prices range from $1 to $2 per hundred, according to size. The buyer places the fruit in a cask with sea water for shipment. It all goes to London, the average annual shipment being about fifty casks of one thousand citrons each."

MEXICO.

Consul James Viosca, of La Paz, Mexico, reports, under date of November 24, 1885, that while the citron has never attained a commercial importance in Lower California, the tree thrives luxuriantly, bearing

yearly an abundant crop of very deliciously flavored fruit, weighing from one to five pounds each, thus proving the fitness of the soil did a market exist for the produce. A small quantity of the green or seasoned fruit is yearly exported to the ports of Mazatlan and San Blas, for domestic uses in making sweet preserves, or what is known as *fruta enbuelta en azucar* (fruit covered with sugar). Otherwise it has no commercial importance.

THE ORANGE AND THE LEMON.

CONTINENT OF EUROPE.

FRANCE.

REPORT BY CONSUL BRADLEY, OF NICE.

Oranges and Lemons on the Riviera.

Varieties.—Among the hundred and over varieties of citrus fruits grown on the Riviera, it is impossible to specify any one or two as most profitable. The oranges are not only exported as fruit, but orange-flower water is distilled from large quantities of their flowers (one firm alone using seven hundred thousand pounds of flowers). Tons are candied green. Neroli, so much used by the perfumer, is extracted from other varieties, and from the dried peel curaçoa is manufactured.

From recommendations given I have selected eight varieties of oranges as among the most useful.

Oranges.

Orange franc (*Citrus aurantium vulgare*).—Stem straight and vigorous, bark gray, head hemispheric, whose branches, numerous and confused, are covered with thorns. The young sprouts are angulous, and of tender green color. The lower leaves thick, oval, lightly notched, light green; upper leaves oblong, darker green, glossy, entire, on a long stem, less winged than the under leaves. Flowers axillary and terminal, white petals, ovary often striated at the base. Fruits average size, rounded, globulous, sometimes slightly concave at top, where the place that the style occupied is always apparent. The stem end frequently shows the striæ noticed in the ovary. Skin golden yellow, slightly rough, and covered with vesicles. The pulp is divided into eight or ten compartments, full of large vesicles nearly as yellow as the skin, which hold a juice abundant, palatable, and sweet. Seeds large, oblong, unequal, each inclosing three or four perfect germs. The tree grows here to be twenty-four feet high, its head, say, twenty-seven feet in circumference; in warmer climates a little larger. It commences bearing at eighteen or twenty years of age. The fruit grows sweeter as the tree grows older. It ripens early, and resists cold better than any other variety; not much cultivated on account of slow growth, and because the fruit is much of it spoiled for transportation by the thorns, but the stocks are much used for grafts of other varieties.

Orange de Nice (*Citrus aurantium nicense*).—Differs but slightly from the above; it is a favorite because of the keeping qualities of the fruit, and the readiness with which a graft from it starts.

Orange de Malte (*Citrus aurantium melitense*).—Skin dark yellow, shading into red; the pulp may be red in part or wholly. It is considered to be a hybrid between the Franc and some East Indian species.

Orange à Pulp Rouge (*Citrus aurantium hierochunticum*).—The skin of this orange is always yellow, never red, but the pulp is dark red. This variety differs little from the preceding in appearance and form.

Mandarin (*Citrus madurensis, or Citrus deliciosa*).—Already well known in California. Here it is one of the hardiest varieties.

Orange bigaradier Franc (*Citrus bigaradia*).—Root long, branchy, bearded, light colored outside, yellowish within. Trunk straight, grayish, branches bushy, covered with long greenish thorns. Young sprouts are pale green, angulous, like most of the genus; leaves elliptic or oblong, narrow, acuminate, lightly notched in the upper part, wavy, a fine green, and carried on stems more or less winged. Flowers in clusters, have calix angulous, five petals, taste slightly bitter, from thirty to thirty-five stamens partly adherent at the base. Ovary round or striated, surmounted by a style, terminated by a tuberculous stigma. The fruit is of average size, round or slightly elongated, smooth or sometimes rough, flattened at the end, yellow to reddish orange color. The peel is bitter, very fragrant, clinging to the pulp, which is yellow, and divided into twelve or fourteen parts; its juice is not very palatable, bitter, acid taste. The seeds are oblong, sharp, and yellow. The tree grows here to the height of about twenty-seven feet; flowers in May and sometimes in autumn; fruit ripens slowly. Neroli is distilled from its flowers, and from its dried peel the liquor curaçoa is made.

Orange de Chine, bigaradier, or Chinois (*Citrus bigaradia sinensis*).—A valuable dwarf variety, about twelve feet high; resists the cold well. The orange is used for preserves or candied fruit, and a water is distilled from its flowers.

Bergamotier ordinaire (*Citrus bergamia vulgaris*).—The Bergamotier is naturally lofty, plenty of branches, but the branches are so brittle that the head of the tree is rarely well filled out or regular. Its leaves are oval, oblong, some pointed, others obtuse, average size, green, the lower surface whiter than any other orange leaf, leaf stems long and winged. Flower white, small, fragrant, scattered or united in clusters, borne on very short stems. Fruit good sized, usually pyramidal, rarely round, yellow, smooth, glossy. It has an agreeable fragrance peculiar to itself, peel thin, pulp yellowish green. This variety is chiefly valuable for the essential oil obtained from its flowers and peel.

Lemons.

Lemons being generally seedlings, a very large number of varieties are produced, which even proprietors of orchards do not try to distinguish. Twenty or thirty varieties have been classified.

The following are said to be among the most valuable: Lemonier ordinaire (*Citrus limonum*), vulgare; Lemonier imperiale (*Citrus limonum*), imperial; Lemonier bignette (*Citrus limonum*), bignetta; Lemonier perette spatafore (*Citrus limonum*), peretta spatafora. This last is excellent in damp situations.

The lemons thrive only in the sheltered nooks within a mile or two of the sea, where every deep warm valley has its small orchard ripening, not only from the direct rays of the sun, but from the warmth thrown back by the cliffs around them. The more hardy oranges can be found ten miles from the coast among the mountains, as high as nine hundred to one thousand two hundred feet above the sea. Our only level land is in small valleys among the Alpes Maritimes, which cover all this district. It is generally noted that this fruit ripens earlier on hillsides where water can be brought to it.

The soil best adapted to them here is a silico-argillaceous or argillo-calcareous soil, the latter, when not too damp; but any good mixed soil seems to answer, as they are not difficult.

In regard to temperature, M. J. Tesseàre gives observations taken by him covering twenty years. The minimum during that time being 26 degrees; maximum, 92.5 degrees; average, 60 degrees Fahrenheit in the shade. These observations were taken three times daily: sunrise, 2 P. M., and at sunset. In the sun at 2 P. M., the thermometer marked minimum 99 degrees, maximum 135.5 degrees, averaging 112.1 degrees. Lowest night temperature, 26 degrees; highest, 79 degrees. There are but few sultry days. During the twenty years there were 4,385 days almost or entirely cloudless, 1,547 cloudy days, 1,348 days more or less rainy, 28 days without observation. This would give in one year 219 sunny days, 77 cloudy, 67 rainy. The hygrometer of Saussure gives minimum of 23, maximum 77, average 61.4.

For the five years, 1870–74, the minimum rainfall was in 1874, 24.3 inches; the average for the five years was 35.1 inches. The peculiarity of the rainfall is the tropical intensity of each shower and its short duration; so that while we have actually more rain than London, England, we have very much fewer rainy or cloudy days. During the long summer, from June to September, the trees are irrigated with water brought in canals from mountain streams, which is generally tempered by storing in large private tanks for some time before being applied, which is at intervals of one or two weeks. This is done in summer, between sunset and sunrise; if necessary in autumn, it is done in the morning. Gardeners watch the leaves of the tree for indications of need of water. The orange needs less water than the lemon.

The earth is worked over twice a year; in the spring, after pruning, at least a foot deep; again in the autumn not quite so deep. The tool used for this work is always tined, as a blade might injure the smaller deep roots. It is considered desirable to cut away the roots which lie near the surface, as they are injured by becoming too dry, and the tree suffers. The deeper growing roots are better for the tree to draw sustenance from, as they keep moist longer.

Fertilizers are used for two definite purposes, and at two different epochs: First, to press the growth of the young tree with manure, speedily decomposed, which will furnish strong nutriment at once to the roots, such as oil-meal cakes, guano, dried blood, stable manures; second, for the support of the mature tree with manures of slower decomposition, such as horn shavings, bones, woolen rags, hair, hide, and even leather. These are placed around the tree as far from the trunk as the roots extend during the autumn, and covered with earth to the depth of a foot.

The object aimed at in pruning is to bring the greatest possible surface of the tree to the direct action of air and light. The spherical form is considered best. To keep this form, shoots are pinched off in June each year. In the early spring, weak and dead wood, forgotten useless shoots, are cut out to let light and air in among the branches; a sharp knife must be used.

Oranges are picked first when just beginning to turn yellow, in October, for distant shipment; next in December for a nearer shipment, when half yellow; finally in the spring, when fully ripe, for home market. They are sold by the thousand, the Caisse, or Patronne. The best are wrapped in gray paper and packed three hundred and sixty in a box, and called Caisses Flandrines. The second quality are packed in the same way, five hundred to the box, and called simply Caisse. The third quality, packed the same way, is called Caisse de Menton. The fourth quality are called Patronnes de Magasin, and the fifth Patronnes de Barque. These latter are shipped by boat in bulk. Those poorer than the above five qualities have no commercial value, excepting for the peel, which is taken off and dried. Oranges as a rule grow sweeter with the age of the tree.

Lemon trees blossom from the earliest spring to late fall, and even during the winter. From the few fertile flowers of late winter comes a large thick-skinned fruit with but little juice, called Testassa. The early spring flowers, from which good fruit ripens in about six months, or in October and November, are the ones most depended on for a crop. These lemons are called here "Primo Fiore," or "Maraviglia." The next flowers of May and June only ripen their fruit after ten months, which are called "Secundo Fiore," or "Granetta." These are generally inferior to the "Primo," but if for any reason those fail, Nature tries to make up for it by putting all the good qualities lost with "Primo" into the "Secundo." The flowers of July and August mature the following April and produce the "Verdame," which is said to keep well for shipment. After the rain of September and October, a few flowers are fertile and give a coarse fruit called "Septembrine."

The fruit, carefully picked, is spread on straw, where the different commercial qualities are selected. They are wrapped in absorbent paper, and packed according to size, and given the following commercial names: Caisse Flandrine, four hundred of the best size in a box; Caisse Lyonnaise, five hundred in a box, and Petites Caisses, where three boxes hold one thousand of the smaller ones. The lemons of the first class in size must be at least fifty-five millimeters in diameter.

The plants are propagated by seed, grafting, cuttings, and layering, principally by the first two methods. When planted in the orchard the distance apart is modified, first, by the kind of culture, whether in large orchards, when other plants are to be cultivated between the rows, and Nature allowed to take its course, or in small gardens, where a system of forcing is used; second, the quality of the soil, and, finally, the form in which they are to be set out, whether in one row, in squares, etc. In a general way, from fifteen to twenty-four feet is near enough for trees of standard size.

The trees begin to bear flowers and fruit at five years, give a reasonable crop at fifteen, but increase in productiveness up to forty years.

Insect Pests.

The following insects are hurtful to both orange and lemon trees, but as the lemon tree is always in flower and is more frequently watered, the *Lepidoptera* in the larva state is more injurious to it than to the orange:

Coccides.—Dactylopius citri (*Bois Duval*).—This insect with soft tegument is very common on both orange and lemon trees of the Riviera. Its body is a red brown; about it are numerous cottony appendices, seventeen on each side; at the end of the abdomen are two much longer than the others. The insect is entirely covered with white dust. Its length is $0.^{m}003$ to $0.^{m}004$, breadth $0.^{m}002$. The antennæ of the female are eight-jointed. The tarsis is half the length of the tibia; the thread-like feet are very long. Web pores are plenty; the genito-anal ring large, with six bristles; the larva has antennæ six-jointed; the abdominal web pores are less numerous than in the perfect insect. The male is long, brown on head and thorax, abdomen yellowish; the feet and antennæ darker in color; these latter have ten articulations. Thorax narrow; elytron very long, grayish white; abdomen very long, with web pores on the edges; sexual organs tuberculous in form, quite large, terminated in a rounded point; feet long; tarsis longer than the thighs.

This insect, a veritable scourge, forms upon the young fruit and leaves cottony and sticky heaps, contrasting strongly by its whiteness with the color of the fruit and the black layer of the "Morphée," which always surrounds them. Breaking off these living heaps, some of the insects will be crushed, yielding a reddish liquid; in them will be found insects in different stages of development, and besides this the larvæ of the Coccinella and the caterpillar of a little *Lepidoptera*, the *Ephestia guidiella*.

The *Dactylopius citri* seeks sheltered spots where the trees, too closely planted, lack air and light. It hurts the growth of the trees by stopping the leaf pores. It unites with the *Lecanides* and the *Aphides* to propagate "Miellat" and "Morphée."

Aspidiotus limonii (*Signoret*).—This Coccus with hard tegument, which is found particularly upon the young branches, has, according to M. Signoret, the lobes at the abdominal extremity detached and apparent, and the fimbriate scales long; the last abdominal segment is elongated. The shell of the adult female is spherical, yellowish white in color, with internal organs yellow, and a large quantity of eggs. The shell of the male is more elongated. Raising the shell of the mother when the little ones are being hatched, numerous small white larvæ running quite fast among the eggs, yet unopened, can be seen. These resemble the Phylloxera, excepting in color. The male is quite common; his head is notched in front, the antennæ are long, thorax rounded and broad.

Lecanium hesperidum (*Auctorum*).—This insect is clothed with a solid cuirasse. It is elongated in form; its color a yellow brown. It adheres firmly to the leaves, and is difficult to distinguish from them. Its antennæ have six articulations, legs slender, claws very long, genito-anal ring surrounded by six bristles. Larvæ long, with six articulations in each antennæ. The male has not been described. Examinations of the female show embryo, but no eggs, which gives rise to suggestion that she may be vivaparous.

Lecanium oleæ (*Bernard*).—Brown, with deep body and two raised transverse lines on the back, almost heart-shaped; the antennæ have eight articulations; yellow at first, they become black. The female lays her eggs and shelters them under herself in great quantities.

The methods in use by the best gardeners for the destruction of this form of pest is to powder the tree with a mixture of sulphur and plaster from April, and to brush trunks, branches, and fruit during the winter. Washing with waters, saline, alkaline, or acid, which might harm the plant, are given up; syringing with medicinal liquids is also discouraged. Carbolic acid, turpentine, or petroleum dilutions are preferred for brushing on, the latter as the cheapest, with water in proportions of one to thirty. These should be applied at night in spring. It is also recommended to wash the trunk with lime water, and to cut off and burn on the spot at night the small branches too much attacked to be cured. Another author advises the use of nitro-benzine, but the essential things seem to be plenty of light and air through and among the trees, and, above all, protection of wild birds.

Lepidoptera.—Acrolepea citri (Milliere).—Tincidæ described by Milliere and Rangouet. The female probably lays her eggs, which are round and of a bright yellow color, near the bud. The young larva soon hatches; it is at first, to the naked eye, a yellowish white, and retains this color some time. At the moment of its final transformation, when it is largest, its body is yellowish green in color, which is particularly noticeable in the hollow of each ring and on the under parts. The head, dark brown, has antennæ, or horns. The eyes are very apparent. A marked distinction between this insect and the *Prays-olellus* is that the latter has, upon the first thoracic ring, two bright, black spots, which are wanting in the *Acrolepea citri*, whose first ring is simply a darker shade. The body of the larva is a yellowish green color, and has six brown feet, armed with little claws, darker brown. The false feet, to the number of eight, are placed under the sixth, seventh, eighth, and ninth rings. They are provided with an apparatus with short filaments, which allows them to adhere or cling strongly to any object. The last abdominal segment is conical, and notched at the anal extremity. It is provided with the same apparatus as the false feet, commencing with the first thoracic ring; the covering is delicately marbled with a reddish color. Preserved in alcohol, the larva, which has lost its greenish tints, becomes yellow, the back a darker shade, the eyes and mandibles very black. Very lively, it burrows in the bud whose covering it has pierced, and leaves a round hole very apparent. Once settled in the bud, it commences by devouring the base of the stamens; then it attacks the embryo of the fruit. It is found, sometimes, at the bottom of the calyx enveloping the base of the fruit, still very small, with its rings, trying to get into it; moving from place to place, it emits thread, which binds the stamens together and incloses its excrements. When the flower attacked opens, the stamens are seen to be upset, and the young fruit, pierced at several points, soon blackens and dries up, even before it is as large as a grain of wheat. If the larva is disturbed, it quickly leaves the inside of the flower and crawls about the outside of it; then, if there seems to be danger, it tries to reach another branch or the ground, dropping down by the thread spun from itself, by which it climbs up again when the danger seems past, absorbing the thread into itself as it goes up. The larva being fully developed, it prepares to spin its cocoon in the calyx of the flower.

The cocoon is a gray-brown, meshes so loose that the phases of trans-

formation can be easily followed; once really shut in, the caterpillar shrinks rapidly. Larvæ commencing their cocoons the twentieth and twenty-first of September, yielded a butterfly the twenty-sixth or twenty-seventh following. Its sleep then lasts but six or seven days. At first the little chrysalis, in its cocoon, is a greenish color on its under parts, the upper parts, and a line upon its front, red. After this the green and red fade and it becomes a light brown, verging toward green, which darkens more and more. At its birth the butterfly is almost black; it is only later that it pales and the varied designs appear upon its dress. It is motionless, antennæ stuck to its body, legs drawn up under it, looking like a small black spindle; when well dried it straightens its antennæ, which it carries pointing forward, and always in motion. It raises its head, stretches out its legs, and makes its toilet; at the slightest alarm it changes its place with a jerky little flight. The designs on the wings of these butterflies vary much, and sometimes disappear completely, to give place to a general mouse-gray color, more or less silvery.

A general description of a good specimen of this insect would be as follows:

The body mouse-gray, under part silvery; head the same color, eyes are large, the dark antennæ half the length of the body.

Examining with care, a black line forming a half crescent is apparent at the commencement of the prothorax; near the center of the folded wings, or in the front third, a second black spot appears resembling the letter A, with top flattened and lacking the transverse bar. The top points toward the head of the insect; the sides are on the two wings. Further back is a third black spot similar to the second, but very much fainter, and the final point of the wings, a darker gray than the rest, make a last noticeable spot. The specks on the wings are too small to be called spots. The three pairs of legs are of different lengths; the second pair has one spur, the third has two. In color they are gray, with black wings.

I have only studied these insects during the blossoming season of August. Professor Penzig, who has made longer studies of them, says that there are three generations in each year; the first in April and May, the second in August, and the third in October and November; according to him the winter is passed as an egg from this last generation. The first generation in the spring from these eggs is not strong or prolific, and not so harmful. The August generation is the most mischievous. They were first noted as hurtful in Corsica, later in Sicily, by M. Panizzi. The methods of destruction used against this insect and the next two are to pick up and burn the flowers attacked, and to gather all grass and weeds growing near the trees, dry them, and burn them in heaps under the trees at nightfall. A great many butterflies attracted by the light are destroyed, besides other forms of insect life, under the burning heaps.

Ephestia guidiella (Milliere).—A Phycide described by M. Milliere, of Cannes, who gave it this name because he first found it upon *Daphne gnedium*, a shrub quite common on the hills. It seems to be polyphagous, however, as it is found on many plants; besides this they are found under the whitish, sticky, cottony heaps deposited on fruit and leaves by the *Dactylopius citri*.

It has the form, but is a little larger than the *Acrolepia*. It differs from the latter in color, being blackish, with a band of darker shade on each side, dotted or marbled. The larva is hairy; there are hairs even around its eyes. Its head and first thoracic ring are a brighter color. Placed in alcohol it is a lighter shade, becoming a chestnut, the band on the sides very marked. It is very lively, seems to flee the light, and is longer in preparing for its transformation than the *Acrolepia*. It first makes a loose shelter, in which it spins a cocoon, impenetrable and whiter than that of the other, and while longer in preparing the cocoon, it is at the same time longer in changing from chrysalis to butterfly, nine days instead of six. The butterfly is larger and a dark gray. Its wings, instead of being folded in a spindle shape, are folded more in the shape of an acute angled triangle. The body is mouse-gray beneath, a little darker above. The abdomen is well furnished with hairs. The under part of the wings is a brilliant ash-gray. The upper wings are fringed only at their extremity and on the inner side. Their general shade is lees of wine, with metallic luster; two light designs cross them. When its wings are spread this color is brighter, but the design fades and nearly disappears if the insect is long on the wing. The under wings have a darker shade above than below; their fringe is long, especially the outer edge; a dark line separates the fringe from the rest of the wing. The legs are an even gray, something the shade of the under part of body and wings. With wings spread the *Ephestia guidiella* measures about $0^m.015$, while the *Acrolepia citri* measures but $0^m.010$ or $0^m.012$. Professor Penzig thinks it has but two generations. The discovery of the larvæ of these insects in the heaps made by the Cocci, raises the question, yet unsettled, whether they feed upon the latter, and so are not wholly harmful.

Eupithecia pumilata (*H. G.*).—A beometride larger than the *Ephestia*. As the butterfly varies in its markings, so the larvæ of this insect vary so much as to make detailed description difficult. Its body is cylindrical; six true legs appear, but those on the tenth ring and on the twelfth and last are false. The body is yellow-green, with black lines on the sides. In the middle of the back a longitudinal line, from which, on each ring, a line runs at right angles down the sides; the body is covered with thinly scattered hairs. The chrysalis, yellow-brown, is quite slender.

The specimens of the butterfly that I have raised are a gray-yellow color, brighter beneath than above. The eyes are large and greenish. The under wings are marbled, with little irregular blackish spots. They are notched in the back part and have a darker line serving as base to the fringe. The upper wings, larger and darker, have the same dark line. On the field there are, besides the spots which the under wing bears, designs lighter and darker.

The Diptera are represented by one small fly, in color blue, striped with yellow, which lives in its larva state in the pulps of the oranges. It is the *Cerutitis hispanica* (B.). M. Peragallo could find nothing more detailed than this fact noted by Colonel Goureau.

Of Coleoptera, the *Curculio-otior-hynchus meridionalis*, which attacks the young shoots of the olive, is equally fond of the orange tree, and all lemons which fall on the ground in damp places are pretty sure to contain more or less of the dark yellow *Carpophilus mutilatus*, and to show the small, round hole in its skin by which entrance was effected. To

obtain a specimen, it is only necessary to squeeze the lemon, and the *Carpophilus* comes out with the juice, but not wet by it.

The Morphèe, or Fumagine.—After years of study and discussion of this disease, which gives the leaves of a grove the appearance of being coated with soot, scientists have united in the belief, well founded, that it is due to the liquid excrement of one of the Cocci in which germs of mushrooms find congenial soil for growth, and do grow very rapidly. To prove the power of this insect to eject to some distance its excrement, M. Peragallo confined in a glass insect case several live specimens of the Coccus on orange tree leaves already affected with fumagine. Within twenty-four hours the glass was sprinkled with tiny drops of a viscous liquid, white and transparent, which had evidently been produced by the insects, and which were soon covered with fumagine from germs in the air. For its cure, the Abbé Loquez says:

> Have no excess of humidity, plant further apart, give the trees air, let them grow tall, be moderate with irrigation—water gives fruit but is liable to injure the tree—finally, burn the infected branches.

M. Riviere suggests lime water washes, fumigating with tobacco, washing and brushing the leaves, branches, and fruit. Dr. Signoret adds hanging wisps of straw soaked in coal tar under the trees. At Menton, petroleum and vinegar water are both used as washes.

Two methods are given in the record of the Entomological Society of France for 1883; the first from Greece, the second from Sicily:

1. Prune well, and syringe the trees with the following mixture: Eight parts water, with one each of petroleum and quicklime, finely powdered.

2. Powder the trees while damp with dew with fresh or unleached wood ashes.

To sum up, keep the trees healthy, do not plant in low places or where there is much fog, cut off sickly branches, and destroy by hand as many insects as possible.

"Gum" shows great weakness, and probable death of the branch on which it appears; it is considered to be a cryptogamic disease. M. Peragallo gives the following insects which seem to be friends of the orange and lemon trees:

Syrphus hyalinatus (*de Fallen*).—From larvæ found at Menton and Roqueburne, in whose neighborhood were quantities of the larvæ of *Acrolepia citri*, black and dried, were developed in his breeding cases a Diptera already known as destructive to the Coccide, identified as the syrphus fly *Alinatus* (de Fallen). This insect is considered by M. Peragallo as one of the most useful parasites of the lemon trees, living as it does on different kinds of insects hurtful to the tree, and being quite common in some sections. He has found also in the chrysalides of Microlepidoptera, larvæ which gave birth to tiny Hymenoptera as yet unnamed, and in one case records the birth of a *Hemerobius chrysops* from the chrysalis of a *Eupithecia pumilata*; these latter cases being more truly in the nature of parasites than the *Syrphus hyalinatus*.

List of Oranges and Lemons grown on the Riviera.

Citrus Aurantium.

Vulgare.	Melitanse.	Nobile.
Sinense.	Hierochunticum.	Longifolium.
Depressum.	Balearicum.	Multiflorum.

Pyramidale.	Sigillatum.	Augustifolium.
Ilicifolium.	Mammiferum.	Tardum.
Crispum.	Limetiforme.	Aspermum.
Piriforme.	Oblongum.	Grassense.
Latifolium.	Ellipticum.	Coniferum.
Genuense.	Olivæforme.	Imbigum.
Duplex.	Torulosum.	Lusitanicum.
Nicense.	Carnosum.	Otaitense.
Microcarpum.	Rugosum.	Mutabile.
Minutissimum.	Ruginosum.	Lunatum.
Gibbosum.	Pomum Adami Parisiorum.	Loursiro.
Corniculatum.		

Citrus Bigaradia.

Corniculata.	Spatafora.	Hispanica.
Sulcata.	Mamillata.	Florentina.
Fetifera.	Longifolia.	Coronata.
Canaliculata.	Volcameriana.	Glaberrima.
Cyathifera.	Racemosa.	Dulcis.
Caliculata.	Neapolitana.	Salicifolia.
Crispifolia.	Asperma.	Sinensis.
Multiflora.	Itan.	Myrtifolia.
Violacea.	Sallesiana.	Fasciata.
Duplex.	Macrocarpa.	Bizarria.

Citrus Bergamia.

Vulgaris.	Parva.	Mellarosa Plena.
Torulosa.	Mellarosa.	

Citrus Limetta.

Vulgaris.	Hispanica.	Aurania.
Parva.	Romana.	Pomum Adami.
Acris.	Tuberculosa.	

Citrus Pompelmos.

Decumanus.	Crispatus.	Ragemosus.
Vulgaris.	*Shaddock.*	

Citrus Lumia.

Dominica.	Valentina.	Aurantiaca.
Rhegina.	Gallitia.	Rubescens.
Conica.	*Dulcis.*	Limeta.
Ollulæ formis.	Saccharina.	

Citrus Limonum.

Sylvaticum.	Barbadorus.	Oblongum.
Incomparabile.	Neapolitanum.	Canaliculatum.
Tenno.	Globosum.	Imperiale.
Striatum.	Parvum.	Lauræ.
Pussillum.	Hispanicum.	Racemosum.
Calabricum.	Balotinum.	Rheginum.
Caly.	Mellarosa.	Sancti Remi.
Bignetta.	Peretta.	Nicense.
Bignetta magna.	Peretta Spatafora.	Paradisi.
Hardonium.	Peretta Striata.	Ferrari.
Rosolinum.	Peretta Florentina.	Amalphitanum.
Aspernum.	Peretta Longa.	Chalcedonicum.
Ponzinum.	Vulgaris.	Bimamillatum.
Duplex.	Ceriescum.	Digitatum.
Ligusticum.	Cajetanum.	
Roseum.	Fusiforme.	

Citrus Medica.

Vulgaris.	Plena.	Sulcata.
Cucurbitina.	Dulcis.	Costata.
Tuberosa.	Florentina.	Glabra.
Maxima.	Elongata.	Simoniformis.
Cornuta.	Rugosa.	Parvra.
Salodiana.	Romana.	

WILLIAM HARRISON BRADLEY,
Consul, Nice.

GENOA.

REPORT BY CONSUL FLETCHER.

Oranges and Lemons.

The genus *Citrus*, for economical cultivation, is divided into three classes—the orange, citron, and lemon.

Varieties.—The varieties of oranges generally cultivated in this province are:

(1) *Citrus Bigaradia dulcis*, or sweet orange.
(2) The Melangola of China, or *Citrus Bigaradia sinensis.*
(3) *Citrus deliciosa*, or Mandarin orange, aromatic and saccharine.

Two kinds of citron are cultivated:

A. *Citrus medica rugosa*, wrinkled fruit, very good candied or otherwise preserved.

B. *Citrus medica cedrato*, a very precious and aromatic fruit, the shell of which is also candied.

The following are the varieties of lemon raised here:

A. *Citrus limonum*, a lemon very good for its acid and medicinal virtues.

B. *Citrus limonum tenno*, a lemon of gentle rind, fruit rich in acid, but too tender to stand transportation.

C. *Citrus limonum oblongum*, an oblong lemon, considered very valuable on account of the quantity of acid it contains.

These three varieties are ranked as the best, and therefore are cultivated the most in this vicinity.

Productive Age.—Citrus fruit trees give full crops when about, say, from sixteen to twenty years old, and they keep *yielding excellent crops* for many years afterwards. It is not often that these varieties become very old, say, not over one hundred years. The foliage expands to a remarkable degree, and an average plant will usually produce five thousand fruit per annum; especially can this be said of the lemon tree.

Planting.—Before the malady *gomma* (gum) manifested itself it was preferred to multiply the trees by burying the ends of shoots in the ground at the proper distance; these shoots soon took root, but now the seed of Melangola is planted, into which, when grown to a certain size, the qualities desired are grafted. The Melangola tree up to the present time is in a very healthy state, and forms a good trunk on which to graft all varieties required. Citrus fruit trees are planted at a distance of about seventeen feet apart on flat land, and from thirteen to fourteen feet apart on hillsides. The shade of one tree on another is injurious to the blossoming of the latter; therefore, care should be taken that fair space be given all the plants in order to have Nature do its best for man. The average number of trees in a hectare of land (or 2.471 acres) is four hundred and ninety, and with this number as a basis from which to calculate, it gives a space of about twenty square meters for each tree.

Situation of Orchards.—Orange and lemon orchards in Liguria are all on the seacoast. Flat and hilly lands in orchard are alike protected by lofty mountains from northern winds. This state of affairs appears necessary; the temperature must be constant, for even the slightest frost damages the lymph of the plant and juice of the fruit. Orange and lemon groves can be, and are, cultivated inland, but the temperature in such places must not reach higher than 40 degrees Centigrade, and not lower than 2 degrees; or by Fahrenheit scale, 104 degrees and 32 degrees. Inland orchards usually do well around lakes on account of the constant climate. Groves are also to be seen on tablelands, but always on the south side of mountains; in such localities the temperature is as given above. Citrus fruit trees need a damp soil, and if the land does not contain sufficient moisture, it is impossible to obtain a good crop. On naturally dry soil, therefore, water near by is of great value.

Orchards in this province and in all Liguria are near the sea and protected from the cold northern winds by mountains. Many small groves can be seen beside stone walls, to which the branches cling, particularly the lemon. The land throughout this province being so mountainous, it must be taken for granted that but few orchards can be seen on so called flat lands.

Cultivation.—Orange and lemon groves, on account of the irregular formation of the surrounding country, are necessarily small, and they are owned by about as many people. On account of this natural abruptness and irregularity, added to the fact that the orchards are not large, it is the opinion of the owners that irrigation is too expensive. Further, the soil on which groves are planted is what the Italians term strong, and it is claimed for it that it retains moisture for a long time. Again, an idea prevails among the people that springs are of no great depth here, and consequently the water therefrom courses through the earth, and at no great distance from the surface, and that such an existence waters the roots without the aid of man. A happy belief. *Certain it is, however, that at Nervi*, a few miles along the coast from Genoa, orchards thrive with but little irrigation, and this state of affairs is noticed even in the driest seasons. Unless groves have strong soil, as above mentioned, and are moistened by an unseen watercourse, they will prove unprofitable *if the owners* do not nourish the dry roots as *often as, say, once in* eight days. In the first four or five years cultivation between the plants is possible, but when the tops of trees reach a certain expansion cultivation would seem impossible, or, at least, improbable.

Produce and Expense.—When the tree reaches between the ages of fifteen and twenty years, each one is expected to yield abundant fruit; the orange from four hundred to six hundred, and the lemon from six hundred to one thousand. On strong soil and with proper care as the orchards advance in years, it is said that a lemon tree will yield from three thousand to five thousand fruit per year. The ground is manured like in the olive groves, with some kind of compost, etc.

Summary.

Oranges and lemons are not raised in such quantities in this consular district as to admit of large exportation, but the trade in olive oil is a big item.

The following table is copied from advanced sheets of what is designed as an accurate report of the importation and exportation of olive oil, oranges, and lemons, for the year 1883, to be soon issued by the Chamber of Commerce of this city.

Exports of Lemons and Oranges.

La Plata States	30,102
France	32,532
England	8,750
Egypt	4,577
Total	84,961

Imports of Lemons and Oranges.

France	6,878	
Tripoli and other African ports	66,155	
Egypt	1,830	
Total		74,863
Total exports over imports		10,098

JAMES FLETCHER,
Consul, Genoa.

MESSINA.

REPORT BY CONSUL JONES, OF MESSINA.

Oranges and Lemons.

Varieties.—Best variety for profit, the *Citrus lusitanicum* (orange); *Citrus lusionium* and *Citrus fusiforme* (lemon). Other choice varieties worthy of culture and for profit are the *Citrus bergamia* (bergamot); *Citrus deliciosa* (mandarin); *Citrus luiretta.* There are some thirty other varieties of less note.

Location.—The finest lemon groves are in the neighborhood of Briga, Pezzuolo, Giampilieri, Santo Stefano, Saponara, and Rometta. The finest orange groves are at Francavilla and Rouella, in the valley of the Alcantara.

Distance from Sea.—Lemon trees do better nearer the sea than orange trees; they thrive at from one quarter to two miles from the shore; orange trees from two to six miles.

Elevation.—The greatest elevation at which lemon trees do well is fifteen hundred feet. Orange trees do well at twenty-seven hundred feet above sea level.

A southern exposure is best, but it requires the most water. A northern exposure is generally too cold. An eastern exposure exposes the trees to April frosts. A western exposure is always damp.

The lemon, like the vine, delights in hillsides, facing south. Plains, as well as hillsides, are well suited to the orange.

Soil, etc.—In this district the finest lemon groves are on argillo-calcareous soil of the Tertiary period, and on calcareo-argillaceous soil of the Quaternary period. These two soils are the best for both oranges and lemons. Sandy soil is not well adapted to orange and lemon culture, as it is too thirsty. When grown on sandy soil these trees are small, and their late fruit (fruit from the last June blossoms, which at latest must be gathered in February and March) is spongy and unfit for transportation. Oranges do better than lemons on sandy soil.

Climatic Influences.—The climatic influences in this district are seldom injurious to orange and lemon trees. The lemon requires an equable climate to produce perfect fruit. The orange and mandarin are hardier and suffer less from sudden changes of temperature; they do well at a higher elevation than the lemon, and at a greater distance from the sea.

Temperature.—The temperature in this orange and lemon district ranges from 34 degrees to 100 degrees Fahrenheit; should it, however, exceed those limits for a few hours only the trees soon rally. During the winter of 1887 the mercury fell to 22 degrees, and the tender twigs were frozen; these being at once cut away, the trees were none the worse for the cold. During the summers of 1888 and 1890, the mercury rose to 103 degrees; an extra supply of water soon made the trees look as green as ever.

The average temperature is 96 degrees in summer and 42 degrees in winter; mean annual temperature, 70 degrees. Nights cold or warm; sultry, moist, ordinary atmosphere.

Spring and autumn the nights are frequently cold, and still always above freezing point, however, and do no damage.

Warm nights increase the evaporation but do not injure the trees. In March and April the cold at early dawn sometimes blights the blooms, which would otherwise produce the "bastard," or late fruit.

During the summer the atmosphere is seldom if ever dry. In winter the air is dry when the wind is north, which rarely happens. West and northwest winds are damp. The prevailing wind is the sirocco (southeast); it is generally warm and moist.

The average moisture of the atmosphere is 0.025 millimeters; quite inadequate to the successful culture of the orange and lemon. Only *groves of the stiffest clay or calcareous soil* with a wet subsoil can dispense with irrigation. Oranges stand drought better than lemons.

There are but few sultry days except in the early spring, when the atmosphere is saturated with moisture; at this period rain is not wanted, and often proves destructive to the crops.

The average annual rainfall is twenty-two inches. From April to September it seldom rains, but pours in torrents in September and October, causing great damage. The heavy rain during the night of October 1, 1889, destroyed a number of groves. Light, steady, and constant rains occur in March and April.

Rain in May and June damages the blooms. Rain in September helps to develop the bastard fruit. Too much rain causes the trees to become chlorotic, and predisposes them to the "gum;" it also makes the fruit watery and destroys its keeping qualities.

Irrigation.—Generally speaking, throughout Sicily orange and lemon culture is impracticable without irrigation. There are a few exceptions to this rule, however, in certain favored localities.

The trees are watered for the first time in June, when the fruit from the early blooms is the size of a pea, and the trees are still in bloom.

The amount of water required to the acre depends upon the age of the trees, the nature of the soil, altitude, exposure, etc. On an average, each lemon tree, on moderately moist soil, requires two hundred liters of water at each watering; two thousand liters of water a year.

Cultivation.—Vegetables are planted between the rows until the trees are large enough to shade the ground. Young trees are, in consequence, worked six times a year. When the trees have attained their full growth they are worked but seldom.

The first working of a full grown grove takes place in October or November, after the autumnal rains have made irrigation unnecessary. A grubbing hoe is used to stir the soil, cover the weeds, and draw away the earth from the foot of trees. The second working is in March, when the earth is thrown back to the foot of the trees. The third working is in April, after which the land is trenched, and a basin is made around each tree.

Fertilizers.—These groves are badly fertilized, as there are no good fertilizers here. Stable manure is so mismanaged that it furnishes but little plant food.

Fifty-five pounds of stable manure are applied annually to each young lemon tree. These gardeners are now finding out that this amount is too great, although the manure is of an inferior quality.

Lemon groves in bearing are manured every three or four years; fifty-five pounds of cow or stable manure to the tree.

Some gardeners put the manure in the irrigation trench, and let the water spread it around the trees; others scatter the manure around the trees, turn it under, and then irrigate. Experiments are being made with sulphate of ammonia.

The best time to fertilize orange and lemon trees is from April to May. To obtain "bastard" fruit the trees are fertilized in October.

Pruning.—A tree is never pruned until it is four years old, its suckers and badly placed branches only having been cut away up to that time. Trees are generally pruned in March, after the crop has been gathered, but no precise date can be given. These trees are always pruned high from the ground; their lowest branches are at least seven feet above the soil, except when they are directly exposed to winds from the sea, in which case they are kept low, that they may escape, as much as possible, from the salt spray. Pruning should not be practiced in summer, as, at that season, the wounds are hard to heal and are apt to predispose the trees to gangrene and other diseases.

Picking.—Lemons are gathered from October to August; oranges, from November to April. Lemons are picked whilst immature, for foreign markets, and should not weigh less than eighty grams each. Lemon juice and essence are extracted from inferior lemons. The greatest care is necessary in gathering the fruit not to bruise it. After the stems have been cut close the fruit is wrapped in tissue paper and carefully packed in boxes containing from three hundred to three hundred and sixty lemons, and from one hundred and sixty to two hundred, two hundred and forty, three hundred, and three hundred and sixty oranges.

Tree Planting.—One hundred and sixty-two trees are planted to the acre.

Propagating.—The lemon is now budded on the bitter orange stock (*Citrus bigaradia*). Prior to 1870 the seedling only was budded, but this tree having been destroyed by the gum, the hardy bitter orange stock has taken its place. The several varieties of oranges grown are also budded on the bitter orange stock.

Varieties.—The best varieties are budded; seedlings never reproduce their own variety.

Orchards.—The orchards are generally small, averaging from five to seven acres. The high prices that ruled a few years ago induced small land owners to plant out orchards, but prices having fallen, and diseases having made their appearance, many of these orchards have been abandoned.

Maturity.—Trees begin to bear at six years of age, and are most prolific at twenty. The greatest age of the average tree is fifty years. Orange trees sometimes last eighty years.

Insect Pests.—A number of insects attack orange and lemon trees: The *Aspidiotus aurantii*, ants, *Mytilaspis fulva*, *Lecanium hesperidum*.

The most troublesome of the parasites is the Coccus, which belongs to the order of the *Hemiptera*, and to the sub-order of the *Homoptera*, and is vulgarly called the scab. In the spring it propagates rapidly in damp, warm weather. It prefers the lemon to the orange. This is very detrimental to trees that are overshadowed by taller trees, or that have not had their heads opened out to let in light and air. Remedy: A solution of lime.

The *Kermes aurantii* is partial to the orange, and punctures its leaves. Remedies: Solution of lime, solution of sulphate of copper, kerosene, infusion of tobacco.

The best way to get rid of ants is to destroy their hills in February with kerosene; fumigations of sulphur are also resorted to.

The *Mytilaspis fulva;* remedy: solution of phenic acid. The *Lecanium hesperidum;* remedy: sulphur fumes.

Beneficial Insects.—The *Coleoptera* (of the cochineal family) and the *Hemiptera*, above mentioned, feed on the Aphides.

Parasites.—There are no known parasites of the injurious insects. Small birds, if preserved from ruthless sportsmen, would prey upon these destructive insects.

Picking and Curing.—The fruit is gathered in baskets lined with cloth, and piled at the foot of a tree, where expert workmen trim the peduncles close to the fruit, and examine each orange and lemon, selecting the choice ones for exportation. This fruit is then carried in large baskets to the warehouse, where, after a second careful inspection, women wrap it in tissue paper. The fruit contained in each box must be of the same size. These packers are most expert in classifying the fruit. Sight and touch are the only sizers used. If the boxes are kept for any length of time in warehouses, they are opened once every three weeks that their contents may be carefully reëxamined, and the damaged fruit removed. Time is the only curing process for both oranges and lemons.

Keeping Quality of Sicily Lemons.

Properly speaking, no process for curing lemons is employed by the fruit growers of Messina. That lemons grown in the Messina District keep perfectly for months before being put on the market, is due to the great care in gathering, handling, and packing the fruit, to their keeping qualities derived from the nature of soil on which they are grown, climate, and variety cultivated.

First—The lemons are gathered with great care, the peduncle being cut (not broken) off smoothly near to the lemon. The fruit is carried to the warehouse in baskets lined with cloth, where it is spread out on the floor (if of wood) or on large mats (if the floor be of stone), and allowed to dry from twenty-four to forty-eight hours—even longer if there is sufficient room in warehouse, but never more than six days. If lemons piled, say, four feet deep are left for any length of time, the first layers become greatly heated, and soon spoil. The fruit, having been carefully selected, is next wrapped in tissue paper and packed in boxes. Upon reaching the city warehouses, the exporters, before shipping, have the boxes reinspected; the least defect in the fruit causes its rejection. When packed for the last time prior to shipping, care is taken to pack each lemon with its point down. If the boxes are kept any length of time in warehouses, they are opened every three weeks and each lemon carefully examined. A lemon with a blemish, so slight as to be noticeable but to an expert, is thrown out as unfit for exportation. Lemon juice and essence are extracted from these rejected lemons. The fruit contained in each box must be of the same size—an easy matter, owing to the monthly harvestings. Sizers are unknown here.

Lemons are gathered from October to August; they should not weigh less than eighty grams each, or average more than from two and one half to three inches in diameter when gathered.

There are three harvests of the true lemon—the November cut, the December-January cut, the April-May cut. The true lemon is produced from the April-May bloom; the bastard lemon, from the irregular bloom of February, March, June, and July. The true lemon requires nine months to attain maturity. The true lemon keeps much better than the bastard. Lemons gathered in November are of a deep green color; after remaining in boxes from six weeks to two months they turn light yellow. Lemons cut and packed in November show three hundred to the box; the same lemons (having shrunk), when repacked in January, show three hundred and sixty to the box; later shrinkage is scarcely noticeable. The November-cut lemon keeps better than that of any other cut; shipments of this lemon are frequently made as late as May to New York. Lemons gathered in January are of a bright yellow color, and are not kept more than a month in the warehouses here before shipment.

Second—The soils best adapted to the lemon are the argillo-calcareous and the calcareo-argillaceous. Sandy soil is not well adapted to lemon culture, as it is too thirsty, etc. The lemon requires an equable climate to produce perfect fruit; in this district, climatic influences are seldom injurious to the fruit. The lemon does best on hillsides, facing south. It thrives at from one fourth to two miles from the seashore, and at an elevation of one thousand five hundred feet.

Little or no chemical fertilizers are used in these groves, and stable manure but sparingly. Water is the great fertilizer on this island.

May not our fresh soils and chemical fertilizers affect the keeping qualities of California and Florida fruit?

WALLACE S. JONES,
Consul, Messina.

PALERMO.

REPORT BY CONSUL CARROLL.

Oranges and Lemons.

The following are the best varieties cultivated in Sicily, viz.: *Citrus bigaradia macrocarpa*, Riss; *Citrus bigaradia coronata*, Riss; *Citrus bigaradia glaberrima*, Riss; *Citrus medica glabra*, Riss; *Citrus medica florentina*, Riss; *Citrus bergamia* (variety *Vulgaris*), Riss; *Citrus bergamia* (variety *Mellarosa*), Riss; *Citrus aurantium piriforme*, Riss; *Citrus aurantium precox*, Riss; *Citrus deliciosa*, Ten.; *Citrus limonum fusiforme*, Riss; *Citrus limonum oblongum*, Riss; *Citrus limonum calabricum*, Riss.

The following varieties are also cultivated, each having its special merits, viz.:

	Varieties.
Citrus bigaradia	21
Citrus limetta	7
Citrus lumia	1
Citrus medica	8
Citrus bergamia	2
Citrus aurantium	22
Citrus deliciosa	1
Citrus limonum	19

Planting and Propagating Lemon and Orange Trees.

Orange trees are planted five meters apart, and lemon trees from five to six apart, depending on circumstances.

The old lemon and orange gardens in this vicinage are generally either the result of certain succulent slips, which were cut from the trees and buried, or planted, two thirds of their length in moist, friable ground, or, of in curving or bending a live branch, without detaching it from the tree, and inserting it to a depth of about thirty centimeters in rich, soft, friable soil. At the end of about two years, or when sufficient roots have sprouted from the branch thus bended, in order to enable it to live without the mother tree, the branch in question is detached therefrom and allowed to proceed, in growth, on its own account.

This method of propagation has become almost extinct. There are certain cases, however, in which it is still resorted to, because of the rapidity with which the trees develop, and which make it preferable to any other, as well as on account of the abundance of the yield of trees thus propagated. But the fact that such trees are susceptible of attack by *mal de gomma*, and readily destroyed thereby in a few years, has convinced even the most steadfast adherent of the method that it should be abandoned and a resort had to propagation through the several varieties of the melangoli seed, called here Aranci amari (*Citrus bigaradia*), and the trees thus derived grafted with the various varieties, as they resist the malady in question with much more vigor. In fact, the orange and lemon trees of Palermo, which are generally obtained by the seed of the melangoli, have resisted the *mal de gomma* much better than those of Messina, which were formed from plants derived from lemon branches. The best varieties are budded.

The orchards in Sicily are very large, and are, in view of the great profit ensuing therefrom increasing rapidly.

Fructification.—They fructify at the age of three years, the yield being largest thereafter, from year to year, up to the twentieth, when they are becoming old and subject to all diseases. At this period they are denuded of their branches and a new graft resorted to.

Insect Pests.—The most troublesome insect, and that which injures the orange and lemon trees most, is called *Coccus hesperidum*, Linn., or *Coccus citri*.

The facility with which this insect propagates itself, and the rapid increase consequent thereon, result, in a comparatively short time, in the death or serious injury to the trees. The mode of attack of this insect is by eating a hole in the tree, from which soon exudes a profuse flow of juice, resulting in death or serious injury thereof, as stated.

The *Coccus citri* lodges in trees having thick leaves, and especially in those shaded by larger trees or plants. In this contingency pruning

is resorted to, with a view of letting in light, and thus causes the insect to seek another refuge or die. No specific is known to combat this insect, but the usual mode of relief therefrom is by washing the trees with lime water.

Other very injurious insects abound, such as the *Kermes coccinus*, *Kermes hesperidum*, *Kermes aurantii*, *Lecanium hesperidum*, and *Pidocchio*, which prefer the orange to the lemon trees. These, too, are destroyed by lime water, solutions of copper, sulphate thereof, etc., petroleum, snuff, etc.

Beneficial Insects.—Terrestrial formicas, or ants, destroy other destructive insects and their eggs, but in their absence they gnaw the tender branches and leaves, thus causing them to atrophy. Therefore all efforts are made to destroy the ants as in the case of other insects, hoeing the ground in winter being resorted to as a means to that end, thus exposing them to inclement and cold weather, death generally ensuing as a consequence.

Parasites.—The lichens, which attach themselves to old trees, those attacked by *mal de gomma*. Shady and moist places favor the development of lichens. Sea water is used as a wash to get rid of this parasite.

The fumagine evoluting from the agglomeration of microscopic plants, is technically called capnodium, or *Fumago citri*. The fumagine attacks all varieties of oranges and lemons and causes grave damage. The trees attacked suffer greatly, the yield thereof being very small. The fumagine attacks the trunks, branches, leaves, and fruit. Only the epidermis or outside of the fruit is attacked. This parasite is destroyed by means of pruning and manuring in January.

Lemon and Orange Groves.

The trees that produce the varieties named at the beginning of this report are grown in Sicily.

Distance from Sea.—There is no fixed distance from sea for planting orange and lemon trees. There are many orange and lemon gardens in the vicinity of Palermo, bordering on the sea, some of which prosper better than those situated more inland. This, however, obtains only when the gardeners are skilled men, and give particular attention to the ground, and adopt proper means with a view of protecting the trees from strong sea winds.

Elevation above Sea Level.—It is impracticable to determine with accuracy the elevation at which orange and lemon trees can be cultivated, the latitude and certain special conditions influencing this. In Sicily, for instance, oranges and lemons are profitably cultivated along the seacoasts at an altitude of from one hundred to five hundred meters above sea level, and often much better crops are obtained where the elevation is from five hundred to one thousand meters.

Exposure to Sun.—It is of great advantage when the gardens have a southern exposure, or when the sun beams down upon them from sunrise to sunset. This exposure is recommended by gardeners here.

Position of Orchards.—Orange and lemon trees are indifferently planted in the vicinity of Palermo in hilly, rolling, or level land. The nature of the soil, climate, exposure to sun, attention to the soil, trees, etc., seem to be the principal requisites; elevation, all other things favorable, having little or no influence, save as to quality. Fruits produced on hilly land are more appreciated, and generally command higher prices than those produced on rolling or level land. There are exceptions to this, however. In Palermo, for instance, fruits produced on certain level lands command as high prices as those produced on hilly land; with this exception, however, the land best adapted to the cultivation of oranges and lemons is generally hilly. In fact, the fruit dealers mark their fruits with an "M," which signifies "Montagna," or "Mountain," which enhances their price, as seen from the following comparison, viz.:

Fruits produced on hilly land, 25 to 50 lire per thousand; on rolling land, 21 to 27 lire per thousand; on level land, 17 lire per thousand.

Soil.—Considerable attention has been given of late years to the character of the soil, subsoil, etc., best adapted to the cultivation of the fruits in question, as well as to the chemical composition of oranges and lemons, which has resulted in the belief that calcareous land, containing certain other material necessary to the life of all vegetation, is the best, in order that they may contain the requisite amount of lime, potassa, soda, etc. The soil best adapted to the cultivation of oranges and lemons is at least one meter in depth, and devoid of rocks, and accessible to water for irrigation, else the trees die.

Deep, clay land, open and exposed to the rays of the sun, accessible to water, abounding with alkaline salts, minus rocks or stones, little or no grass, not exposed to strong winds, rains, or frosts, etc., is deemed to present the best advantages in all respects.

Climatic Influences.

Temperature.—The temperature in the adjacent territory of Palermo, in summer, does not ordinarily exceed 35 degrees Centigrade, and rarely falls lower than 20 degrees, and in winter the maximum is 23 degrees, and the minimum 10 degrees. Consequently, the average summer temperature is 27½ degrees, and that of winter 16½ degrees, the average annual temperature being 22 degrees.

Neither cold nor warm nights, in the territory conterminous to Palermo, seem to wield an influence upon the result of the cultivation of oranges and lemons therein. Sultry days, although frequent in summer, and occasional warm or cold spells, appear to exert no detrimental influence upon either lemons or oranges. For instance, the fruits in question flourish quite well where the thermometer does not fall below +3 degrees Centigrade in winter, nor rises above 34 degrees in summer. It has been observed in Palermo on various occasions that the orange and lemon trees resist a summer sultry temperature of 40 degrees Centigrade, and that of —2 degrees in winter, without any apparent detriment, while many other plants or trees were destroyed or damaged.

The atmosphere in and conterminous to Palermo in winter is almost invariably humid or moist, while the climate is mild. In summer the atmosphere is very warm with little moisture, save immediately on the seacoast, the sirocco which often obtains making life of all kinds perilous. During this period irrigation is lavishly resorted to in order to keep the trees alive and preserve the fruit.

Rainfall.—The conditions of temperature and climate in Sicily are exceptional, compared with other parts of southern Italy. The strong,

constant winds which prevail in winter condense and accumulate the vapors, over which they traverse, into a small compass, and as a result the rainfall is often so copious as to inundate entire localities. Rain commences about the latter part of September, and ends in April, twenty-two inches falling within the interim named.

When rain falls in large quantities the trees are damaged; but in small quantities it is advantageous to them.

Irrigation.—The cultivation of oranges and lemons, in Sicily, generally cannot be undertaken, unless the trees are irrigated from spring to autumn, or when the land is not adjacent to springs, the drippings from which serve therefor, or when springs do not exist in the subsoil, the filtration of which sufficing to maintain the ground in a moist state during summer. The custom of opening canals parallel to the rows of orange and lemon trees into which water, accumulated in an elevated reservoir, is allowed to flow, thence into and between the openings or small depressions between the rows of trees, until the ground is thoroughly saturated, the more remote points from the source of the water being irrigated first, until finally the irrigation water and it source coalesce or meet, obtains here.

In the best conducted orange and lemon gardens in the vicinity of Palermo, irrigation is resorted to every eight days during the first year of the growth of the trees; every twelve days during the second and third years; every fifteen days during the years from the fourth to the eighth, inclusive, and from the eighth year forward invariably every twenty-two days.

Orange and lemon gardens require, on an average, three hundred and fifty cubic meters of water for each irrigation to the space of one hectare of land in good condition.

Great attention is necessary as to the amount of water required. If too much is used the trees are subject to a disease called "*mal de gomma*," literally translated, "illness of the gum," or "gum disease." If too little, development is delayed, and even their death may ensue.

Cultivation.—April and May are the best months in which to cultivate orange and lemon trees, the inclement weather having terminated, thus insuring the safety of the buds.

Oranges and lemons are cultivated from the dry seed, which costs 1.80 lire per kilogram, or from the fresh plants containing the seed, the latter requiring more attention than the former.

Planting or sowing, as the case may be, commences in April, as stated, or later, in order to avoid the white frosts, the ground being previously prepared.

Trees resulting from dry seed are generally good and strong, and attain a height of at least one meter, before being grafted with a view of propagating the various varieties desired.

The gardeners of the Province of Palermo recommend that a distance of about five meters should intervene between each orange tree when the ground is level, and about four meters in undulating, rolling, or declivitous land. Lemon trees are recommended to be from five to six meters apart, when large trees are expected or desired, as is the case with all trees derived from "Cedrangoli amari" (*Citrus bigaradia*, Riss).

The best means of planting trees is by placing them in parallel lines from north to south, in order that they may be equally exposed to the sun's rays throughout the entire day, and so placed as to form a series of equilateral triangles, with a tree on each angle. To this method of planting the name Losanga has been given.

It is customary during the early stages of the growth of lemon and orange trees to alternate them with other plants, such as vines, cotton, etc., in order to give them strength and nutrition, as well as to utilize the necessarily large vacant spaces of ground.

At the expiration of ten years, however, or when the orange and lemon trees have become so large and tall as to obscure the plants in question with their branches, etc., they are taken up and utilized in a new field.

Fertilizers.—Alkaline substances are better adapted than any other materials for fertilizing. Gardeners in the vicinity of Palermo formerly used seaweed, mixed with the excrements of horses and cows or stable accumulations.

Fragments of dressed leather, woolen rags, scrapings from horns, and certain other remains of old or cast-off manufactures, as well as decayed fruits, are regarded as the best admixtures of fertilizers for oranges and lemons. The materials or substances in question are stratified in proper places with a view to their fermentation before being used.

When trees are planted they are abundantly manured, and after one year the ground around them is cleared away to a depth of forty centimeters, forming a circular ditch, with a diameter of two meters, into which two baskets of manure, or about twenty kilograms, are deposited, whereupon the ditch is covered with the earth previously removed, placing it so as to form a shallow ditch around the tree. This operation is resorted to in January and February. Small trees are manured twice a year, for the first five years, viz.: in March and August.

Ordinarily, however, when trees prosper, manuring is resorted to only every three years, the quantity used being about forty kilograms to each tree.

Pruning.—The first pruning is made after the expiration of the third year. The height from the ground depends on the quality of the land in which the trees are planted, as well as the desire for either high or low trees. When the land is exposed to northern and southern winds, it is better that the trees should be low; but inversely, should this exposure not obtain.

In Palermo, as in all Sicily, the orange and lemon gardens are pruned from December to June, while the trees are devoid of fruit, the process being governed by the gardener's interests and experience rather than by any theoretical suggestions.

Gardeners take care to clip or clean the trees yearly, cutting off all old and useless branches. Pruning is resorted to every three years.

*Picking and Curing.**

Oranges are picked from November to March, and lemons, from November to August. The first picking is generally made in Novem-

* In a subsequent dispatch, Consul Carroll says that, "in connection with preserving oranges and lemons after being taken from the trees, it may be proper to say that this consulate is often applied to for information as to the supposed or alleged means resorted to here for that purpose by California and Florida fruit growers, and to repeat, for the information of fruit growers in the United States, that there is no process resorted to nor known here to preserve the fruits in question other than folding them in fine tissue paper, which is changed from time to time, and the fruit examined and all contaminated oranges and lemons eliminated from the baskets or boxes in which, for the time being, the fruit may be placed. Precaution is also taken to place or keep the fruit in question in a dry, equable temperature.

"Oranges and lemons are generally picked before maturity."

ber; the second, in December or January; and the third, in March or April. During the summer months, however, such as are verging on maturity are picked from time to time.

Oranges and lemons for export are picked prior to maturity, and thus shipped to ripen on the voyage.

Oranges and lemons for export are not cured, but simply selected with a view to bearing the long voyage. Those not shipped, and for which a sale is not readily found in the markets of Palermo, are preserved, from March to August, in well ventilated caves or grottoes, to be sold to ice cream dealers for the purpose of making ice cream, jellies, lemonade, etc.

Packing and Shipping.

When oranges and lemons are picked they are carefully selected and wrapped in tissue paper, packed in open boxes, and placed in the warehouse. Again, before shipping, they are carefully selected, newly wrapped, and packed.

Generally speaking, lemons can be divided into two categories, viz.: normal lemons and abnormal or anomalous lemons. The normal are those that bloom in the months of April and May, and the abnormal or anomalous those derived from the blossoms of February, March, June, July, and other successive months, and which depend on waterfalls, to a more or less degree, during warm weather, for irrigation.

The normal lemons arrive at maturity in about nine months—that is, from May to January, inclusive—the picking thereof being commonly made in three successive periods, viz.: from November onward. The lemons picked in the first period are green, and those picked in the third period more mature. They are picked according to the requirements of the purchasers. The first and third pickings are more valuable than those of the second, consequent upon fruits being more abundant during the latter period.

The fruit under consideration is believed to be the best, and by gardeners is classified as first class fruit and sold at very high prices.

The fruit picked at other times is called anomalous.

Lemons are picked by men who, if the trees are too high to permit their doing so from the ground, climb up and detach them, taking care to leave a piece of stem, placing them in baskets lined with linen, on the handle of which is a wooden hook tied in order that the baskets may be hung on the branches. So soon as a basket is full it is lowered from the tree by means of a rope, provided with a knot, and exchanged for an empty one by a boy known as "panieraio," or, literally, "basket maker," whose duty it is also to empty the baskets in the place designated by the "taglia piedi" (peduncle cutter). This is an expert workman in his line, who performs two offices at the same time, viz.: cuts the peduncle of the lemons close to the crown, and afterwards separates the good from the bad lemons, depositing them in two separate heaps. Small lemons, although they may seem to be good, if of less weight than eighty grammes, are, as a rule, not exported.

It is estimated that out of the total lemon crop about two thirds are considered fit for export, the remaining third being utilized in the manufacture of acid, essences, etc.

The "taglia piedi" (peduncle cutter) places the lemons on a straw bed, in order to protect them during the voyage from damage.

When lemons are classified, girls place them in baskets lined with linen. Each girl places in her basket two hundred and eight lemons, four lemons at a time, thus making fifty-two operations or movements, and, when completed, places the basket on her head and conveys it to the warehouse.

In the warehouse good lemons are placed in flat lots one and three tenths meters high, where they are allowed to remain from five to eight days, in order to determine their strength, at the end of which any decayed or damaged lemons which may be found are picked out. This is not, however, general, especially when the producer of the fruit is not the shipper, and has no interest in the shipment thereof. It is only done in cases where the shipper has purchased the fruit, or the producer ships it on his own account.

In the warehouse, near the gardens, the lemons are wrapped with tissue paper, placed in boxes, the interior of which is lined with paper of the same kind. The boxes, so prepared, are carried into the city warehouse, where the lemons are taken out of the boxes and a new assortment made, and, in order to ship them, the above operation is repeated.

Should the boxes not be promptly shipped for any cause, and remain in the warehouse some time, then it is in the interest of the person on whose account the fruit is to be shipped to assort them, in order to ascertain if there are any damaged fruits among them.

The fruit is shipped in boxes of the following dimensions, viz.: breadth, 29 centimeters; height, 42 centimeters; length, 81 centimeters.

The number of lemons which each box contains depends on their size, and in order to be exact the fruit is divided into four categories, as follows, viz.: two hundred if of the first category, two hundred and forty if of the second category, three hundred and sixty if of the third category, four hundred and twenty if of the fourth category.

Boxes are divided into two compartments, each containing half the number stated above, placed as follows, viz.:

First category, in four strata, twenty-five per stratum; second category, in four strata, thirty per stratum; third category, in five strata, thirty-six per stratum; fourth category, in five strata, forty-two per stratum.

PHILIP CARROLL,
Consul, Palermo.

SICILY.

REPORT BY CONSUL LAMANTIA, OF CATANIA.

Oranges and Lemons.

Varieties.—The names of the best varieties of oranges for profit are: The common orange (a round fruit); the calabrese (a long keeping fruit); the sanguigno (a blood-red orange); the oval (a late, sweet, and good keeping); the mandarino (mandarin, the largest one).

The names of the best varieties of lemons for profit are: *Il limone comune* (common lemon for trade); *Il bergamotto* (for making essences); *Il cedro vero* (citrus medica, for preserving).

Situation.—The same are located in low and high land, as well as all around Mount Etna, at a distance from three hundred to six hundred meters from sea, at an elevation from five hundred to six hundred meters above sea level, exposed to sun, on level lands, because it is better, and in rich, calcareous soil.

Climatic Influence.—The minimum temperature in January is 0.5 degrees Centigrade; the maximum is 35 degrees Centigrade, in August, and the average, 17 degrees, in May.

Nights in summer are rather fresh, and cool in winter. Days generally clear, seldom moist, and good atmosphere.

Rainfall from twenty-five to thirty inches for year, and rain in proper season helps the growth and the fruits greatly.

Irrigation.—Irrigation is done by spring and stream water, and by well water elevated by steam or horse power.

The groves, with said water, are generally irrigated at option, and whenever needed, as lemon trees bear all the year.

Cultivation.—The following information I have been able to gather by personal visits to the owners of the beautiful large groves of orange and lemon trees, the production of which forms one of the principal resources of the country, viz.: When it is wished to plant a new lemon grove, the gardener from November to April prepares in the best spot of his garden a well manured seed plot of two square meters, whereon he sows a quarter of a gallon of bitter orange seed, and covers the same with about two inches of fine earth. Two months later you see the young plants out of the ground, and during the coming summer the seed plot is to be watered at least every four days. After one year the young plants are at a height of eighteen inches, and then the gardener prepares a large seed plot to plant the same, at a distance of eighteen inches apart, where they are left till another year. The new ground is hoed about two and a half feet deep, and divided in square compartments of one and a half feet each side, in the corners of which are located the largest seedlings taken out from the seedling bed, leaving there the smallest ones, to be replanted later on.

This method of planting is called by these gardeners *mettere a casella* (planting in cell). There they are kept for the second year, with good care, the stems being fastened to sticks driven in the ground alongside, in order to grow straight and to protect them from the wind.

On the third year the seedlings are already grown sufficiently to be replanted in another larger place, in order to give them more room. Consequently half the largest ones are again dug up and planted in another prepared bed.

This second method is called planting in *piantonaio*. Here the plants are left until the fourth year. In January or February of the fifth year the grower divides all his ground, already prepared during the previous fall, in square compartments of fourteen feet long each side, and in the corners of each one he digs out round ditches, with some well manured animal compost mixed with the earth. It is proper, however, to note that the young trees are always to be kept free from sprouts, and watered and manured diligently. This operation is done as follows:

Every fifteen days the ground is removed from the bottom, and the grower around the tree forms two circles, one of a foot and the other of two feet in diameter. Then he removes the ground from the base of the tree about five inches deep, and fills it with manure, covered with the same ground. This operation is also recommended for large old trees.

In the fifth year the said trees of bitter orange seedlings are grafted into lemons, or oranges if desired.

Fertilizing.—A lemon grove must be dug at least three times a year; that is, on the first of January, pretty deeply, and the ground manured, if possible, in all its extension; (2) In the month of April, for forming the *conche* (compartments) and gutters for watering in the hot summer; (3) In the middle of June, for weeding. In the fifth year the young bitter orange trees will be grafted.

Grafting.—Although no inquiry is made about grafting, yet I may give some details of the methods used in Sicily. Grafting is done in *becco di flauto* (beak of flute), by *spacco* (splits), or by *scudo* (shield). This last one is generally practiced in this island, and the proper season is in the month of October or May. The first method is called "*ad occhio dormente*" (sleeping eye), because it is necessary to await the coming spring season to see whether the grafting has turned out well. The second is practiced by smarter agriculturists, and is called "*occhio vivente*" (living eye), for the reason that should it fail, in the coming fall it is operated again. The shoots are to be chosen from the best and most vigorous adult trees, and so at the end of the seventh year you will have a good producing young lemon grove, fruiting all the year around.

A fifteen-year old tree generally produces five hundred lemons, while at twenty it yields over one thousand. Professor Cassella states that he has seen several very large old trees producing as many as ten thousand fruits per year.

Pruning.—Pruning is done according to the growth of the tree. The method used in Sicily is *a tronco rovesciato* (capsized cone). This form is practiced from the time the tree is young, by cutting the main trunk and letting the lateral branches grow, in order to have free ventilation and free sunlight, and to effect the fruits to maturity.

The height of the trees varies according to locality and usage of the country. In Messina, for instance, they are left pretty high, while in this province they are kept low, on account of strong winds, which sometimes prevail around Mount Etna.

Picking.—The regular season for picking lemons in this district commences from October, in low lands, and in November, on high lands, up to the end of January. That is called *il primo taglio* (first cut), and the fruits are considered the best for quality and long keeping. The second cut, larger than the first one, begins in March and lasts until the end of April, and the last one, or third cut, known as *verdelli*, from May to the end of September. Finally, lemons bear all the year around.

Orange picking commences in low land in November, and on the *montagna* (mountain) from January to April. These are the best fruits, and durable, fit for packing and shipment. The same are always picked a little greenish, and not in full maturity; but they acquire their natural bright color after they are wrapped in tissue paper and boxed for shipping.

Before shipment, however, they are chosen into four different sorts; that is, first and second choice fruits are thoroughly examined, to be entirely free from thorn touch or any disease, and they are shipped for farthest markets. The third choice are sent to near markets, and with the fourth one is made essence and *agro cotto.*

The fruit is gathered with care, the stem is cut with a very sharp round-bladed knife, and left to the eye to prevent decay.

Planting and Propagating.—The distance planted apart must not be more than sixteen feet, for the reason that if trees are allowed to grow too large they cannot stand to support the lateral branches overloaded with fruit, besides preventing free ventilation, without which disease is generated.

As before stated, trees are propagated by seedlings and grafting. The best varieties are, of course, obtained from seedlings, and then grafted to the desired kind.

The orchards are pretty large in some localities, and small in others.

Maturity.—The age of fruiting is at eight years, giving the largest crop at twenty. The maturity of trees is from seventy to one hundred years, according to the soil, exposure, locality, and culture of same.

Insect Pests.—The insects damaging this beautiful plant are: *Il pidocchio del limone* (lemon louse), and *Il pidocchio dell'arancio* (orange louse).

The first one is an insect of a whitish color, which attacks both leaves and fruits. It made its first appearance in Sicily in 1862, and notwithstanding the several efforts to destroy it, nothing has as yet been accomplished to succeed.

The second, *pidocchio* (louse) of orange, is another insect of a dark brown color, and a very injurious one to both orange and lemon, by infesting the tree bark, leaves, and fruits.

Another insect, supposed to be the *Coccus aurantii* and a *Crittogama*, called *Nero degli agrumi* (black disease), first of a whitish color and then black. Both of them attack, also, the bark and branches of the tree, propagating on the leaves, blossoms, and fruits, causing the former to stiffen, turn yellow, and dry, while the latter grow very little, turning black, and never acquire the natural color of the ripe fruits.

If the parasite develops early in the season, the plant will thoroughly be covered with the disease, the fruit stops growing, gets black, and falls. It is said that petroleum sprinkled on the trunk and on the branches has proved somewhat of a remedy.

The *mosca* (fly) is another pest damaging both kinds of fruit. It generally appears in the beginning of summer, stinging the fruits and depositing therein its eggs, which develop into grubs which destroy the fruit.

The Gum Disease.—Besides those insects, there is also *il male della gomma* (gum disease), which greatly injures the whole tree if not prevented in time. It makes its first appearance with a small spot on the trunk, gradually enlarging to about one inch wide, and, in the course of four days, causes a crack on the bark, wherefrom a white yellowish liquid, like milk, drops out. Said liquid becomes thick and thicker, like small gum drops, and in a few days later they look like transparent yellow pearls.

According to Professor Cassella's experiments in his grove, where he has saved a great number of trees, to destroy and preserve orchards from such a disease, it seems the following methods are highly recommendable, viz.:

1. When a plant has been attacked, all the infested parts of the bark and wood are to be cut out, and care taken to destroy all the tissues affected by the disease, then take some quicklime, and while it is still warm rub all the wound, and especially the parts mostly infected. This done, cover the same to about one third of an inch thick with the same lime, *but cold*, and cover the whole with paper, or something else. Two

months later take everything off, and you will find the wood without any alteration.

2. To preserve the tree from the disease, mix nine parts of lime and one part of ashes, and dissolve the same like whitewash. Then dig a ditch around the tree, about three feet in diameter, by unearthing the largest roots of the tree, and pour into the ditch about thirty or forty liters (seven and one half or ten gallons) of the compost stuff; and with such a proportion for large, adult trees, treat the others according to age and size. In conclusion, to avoid such disease, for new groves bitter orange seed is recommended for planting, and then grafting at pleasure, as above stated.

Replanting.—On replanting young trees for final stay, as per experience had by several orange and lemon growers in this district, I understand that one of the most interesting points is the secret that when said planting is to be done, it is necessary to cut the end piece off the main root, about three inches long, for the reason that, if left on, it would draw all the humor from the ground, and would also prolong the growth and the trees to bear fruits. I may here give the total production of this fruit in the whole kingdom of Italy. Out of the twelve agrarian regions into which Italy is divided, only in two of them the acid fruit tree is not cultivated, that is, in Piedmont, Emilia, and a part of Lazio. According to a statistical report in 1880, by Professor Cassella, it seems that the total production of said fruit amounted to as follows, viz.:

Regione meridionale Adriatica	85,000,000
Regione meridionale Mediterranean	725,000,000
Regione meridionale Sicilia	1,622,000,000
Total fruits	2,432,000,000

VINCENT LAMANTIA,
Consul, Catania.

SICILY.

REPORT OF CONSUL WOODCOCK.

In this district, comprising the southeast third of Sicily, the land rises gradually from the seashore to the summit of Etna. The mountain is a little over two miles high, and Sicily is in a semi-tropical climate. The slopes of Etna, therefore, have every variety of climate from the semi-tropical to the frigid, according to altitude. Citrus groves make beautiful these slopes with their vivid green, from the seashore to an altitude of about one thousand feet. At this higher altitude the cultivation of the orange and lemon is not so profitable, owing to the uncertainty of a crop. Heavy frosts at such an altitude are liable to injure the buds. The fruit, however (called *Montagna*), is of the best quality.

The orchards that skirt the seashore bear abundantly, and seldom fail in producing a good crop. The fruit (called *Marina*) is inferior to the mountain fruit, and both trees and fruit are more subject to disease and pests.

The most desirable locality for a citrus orchard is that most distant from the sea, and not of such an altitude as to lie within the frost line.

Propagating the Plant.

There are four methods of propagating the citrus plant: by the seed, by cuttings, by grafting, and by budding.

The seeds for planting are taken from the choicest fruit when perfectly ripe, and are planted in the spring in some warm, sheltered spot, from four to five inches apart. The soil should be composed of loose earth and well rotted manure. The young plants should be sparingly but frequently watered. The plants must be transplanted to the orchard after the growth of a year or two.

To propagate by cuttings, young healthy shoots that are straight are selected. They should be about one foot in length, and must be planted in the ground to the depth of four or five inches, in a soil similar to that used for the seed. Care should be taken to plant the cutting upright, as it grew upon the tree. When the cutting becomes well rooted, and has had a healthy growth of a year or two, it may be removed for final planting to the orchard.

The grafting and budding methods, which are so commonly practiced, need not be described. Citrus plants in this part of Sicily are propagated almost entirely by the budding method.

For the stock upon which to bud use is made of the bitter orange tree. The bitter orange is indigenous to this climate. It is more hardy and less liable to disease than those that bear the choicest fruits. Its natural fruit has no value, but the Sicilians sometimes convert it into a kind of preserves.

For the purpose of propagating the choice fruits, the bitter orange plant is grown in nurseries from the seed. When the plant is a year old it is transplanted, and when it has attained a growth of about one inch in diameter (being three or four years old) it is again transplanted to the orchard.

Orchard.

The distance to be maintained between the trees in the orchard depends much upon the location and nature of the soil. When the locality is warm, and the soil is naturally rich, mellow, and of easy culture, the distance between the trees must be greater than when the soil is hard and the climate colder, because the trees will grow more luxuriantly and form larger tops. In such a soil, for lemons the plants should be about twenty-four feet apart, and for oranges about seventeen feet. When the soil is naturally hard and poor, and the climate colder, the distance between the trees for lemons may be about twenty feet, and for oranges about thirteen feet. The judgment of the horticulturist must determine this matter.

When the bitter orange plants are thus transplanted to the orchard, the tops are cut off about four feet above the ground. When they become well rooted and of healthy growth, they are budded from the choicest varieties of orange and lemon. Two buds are generally inserted in the stock, opposite each other.

The orchard is thoroughly cultivated, being worked over with the mattock and spade at least five times during the season, commencing in March and ending in October. The ground, when the trees are young, does not require so thorough a cultivation.

The plants are irrigated whenever they require it. For this purpose the streams that tumble down from Etna are utilized. Where this is impracticable, water is elevated from wells by steam or mule power.

Some grow vegetables between the trees, but this practice is condemned by the best horticulturists.

As to the time when the trees begin to bear a full crop, much depends upon the climate, cultivation, and fertility of the soil. Generally they commence to bear a full crop when fifteen years old.

As to the longevity of the citrus tree, there is here a diversity of opinion. I have been told by some horticulturists that the lemon and orange budded upon a bitter orange stock will live and continue fruitful from one to two centuries. Doubtless they will live and continue to bear from fifty to one hundred years.

Lemon trees are healthy and vigorous, bear annually on the average about a thousand of the fruit, and oranges about six hundred. There are instances in which trees have borne ten times the number specified.

Gathering and Boxing the Fruit.

The time for gathering the fruit for export is here in the month of November. For export to so distant a country as America, the best and soundest fruit is generally selected. It is plucked when not fully mature, and is yet of a greenish color.

In gathering the crop great care is taken not to bruise the fruit. It is plucked by hand, and gently deposited in a basket that is lined with cloth. The stem is not removed from the fruit, but is cut off about a quarter of an inch from its base.

Great care is taken in preparing the fruit for market. Each individual fruit is carefully cleaned of all insects, or injurious matter, with a sponge and cold water, and is wiped perfectly dry before boxing. The fruits are carefully assorted. Those that are large, plump, and healthy in appearance, without marks or spots upon the surface, are boxed by themselves, and denominated "first class." Those whose skins bear any blemish, or otherwise are not fine in appearance, are boxed by themselves, and denominated "second class."

The boxes for the fruit are so constructed that they will hold from two hundred and fifty to three hundred and sixty of the fruit. Each box is inspected to see that no nail or sliver protrudes to injure the fruit. It is then lined with common silk paper. Each individual lemon is enveloped in the same kind of paper prior to being deposited in the box. The boxes are frequently opened, inspected, and all infected fruit removed. Especially is this done just prior to shipment.

Laborers in citrus orchards receive as wages from 30 to 40 cents a day, without food being furnished them. In summer they are required to work ten hours a day, and in winter eight hours.

The cost per annum of cultivation in the best orchards per hectare (2.471 acres), as estimated by a practical grower, Mr. Augustus Peratoner, United States Vice-Consul, is, on the average, 650 lire ($125 45).

Diseases and Pests.

The diseases and pests attacking the citrus trees in this part of Sicily are as follows:

A disease called the "colla" (glue) sometimes (though not often in this district) affects the citrus. It is said to be caused by a sudden

change from a high to a low temperature; this checks the exhalation of the tree, and the matter to be exhaled accumulates within until it bursts the passages and forces its way out through the bark. On coming in contact with the air, it condenses in drops of a light yellow gum. The only remedy for this disease is to cut off the branches infected.

A parasitic growth of a fungous nature frequently gathers upon the bark of the trees. The lemon tree is more subject to this than the orange. It is removed after a heavy rain, or after thoroughly soaking the parts affected, by scraping.

An insect called the *Pidocchio nero* (black louse) infests the bark, leaves, and fruit of both the orange and lemon; also, an insect called the *Pidocchio bianco* (white louse) infests in a similar manner the lemon tree. In appearance it is like a minute scale or scab, of oval form, and attaches itself with great tenacity to the bark, leaves, and fruit. This insect prevails to a large extent in our orchards. As a remedy, a wash of lime water is used; also, water slightly tinctured with kerosene.

The fruit of both orange and lemon is sometimes injured by an insect called the fly. It makes its appearance in the beginning of summer, and commences its devastation by stinging the fruit and depositing therein its eggs. These eggs develop into grubs, which destroy the fruit. When the fly first appears the fruit on the tree should be frequently washed. The water should be applied with a sponge. Some slightly tincture the water with kerosene or soda. Fumigating the trees with the smoke of sulphur has also been tried. No remedy has yet been discovered that effectually destroys the noxious pests. Good ventilation, thorough culture, and plenty of sunlight are the best preventives.

Exports to United States.

In the export of citrus fruits from Catania to the United States during the past three years, there has been a gradual decline. This is probably owing to the decline in prices. There were exported from Catania to the United States of lemons and citrons:

Years.	Boxes.	Value.
1882	241,107	$441,227 72
1883	228,857	324,284 84
1884	168,575	391,068 20

ALBERT WOODCOCK,
Consul, Catania.

CONTINENT OF AMERICA.

MEXICO.

GUERRERO.

REPORT BY CONSUL SUTTER, OF ACAPULCO.

Varieties.—Sweet and bitter oranges, navel oranges, lemons, limes, shaddocks, citrons.

Limes and sweet oranges are the most valuable. Some fifteen thousand boxes of limes, representing for the growers a value of about $25,000, are exported annually, per steamers of the Pacific Mail Steamship Company, to San Francisco. Brought to town, selected, and packed for export, this fruit costs, more or less, $3 per box.

Only small quantities of oranges are exported to San Francisco per steamer from December to February, before the crop from the islands in the Pacific overstocks the market.

Oranges are obtained at $5 per thousand, but on account of high rates of freight cannot compete in the San Francisco market with the fruit imported from those islands.

Maturity.—Lime trees, which are allowed to grow like a bush, with branches rising from the roots, commence to bear at the age of four years, and are in full bearing when eight years old; in good soil, and with but very little care, the tree will attain the age of fifty years. This tree is indigenous, whilst the other varieties of the citrus family are said to have been imported.

Orange trees commence to bear at the age of five years; are in full bearing at the age of ten, and will remain fruitful fully as long as the lime tree.

Propagation.—All the trees are seedlings.

Insect Pests.—Ants are the only insects which are injurious to the trees; much more to the orange than to the lime trees. People protect their trees in various ways from ants with more or less success. The ants are destroyed by digging up their nests, or are kept off the trees with fine sand, fire, water, petroleum, etc. Fungous growth, and other parasites, are not found in such abundance as to seriously injure the trees.

Planting.—Most of the trees are planted very irregularly, in selected, favorable spots, which may keep moist all the year round. In a few newly laid out lime tree plantations, the distance between trees is twenty feet in every direction.

Situation.—Anywhere, mostly in moist places along small streamlets, or gulches, on the hillsides, in low bottoms along rivers, or near the seashore; in sandy, black loam they yield the best results; the sweetest and thin skinned oranges usually grow on hillsides, whilst the fruit of low lands is generally thick skinned.

Some orchards are in close proximity to the seashore, in sandy, black loam, in some instances, with lagoons of brackish water on the side opposite to the seashore, and give very excellent results. Thus situated, there is one newly, regularly planted, of eight thousand lime trees and one hundred orange trees, with room for many thousands more, and with the advantage of cheap transportation by water to Acapulco, the port of shipping.

Irrigation.—No system of artificial irrigation is in use; the ground between trees is not cultivated, but merely kept free of undergrowth and weeds, lands being as yet of but nominal value.

Yield.—As the orchards are not regularly planted, and the trees are scattered here and there, without any regard to economy in land occupied, it is utterly impossible to state even only approximately the yield or cost of cultivation of an acre per annum.

One orange tree, from the age of eight years up to fifty years of age, under ordinarily good conditions, will yield on an average three thousand oranges every year, worth, picked, $4 per thousand. A lime tree, from

the age of eight years to the age of fifty, bears fruit all the year round, and will yield about eight thousand per year, worth on the tree, say, $10.

Land being but of nominal value, no interest on capital invested in the same, or any ground rent, is to be taken into account; nothing is irrigated, consequently the cost of cultivation is very little, say, $150 per annum for an orchard of several hundred trees.

There being no export market for the other varieties of the citrus family, they are of comparatively little value, and only raised for home consumption.

JOHN A. SUTTER, Jr.,
Consul, Acapulco.

SONORA.

REPORT BY CONSUL WILLARD, OF GUAYMAS.

On receipt of circular, I addressed letters to several of the orange growers in the interior of Sonora (for at Guaymas but few oranges are grown), and in reply was informed that, as the cultivation of oranges as a business in Sonora dates back only a few years (since the Sonora Railway has been in operation, in 1882), they did not feel competent in giving a proper report.

I am told that the first plants or cuttings of oranges cultivated in Sonora were brought by the Jesuit fathers ninety years ago from Italy, and were planted at the Missions of San José de Guaymas and Hermosillo. But little attention was paid to their cultivation, excepting for home consumption, as there was no market for them on the coast (as they are grown from Guaymas to Panama), and no quick transportation existed to take them to a market north. After the Sonora Railway was finished, it furnished the means of getting them to a market in the United States, and in 1883 a small shipment was made, with good results, and since then orchards have been planted, and oranges now figure as an article of export to the United States by rail. In 1888 fourteen thousand boxes, of two hundred oranges each, were shipped. The fruit is sold on the trees at from $6 to $8 per thousand, being purchased by fruit dealers, through their agents, who pick, pack, and ship the fruit.

The Sonora orange commences to ripen in November, and by the end of December the fruit is nearly all harvested. Orange trees are grown along the seacoast and in the interior of the country up to three thousand feet altitude; those which have given the best results are from the sea level up to eight thousand feet. Bottom lands have been used for this purpose heretofore, but I am told some orchards have been recently planted near Hermosillo (inland one hundred miles from Guaymas) on rolling lands and hillsides. The trees are irrigated throughout the year, particularly in the dry season, which commences in October and ends in July.

The trees are raised from the seed of the sour orange and are set out or planted from thirty, forty, and sixty feet apart; the second year are grafted or budded with the sweet orange. They commence to give a small quantity of fruit the third year after grafting, and are in full bearing condition in the eighth year, yielding, if well grown, from one thousand to one thousand five hundred oranges per tree. No insect pests have appeared as yet to destroy the tree or fruit.

Lemons, figs, and olives are cultivated to a limited extent. This fruit from the few trees cultivated is used for home consumption alone, none being exported.

A. WILLARD,
Consul, Guaymas.

LOWER CALIFORNIA.

REPORT BY CONSUL VIOSCA, OF LA PAZ.

Varieties.—The Castillian orange (*Naranja de Castilla*) is the best variety known here for profit, supposed to have been introduced by the early Spaniards; of recent years seed and young trees, brought by fruit growers from the States of Sinaloa and Sonora, have been planted in different orange orchards, resulting in quite an improvement in the quality and flavor of the fruit over the old orange-producing trees in the country; other varieties are of limited production, such as mandarin, pear, and king orange, and of not sufficient quantity for export.

The citrus family comprises here six species fruitful and profitable for cultivation. Citron, shaddock (*Toronja*), large lemons, limes (*Citrus limetta*), lima, sweet lime, king orange, and *Lima chichona*, or sweet teat lime. This last fruit weighs commonly from twelve to fourteen ounces, and is very delicious. The king orange is the production of an orange tree, a young shoot grafted into a sweet lime tree, and in time from that to a shaddock or toronja, and, finally, a shoot from this last is again grafted on a common orange tree. Each of the orange fruit weighs from four to five pounds, and is of a very delicate and sweet flavor, and also exempt from acid.

Situation.—The locations where the trees grow are San Antonio, San José, and La Paz. San Antonio is fifty-six miles from the sea; the other places are ports of entry.

Elevation of the first named town, one thousand two hundred feet; the other two are in a level valley; all fully exposed to the sun.

Level land is best. The soil here is alluvial, sandy, and the subsoil within four feet under is of clay and gravel.

Temperature.—The average temperature is 85 degrees; minimum, 60 degrees; maximum, 93 degrees Fahrenheit. During winter nights are slightly cold, never warm, but quite warm during the day. In summer, sultry days very seldom, and the atmosphere generally very clear.

Rain commences in July and ends in October, in time to assist the growth progress of fruit.

Irrigation.—Irrigation is practiced all the year round. The citrus family have to be watered every three or four days, and give them as much water as possible.

Cultivation.—Young trees are transplanted in the month of September, and also in February, and the cleaning of trees takes place in December.

Fertilizers.—Cow and other manure is used as fertilizer, but in setting young trees a circular hole is excavated of four feet diameter and of three or four feet depth, and about a four-inch layer of old cattle bones is put down, and on the top of it another six inches of clay, and after another six inches of manure, and following common soil. The tree is set on the top of that. The best results have been obtained in that way.

Pruning.—First remove the inner superfluous shoots living at the expense of the sap of the tree, and cut all other unnecessary branches to allow circulation of air. It is evidently proved that the tree should be allowed its full growth from ground. It is best either to protect it from the hot breezes, or from the heat of the soil, and even from frost, as generally the upper part only suffers, and the rest of the tree is fully protected.

Picking.—The picking of oranges takes place early in November, when they are just ripe enough for shipping. Oranges are cured by burying them separately under four or six inches of very dry sand, in a shaded and ventilated place, for a month or two; after that they can be taken out, will look proportionally fresh, and will keep in that condition for six months.

Packing and Shipping.—When packed for export, the oranges are wrapped in paper and packed in special boxes.

Planting.—Orange trees are planted twenty feet apart, lemons fifteen feet, and limes twenty feet. Orange trees are propagated by seed, shoots from roots, and by branch cuttings.

Some orchards are quite large and others are small.

Maturity.—Fruiting begins at five or six years from the time the seed is planted; when the tree is fifteen years old and upwards, it produces the largest crop of fruit. The full maturity of the tree is uncertain.

Insect Pests.—Trees here are very seldom troubled with insect pests, with the exception of some seasons by an insect in the shape of a tick, called *manteca*, which is very easily removed; but sometimes worms, in the shape of teredo on the roots, kill the tree beyond cure.

Picking.—The picking of lemons takes place in August and September, and curing goes through the same process as the oranges.

JAMES VIOSCA,
Consul, La Paz.

SOUTH AMERICA.

STATE OF BAHIA, BRAZIL.

Introductory.

I have the honor to report the following concerning oranges and lemons, as called for in the circular dated September 28, 1889:

As neither figs nor olives are grown here in the State of Bahia, nothing need be said of them. Very little attention is paid even to the cultivation of the orange or the lemon; so little that all that are grown are used in the place, none being exported even to adjoining States. The supply is so limited as practically to prohibit exportation, on account of the very high price that must necessarily be paid for them.

Should one wish to send a box of selected oranges to a friend in the States, he must pay for such box of one hundred, packed ready for shipment, 12½ millreas, equivalent to $6 12½, and this in the orange season, too. Therefore, as none are grown except for home consumption, it seems quite useless to answer the questions in the order in which they are submitted.

Oranges.

Varieties.—The best variety is called *Lavanja de embigo*, or Navel orange. These oranges are seedless. When properly cultivated, they grow to a great size and have a most delicious flavor, being also very juicy. It is not an infrequent thing to find oranges of this class weighing a kilo each, and often a little more, and measuring in circumference from eighteen to twenty inches. The orange of this class of ordinary growth measures from twelve to fifteen inches in circumference.

The other varieties, not choice, however, are *Lavanja de terra*, or Seville orange, which has rather a bitter taste, with seeds, and not as large, nor of course as fine a flavor, as the *Lavanja de embigo*.

Another kind is the *Lavanja de Cravo*, or *Tangerine*, similar to the Tangerine of Florida, with seeds. The fourth and the last class is the *Lavanja brabo*, or wild orange, with pips also.

Whatever cultivation is given, the Navel orange receives, though some attention is being given to the Tangerine.

Situation.—Anywhere along the seacoast. I have been informed they may grow anywhere, in fact, in the State.

As there is no land in the State that is cultivated that has any great degree of elevation, it may be said they will grow at any elevation.

Soil.—Clayey soil mostly about and in this city. Some sandy. In the interior of the State more of an alluvial nature. The character of the subsoil is presumably much the same as the soil. In most cases the subsoil has never been turned up. The land is never prepared by plowing it. The grass and weeds, when cut away at all, are cut by large hoes.

Climatic Influences.—Along the coast the mercury ranges between 76 degrees and 92 degrees in the shade. In the interior, especially on the higher elevations, the range is greater. Cool nights and very moist atmosphere. Rainfall in inches, I do not know. Generally the rainy season begins about April first, continuing to November first, though there are frequent showers in the dry season from November to April. Consequently, as the fruit is usually picked from May to August, it ripens in the rainy season.

Irrigation.—There is no irrigation.

Cultivation.—Consists simply in cutting the grass and weeds that spring up whenever needed, and is done, as stated, with a large hoe.

In a very few orchards the ground is seeded with grass, which is cut when green, after which the soil is loosened with the hoe, then animal manure is scattered broadcast through the grove.

Pruning.—Pruning is done after the tree reaches its fifth year, or thereabouts, say four to six feet from the ground. It is then continued every year thereafter while the tree has growth.

Picking.—This depends on the demand, as they are not shipped. People will buy them only when ripe, consequently they are allowed to remain on the tree till reaching the stage of ripeness.

Were the oranges to be shipped, the picking before being ripe would, of course, depend upon the length of time occupied by the steamer to the place of destination.

Planting.—The trees are planted from twelve to sixteen feet apart, and propagated by cuttings in Bahia. The orchards are very small generally.

Maturity.—The trees commence to bear in about five years. If the trees are properly cared for, largest crops are obtained from the eighth to the twentieth or twenty-fifth year in the life of the tree. Much depends, of course, on the seasons—whether very dry or very wet. They are fruitful for thirty or forty years.

Insect Pests.—A sort of white worm, which is destroyed by brushing

the trunk of the tree with a mixture of clay and water, or rather, painting it with the liquid mixture.

Lemons.

There are but two varieties of lemons in this State. The one called *Lima doce*, or sweet juice; the other *Limao*, an acid, nearly round lime. This lime is abundant, but is not cultivated to any appreciable extent. It is much more acid than the lemon proper, and is known, I believe, by the scientific name of *Citrus limetta*, the lemon being known as *Citrus limonum.*

As the limes are not shipped, there is no curing, no packing. They are picked whenever there is a demand for them, and, like oranges, may be obtained nearly the entire year, though, like the oranges, they are best in their season, which is the same as the orange season.

There are no statistics issued on the subject from any source. Prices of both oranges and lemons depend on the supply. The lowest price for the best quality of oranges is about 4 vintins, equal to 4 cents. The maximum price is about 8 vintins, say 8 cents. Lemons, or limes, may be bought from ten for 1 cent to one for 3 cents, depending on the supply or scarcity.

D. N. BURKE,
Consul, Bahia.

SPAIN.

MALAGA.

REPORT BY CONSUL MARSTON.

Oranges and Lemons.

Varieties.—The names of best varieties for profit are: China oranges and the Castillian lemons. There is another kind of lemon called the Reales, which is large and long, but the Castillians are more productive.

Location.—The trees that produce the varieties named above are grown in all parts of the Province of Malaga where there is water, and generally by the side of small rivers and streams.

The distance from the sea is about two kilometers, and the elevation above sea level one hundred feet. Any elevation, with water and sun, will answer. The more sun the better. Level land; sandy subsoil is the best.

Climatic.—Temperature, 45 degrees to 90 degrees Fahrenheit; average, about 78 degrees; nights immaterial. For both oranges and lemons, moist days, or ordinary atmosphere, are most beneficial.

No record of rainfall is kept in Malaga. Rainfall is always good for both trees and fruit.

Irrigation.—In summer only, three times a week, at any stage of growth, and as much as possible. Never water for ten or fifteen days before picking fruit.

Cultivation.—Twice a year, by plowing or digging around the roots.

Fertilizers.—Stable manure, placed around the trees to the depth of eighteen inches to two feet, in the month of January.

Pruning.—After four years old, begin to prune; height immaterial. If plowed with horses or oxen, then prune off lower branches; if you dig around the roots by hand with spade, it is immaterial.

Picking.—Picked when nicely ripe; for exportation, while they are green and before they turn yellow; nothing done to cure them here.

Packing and Shipping.—Packed in tissue paper first, and placed in cases one eighth, one fourth, and one third, and sometimes one half chests for shipment.

Planting and Propagating.—The distance the trees are planted apart is thirty-six feet; they are propagated from seed of bitter oranges, and grafted. The best varieties are seedlings.

The orchards are large and small.

Maturity.—Begin fruiting at four years of age; largest crop at about fifteen years; twenty-five years, full maturity.

Insect Pests.—Both lemon and orange trees, in certain locations, have been attacked by some kind of insect, but growers here are ignorant as to its name or nature.

There are parasites, but their names are not known; they injure the fruit by eating the buds.

Packing and Curing.—Never pick either oranges or lemons while wet, or immediateiy after rain; let them be perfectly dry. They are both hard and green when picked for exportation, and taken to the place of packing and there assorted as to sizes. The United States prefer the small, England and France the large, and north of Europe the medium sizes. They are then wrapped in fine tissue paper of different colors, and placed in rows in the case or box by women and girls, who are remarkably adept at the work. The package is then taken by men, the lids nailed on, and strapped with the ordinary wooden hoop-pole split in two pieces, branded, and then they are ready for shipment. The season for picking lemons is in September and October, and for oranges November and December of each year.

H. C. MARSTON,
Consul, Malaga.

PORTUGAL.

AZORES.

REPORT BY CONSULAR AGENT MOREIRA, OF ST. MICHAELS.

Varieties.—The name of best variety for profit is the common orange (*Citrus aurantium*), or China orange, which is the orange exported.

Names of other choice varieties worthy of culture are: the Selecta (selected) without pips, which never attains a deep color, and does not ripen well till March or April; the Tangerine, a variety of Mandarin, a delicious small orange, but not cultivated to any great extent; a few boxes are shipped, but of the Selecta hardly a package is exported.

Situation.—The trees that produce the varieties above named are grown in almost all situations of the island; distance from sea, from one half up to three miles; elevation above sea level, from eighty to four hundeed feet; for exposure to sun, eastern aspect desirable; they grow in all lands, but level land is preferable.

Soil.—Light soil, and also argillaceous mixed with pumice stone.

Climate.—Generally moist.

Temperature.—Winter months, minimum, 48 degrees; maximum, 75 degrees; average, 61 degrees. Summer, minimum, 50 degrees; maximum, 82½ degrees; average, 69½ degrees. Nights generally cold in winter but very warm in summer; few sultry days; atmosphere moist.

Rainfall averages forty inches per annum on the lower grounds, but on the higher lands probably sixty inches. Our soil is porous; the rain soon sinks into the ground and the soil soon dries up, therefore genial showers in summer are very beneficial. In some years there are droughts in summer, and the fruit trees suffer much, consequently the fruit is small and frequently rough.

Irrigation.—Irrigation not required.

Cultivation.—There is no particular method of cultivation.

Fertilizers.—About February lupin is sown broadcast, and when about two feet high is dug into the ground; some people (but very few) sometimes use farmyard manure, and guano has sometimes been applied.

Pruning.—Pruning is not generally practiced before the trees attain an age of seven years, and then at about four feet from the ground.

Picking.—Picking begins about the fifteenth of November and continues up to March; the fruit is not properly ripe until January.

Curing and Packing.—There is no system of curing. The fruit is packed in boxes containing from four hundred to five hundred oranges, according to size of fruit, wraped in Indian-corn leaves.

Planting and Propagating.—Distance from plant to plant, in rows, fifteen to twenty feet. If planted closer, which is sometimes done, the trees shoot up too high and the branches touch one another, preventing the sun from shining into the trees as much as desirable. The trees are now mostly propagated by selecting a healthy branch about half an inch in diameter, taking off the bark all around, about an inch in height, then putting around it some sifted soil. When it begins to throw out roots it is cut off from the tree and planted out in beds till it attains a height of at least three feet, and then it is ready to be transplanted. They are also propagated by layers, that is, by pegging down the lower branches and grafting in the ordinary way. From seedlings the oranges are better than from layers, but they take a long time before they produce any fruit. Sometimes, also, the trees are budded. The orchards are from one third of an acre up to twenty acres in size.

Maturity.—The trees will produce in seven years, not, however, in large quantities; but the largest crops may be expected when they attain the age of twenty years up to forty years, at which latter period they begin to produce less.

There are no insect pests.

Many years ago there was a fair quantity of lemons, and some were shipped, but now there are very few. Nobody ever thinks of planting lemon trees, except for their own use, or for sale in the market, where sometimes 5 cents are given for one. None are now shipped.

AUGUSTO S. MOREIRA,
Acting Consular Agent, St. Michaels, Azores.

OLIVE CULTURE.

ITALY.

REPORT BY CONSUL LAMANTIA, OF CATANIA.

Variety.—The common olive tree in Europe has oblong leaves, and is the kind which was first imported, and from the wild state reproduced in varieties, and grafted, offers so many varieties too difficult to mention. In fact, the Indians knew but one kind, the Egyptians only three, and the Hebrews and Greeks five. The Romans, as to Virgilius' statement, knew but three varieties; Cato says ten; Columella stated twelve; Macrobio reported fourteen, and Pliny declared fifteen varieties. In other times the botanic Tournefort classified them to seventeen varieties.

By an interesting report, however, published in 1871, by the *Ministro d'Agricultura, Industria, e Commercio,* it seems that there were registered three hundred varieties actually cultivated in the several regions of Italy, viz.: Lombardy, twenty-three varieties; Venetian, twenty-one; Liguria, twenty-four; Emilia, ten; Marches, sixty-three; Tuscany, thirty; Lazio, twenty-seven; Adriatic Coast, sixty-seven; and Sicily, twenty-one varieties. The olive tree in Sicily blossoms from the month of April to June, and experience has proved that when it happens in April, yields a full crop, while blossoming in May or June gives a scanty one.

The flowers on the bunches develop very slowly, but as soon as they fade the fruit sets on, and is formed in a few days. Ten or fifteen flowers compose the bunch, but only a few of them set on, and many of them fall down.

Bunches with three or four fruits stand well, and the fruits so formed come to perfect maturity from the month of October up to the end of March. The olive tree, when it is located in favorable conditions and cultivated properly, grows to an extraordinary size, very high, and lives very long. In fact, Pliny says that in his old times at Luiterno, a city near Rome, were seen trees which had been planted two hundred and fifty years before by Scipio the African. Gasparin writes to have seen at Rogliano, in the Island of Corsica, olive trees from seventeen to eighteen meters high.

Extraordinarily large are also several Saracen olive trees in Sicily, some of which Professor Aloi says yield as much as ten hectoliters of fruit. One of them, near Girgenti, which himself measured, has a circumference of eight and two tenths meters (twenty-five feet) at six feet from the ground. Their age, he further states, is from one hundred to one hundred and fifty years, while other authors agree to be from five hundred to six hundred years.

In some counties in the Province of Cosenza (Calabria), there are some olive trees, visited by Professor Aloi, which he judges to be of a very long origin, and some people of that country even pretend the said trees to have been from the time of Luigi D'Angio, who was sent there in a manner of banishment and to govern in the same time that country.

Vegetation.—In many parts of Italy this plant grows spontaneously, and principally derived from seeds deposited by some large bird's excrements, which are in a condition of sprouting. But the plant left to itself grows and rises slowly from the ground, the branches furnish a few and small leaves, bearing very late, and the fruit yields but a little oil.

The olive tree propagated by seeds and subjected to grafting, when located in open air and on well adapted land, throws towards the ground a good main root, from which many others grow down deep, and the tree from its base acquires a majestic appearance. On points where the trunk joins the roots, on the largest of them develop certain swellings called *ovoli* (springs), which are used for propagating the culture. If the plant be destroyed by storm or killed by frost from its base, yet many shoots will come out, although less than when it is in the regular course of vegetation; these springs repeat their growing from the original roots.

The olive leaves last from two to three years, and grow matched on the branches one against the other.

Climate.—The olive plant is one of those generally liking warm climates, and in a changeable temperature it grows well, and fructifies even exposed to any direction. The extreme limit of its vegetation is marked about the 45th degree of north latitude. Excessive heat and intensely cold weather are injurious to its culture. In fact, beyond the African Atlantic the olive plant is seen no more. As Humboldt remarked, in his voyages in the several parts of South America, and as Poiteaux observed at Cajenna and St. Domingo, that if the plant could vegetate in those regions it would never bear fruit. Some writers have asserted that the olive plant wants to grow near the sea, and they have even established the extreme limit, beyond which, under this respect, the plant does not find the necessary conditions for its vegetation. This opinion has, however, been contradicted, and proved by the fact that many olive trees are seen growing and producing well in the interior of continents and very far from seashores. If the olive plant shows its preference near the sea it is because there the temperature is more suitable to its vegetation. The olive tree commences to vegetate when the temperature is at 12 degrees Centigrade above zero, and blossoms at 18 or 19 degrees Centigrade. A temperature of 5 degrees below zero, followed by a sudden thaw, operated by the sun's rays, is sufficient to kill it totally at the base. With a lower temperature, not followed by sunny days, the plant does not suffer as much, as it can stand a cold of 10 degrees Centigrade below zero. It is not so much the cold weather that injures the olive growth as it is the frequent change of cold weather to warm, and the often melting of ice.

One of the greatest enemies of the plant is frosty weather, especially when the snow fallen on the branches dissolves by the sun's rays, and congeals again during the coming night; at 12 degrees below zero it not only kills all the leaves, but even the trunk and its roots to the ground.

A cold of equal intensity is more fatal during the spring season than it is in winter, for the reason that the plants are then in a state of vegetation, and consequently the new sprouts are ruined and destroyed.

A cold in a vaporous atmosphere hurts more than in a dry one, and it is for that reason that with the same degree of cold the olive plants on plain lands, because in a vaporous atmosphere, become more damaged than those located on hills. The altitude where the olive tree can thrive varies according to the several regions in which it is cultivated. In central north Italy, for instance, it ordinarily trespasses five hundred meters above sea level, while in Sicily it goes over seven hundred meters. But Professor Aloi assures me that he has seen olive trees in this island at eight hundred meters. It is proper, however, to note that if at the extreme limit of altitude the olive tree can vegetate, it is impossible there to bear fruit. Hence, planting in such localities does not pay. I may here give the agrarian climatic temperature in Sicily, which is divided into three different zones, viz.: the marine or warm climate, the medium or hilly temperature, and the mountainous or cold one. The height of the first is considered to be from sea level to six hundred meters above sea level; the second from six hundred to one thousand one hundred, and the third from one thousand one hundred to one thousand eight hundred meters.

The following table shows the several principal products cultivated and grown in same:

AGRARIAN CLIMATIC ZONE IN SICILY.

First Zone (Low Land, Warm Climate, from 0 to 600 Meters).	Second Zone (Hilly Land, Temperate Climate, from 600 to 1,100 Meters).	Third Zone (Mountainous, Cold Climate, from 1,100 to 1,800 Meters).
Olive trees.	Corn.	Prairies.
Vineyard.	Wheat.	Chestnut.
Sumac.	Horse beans.	Oak trees.
Fig trees.	Pistacchio trees.	Ilex.
Prickly pears.	Rye.	Pine trees.
Almond trees.	Barley.	Beech trees.
Oranges and lemons.	Chestnut trees.	
Cereals.	Filbert trees.	

Situation.—The success of olive culture greatly depends on situation and soil. Calculating the method of vegetation of this plant, it may be determined that, in warm climates, situations facing from east to north are to be preferred, so that the plant will not suffer from the summer heat. In climates less warm, however, an eastern exposure is best, and in climates of the last zone a southern exposure is best. As above stated, in climates less warm the expositions to east are to be preferred, but if the locality is subject to frequent white frosts, then it is better to cultivate it in expositions facing west and north, for the reason that exposed to the east the plants covered with white frost, and quickly touched by the morning sun, the sudden change from one temperature to another, they run the risk of getting dried.

As far as inclinations are concerned, those of hilly and rolling ones are to be preferred, for the reason that olive plants cultivated on flat land, although they present a flourishing vegetation, yield fruit too rich in oil, while those situated on hilly and rolling land give best results. The same may be said of trees planted in a mild temperature.

In flat land the fruit sets badly, becomes waterish, yields less oil and more dregs, is subject to fall before maturity, and is easily assailed by insects and disease. The trees on the highest zone of temperature suffer from the cold, and have, of course, less duration. It is, therefore, wise that in planting an olive grove preference must be given to middle altitude of hilly and rolling lands, without calculating the majestical aspect the trees may show on flat soils, for their fruit yields but a little oil.

Soil.—The olive tree is a plant which adapts itself to any soil, even to the most sterile one; but it does not give everywhere the same quantity of fruit. In the soil it likes a certain coolness, but not exceedingly, for the reason that too much dampness, stagnated in the ground, renders it too hard, thus causing damage both to roots and trees.

The best soil for olive culture is the calcareous silico-argillaceous, rather deep and permeable. A stony soil, covered with a little ground, sufficient to let the young trees vegetate, may be adapted for the olive culture. The proofs thereof are the trees grown on the hills around Messina and on Mount Etna, which are covered with but a few centimeters of ground. In compact soil, and those on impermeable subsoil, the olive plant dies.

Fertilizing.—The manure adapted for fertilizing the olive tree must be subordinate to its composition.

From the analysis made by Duracher and Malaguti, the following has been obtained, viz.:

DESCRIPTION.	Potash	Soda	Magnesia	Lime	Phosphoric Acid	Sulphuric Acid	Flint-stone	Iron and Magnesia Oxide.	Chloride of Soda	Chloride of Potash
In the wood	25.54	-------	7.23	20.12	10.15	3.43	13.75	4.43	12.16	1.26
In the leaves	26.67	-------	7.31	21.93	7.98	1.64	20.88	6.11	5.39	2.37
In the fruit	7.13	20.51	10.25	22.91	10.53	4.60	12.41	2.59	7.92	------
Total	59.34	20.51	24.79	64.96	28.66	9.67	47.04	13.13	25.47	3.63

From the above table it seems that the olive tree contains mostly all the materials generally needed by other plants, and that lime, flint, and phosphoric acid are the most in proportion to other materials. Consequently, in manuring said plant the compost is to be made accordingly, in respect to others shown on the table. But many of said materials are contained in the soil, and in such cases it would be superfluous to add others. Therefore, it is necessary to learn the composition of the soil in order to know and to be sure how to properly manure the plants. Besides the above materials, well decomposed excrements of any animals, as well as wood ashes, etc., make also a good compost for manuring, and the proper time to do it is after the winter season, when, through the watering vehicle, the materials are absorbed in the ground. At last, in manuring the plants the material shown on the table must not be neglected, and of which potash, soda, magnesia, lime, silica, and phosphoric acid must be more in proportion, as such composts greatly benefit the olive culture. The quantity of manure to be given to each tree varies according to its size, quality, and composition of ground; and it is, therefore, impossible to establish a certain quantity, and the best thing to do is to manure annually with a little compost, except in cases where a plant shows dullness, when a good dose of manure could be given in order to make it revive again.

Propagation.—The olive culture can be propagated by (1) *semi* (seeds); (2) *ovoli* (springs); (3) *talee* (stocks); (4) *polloni* (sprouts); (5) *tronco vecchio* (old trunk); (6) *olivastrelli* (olivasters).

All the plants derived from any of those propagated must be grafted, as they generally grow from a wild state. Exception, however, is to be made in the case of young trees derived from stalks taken from the upper grafted trees, or from plants which need no grafting, and those which are obtained from springs, sprouts, and old trunks.

Propagating by Seed.—This system, although requiring more time for growing and fruiting, as a method of propagation deserves to be appreciated, for the reason that plants originating from seeds are of longer duration, become larger, and better withstand cold weather, insects, and diseases.

To carry out propagation by seeds it is necessary first to prepare a good size seed plot, enough to contain all the young plants developing therefrom, and there to remain for three years, after which time they are to be planted in a reservoir for replanting. The seed plot must be exposed to the north, and the ground must be clear of roots and flint-stones. In winter it must be richly manured with animal excrements, not quite decomposed, the ground deeply dug up, and always kept free of grass. During the spring and summer seasons it is necessary to keep it fresh, and water it whenever necessary to help the seedling to sprout. In July the young plants are out of the ground, and in November they are four or five inches high. During the second year the seed plot is to be worked the same as the first year, and in October, or in the coming spring season of the third year, the young plants are large enough to be transferred to the reservoir by taking off all the little branches therefrom.

Propagating by Ovoli.—The *ovoli* (spring) is a bud found on rooty stumps and on the larger roots. It has the shape and the size of a goose's egg, and shows out from the bark of trees. From each adult plant no more than three or four *ovoli* are to be taken off, otherwise you hurt the tree. To obtain *ovoli* or *talee*, instead of ruining many plants it is better to cut down one or two trees, from which a few hundred of them can be obtained for propagation. The said trees, however, must be of a good quality, apt to produce fruit of a white and juicy wood, and not reddish or veined. The springs on the roots are to be preferred to those located on the stumps of the trees, for the reason that the former are always more tender and juicy; hence, better adapted for budding.

Propagating by Talee (stocks).—This is simply done by cutting off from the best fruiting plants a bit of branch about one and one half feet long, which is laid in the ground by the largest end deeper down. The trees of the said stocks must be vegetating and of a large size, with thick bark, and well furnished with gems, wherefrom it is easy for rooting and budding. In order to succeed, however, it is necessary to lay it horizontally in a reservoir facing the same direction of its plant. Besides single talea, propagation can also be done by *talea composta* (composed stock), which, beforehand, needs to be placed in a temporary reservoir, and only when supplied with roots and buds is planted in another one. This method of propagating requires the identical work like the single talea, by placing it horizontally in the ground, the largest end deeper down.

After one year, the young branches will provide themselves with leaves and roots, when the stock will be cut in pieces and each piece planted in the reservoir.

Propagation by Polloni (sprouts).—Between the intersection of roots with the trunk of the largest roots on the base of trees, sprouts generally grow up, the same as in other plants, from which good advantage can be obtained in propagating the olive growth, as this is the quickest

mode of all. Very often, it seems, sprouts are provided with roots, and if they spring up in great number from the plant some are dug up, leaving the largest and most vigorous ones, and covering their bases with earth.

Propagating by Trouchi Vecchi (old trunks).—Advantage can also be derived from old trunks in the propagation of olive trees.

When a plant dies and contains living roots, you see a great number of sprouts growing therefrom, which are also useful for propagation, and for which use those most vigorous and largest are left on the mother plant, well covered with earth, and the smallest ones are taken out to let the former have more space. In this state of growing they are left until their young trunks grow as thick as one and one half inches in diameter, after which they are hoed up and detached from the mother plant, transported to the reservoir, and planted at the distance of two feet from each other. Where the sprouts of the dead plant are not many, then it is better to leave them attached to the same.

Propagation by Olivastrelli (olivasters).—Where the olive tree grows spontaneously in a wild state, and is not touched by animals' teeth, care can be taken of it until it grows to a proper size, when it is transported to final position, or planted in the reservoir, at a distance of two feet each side.

It is, however, worthy of note, that of all these methods of propagation, the one operated by seeds is the best, for the reason, as above stated, that plants so propagated live longer, and better resist the cold weather. In propagating by stocks, the character of the tree wherefrom stocks were derived is perpetuated.*

Grafting.—Following the propagation, I ought to proceed with the reservoirs, but as the small plants propagated by the methods above stated must be, in most cases, grafted, which can be done in the reservoir as well as in final stay, I proceed about the grafting in reservoir. Plants propagated by seeds, springs, and sprouts derived from grafting, as well as those from roots of trees already grafted, and those spontaneously grown by seeds in a wild state, need, of course, to be grafted.

The olive tree can be grafted by several methods, and they are as follows, to wit: (1) A *scudetto* (shield); (2) An *anello* (ring); (3) A *corona* (crown). The first method is mostly used in Sicily, on account of its simplicity and certainty; the second one is seldom used, because it is difficult, and it is operated late in the spring; the third one is practiced for adult plants, and likewise in the late spring season, when the plants are in a state of anger. Here I do not proceed minutely in describing the several methods, as grafting is well known by every agriculturist in the United States.

Treating Plants in Reservoir.—While the plants develop in the reservoir, it is necessary to predicate all the possible intelligent care, for the reason that if they are neglected they will be of poor fruiting production.

As to the length of time to keep them in the reservoir, several eminent agriculturists differ in their opinion, to wit: some propose five years, while others advocate fourteen. Practical observations, however, have proved that allowing plants five years in the reservoir, they can never acquire sufficient roots to be transplanted for final stay. On the

* Prof. A. Aloi's report.

other hand, if left for fourteen years, on the seventh or eighth year one half of them, the odd ones, are to be transferred to another reservoir, as the one would not be large enough to contain all the young plants located therein at a distance of two feet apart, as above stated. It is therefore advisable, in Professor Aloi's practical experience, that the proper time for allowing young plants in the reservoir is from seven to eight years, counting the time of the seed plot.

For the first two years keep the young plants clear of little lateral branches, but leave the leaves remaining on the arm pits. Fasten the little stock on sticks placed alongside with them, in order to protect them from strong wind or stormy weather. Water the reservoir in case of long drought, and fence it to prevent animals from destroying it, and always keep the ground clear of grass.

From the second to the fifth year treat the plants as above stated; only on the fourth year change the sticks for larger ones, in order to better sustain the growing plants. On the sixth year they are in a state for designating the shape you want them to grow.

The height of the trunks principally varies according to the situation of the ground wherein the plants are to be located for final stay. If the soil is fertile and fresh, they (trunks) can be left at about six feet high from the base, and if it is arid at about four feet. The reason for this is, that the shorter the plant the more vigorous they grow.

Having thus fixed the height of the trunks, all the young branches grown under them are to be taken off, and to the main sprout growing high must be done the same, and by leaving on its upper end about from five to eight branches well distributed around the same, in order to form the head of the trees.

Another method in fixing the height of them is by cutting all the branches off the plant to the fixed point of height, in order to permit its roots to develop and to incorporate themselves in the soil before the plant requires nourishment, and at the same time sprouts will grow to the desired height.

Transplanting for Final Stay.—We have learned up to this the sort of land and the exposition better adapted for the olive culture, as well as the several methods of propagation and the treatment to be given young trees in the reservoir. I now deem it proper to treat about the system of removing them therefrom, and the distance apart to be left between them. Further, I will proceed with pruning, and of the several insect pests and diseases afflicting the precious Minerva's plant.

When a grower is to transplant young trees from the reservoir to final stay, it is necessary for him to establish a plan, and decide whether he wants to exclusively form an olive grove, or together with plants of other fruits.

The disposing of planting in different manners is subordinated more to the inclination of the land than to the grower's faculty. The land may be too hilly or too flat. In the first case, it is better to plant all the land exclusively in olive groves, and in rows, for the reason that disposing them with plants of other fruits between they would yield less fruit; besides, rainfall on hilly soil washes out the necessary elements of their growth, and the roots of the other plants would always be exposed.

The several dispositions to be given to olive trees, and the inclination of the land, determine the distance apart between the trees. If a certain area of land is desired to be exclusively cultivated as an olive grove, the distance apart between the plants is to be such that, in the spring equinox, a plant must not shade the one standing by in the direction from south to north. For that purpose a distance of sixteen feet apart is sufficient. In a very rich soil, however, where the plant can grow very large, this distance must be doubled (thirty-two feet).

The inclination of the land for the grove properly adapted to the cultivation must be running from north to south, for the reason that if exposed to north entirely the culture would be retarded by cold weather.

Disposing the plants in rows, however, with the object of locating plants of other fruits between, the distance amongst rows must be thirty-two feet, and twenty-two feet between plants of the same row.

The best disposition to be given trees is the *hexagonal* one, for the reason that if it runs from south to east the plants will be in a position quite open to the sun, and will vegetate and grow well.

The proper time for transplanting from the reservoir to final location is in the month of July or August, when ditches, either round or square, of four feet wide by three deep, will be dug for planting the young trees taken from the reservoir, on hilly or rolling land. If the ground is flat, the ditches must be no deeper than eight inches, and if on inclining soil, sixteen inches deep. This done, throw therein some filling of old plaster or old mortar, with some stratum of good earth, wherein place the tree, with the roots well scattered around the base; cover the same with some earth again, manure over it, and some wheat husk or hashed straw to keep the soil fresh during the summer, and to nourish at the same time the tender roots. Shake the trunk a little, so as to allow the ground to be well settled between the roots, so that they will be easily rooting. After this operation has been done, cover carefully the ditches with the same ground removed therefrom. On the upper side, near the plant, form a sort of a little basin, so as to hold the rain water to water the same. In the summer, if a long drought should prevail, they must be irrigated.

Pruning.—An old motto in Sicily says: "He who works a growth demands the fruit; who manures it obtains the fruit; and who prunes the tree forces the growth."

The principal forms to which olive trees can be reduced are four, to wit: *At albero* (shape of a tree), *at pina* (shape of a pine), *at paniera* (shape of a basket), *at umbrella* (shape of an umbrella).

The first form is mostly used in Sicily, in Calabria, and in some parts of the Roman and Tuscan provinces. It consists in leaving the tree take its natural habit, the pruning being limited by cutting off now and then all the dried and broken branches, and all those deviating the humor from the central trunk. The form *at pina*, called also "cone," is more correct than the former, and consists in allowing the branches to be disposed in a shape without hurting one another, thus forming a good exterior without exceeding leaves.

Pruning *at paniera*, called also *vaso* (vase), consists in taking from off the main trunk all the disfiguring branches, to make the tree look in the shape of a vase. The olive plant so pruned appears with all its branches well ventilated, and, therefore, besides producing the great quantity of fruit, it furnishes them completely matured. For this reason, pruning *at paniera* is considered as the most advantageous one, and the same is generally used in this island. Finally, a good pruning must be based upon the following principles, viz.:

(1) An olive plant produces no fruit on new sprouts before two years' time, for the reason that said sprouts in the first year bear no fruit, but simply develop and bud fruiting gems; in the second year, when they will grow larger for blossoming, setting, and fruiting.

(2) The blossoms do not set, neither produce fruit, if not exposed to the sun's rays during the longest part of the day. This fact must not be neglected by the pruner when he applies his pruning knife, if he wants to gather the fruit. He must always prune so as to let the fruiting branches be exposed to the sun, so that its rays will penetrate through the plants, as those thickly loaded with branches and leaves not pruned as above stated bear less fruit than the former.

It is necessary for growers to keep those facts in mind, if they would succeed in this culture.

(3) The horizontal and bending down branches produce a great many fruit, while the vertical ones bear none. The pruner must consequently turn his attention to raising the plants as above stated, and not in a vertical shape.

(4) When a plant has a great number of bearing branches, the fruit will naturally be small, yield less oil, and the crops will be biennial. To avoid this the smart pruner should simply leave a certain number of the most vigorous branches—enough so as not to force the plants—for by so doing they will render larger olives and more oil every year.

(5) The olive trees being of so many varieties they consequently require different treatment. To keep in mind the several varieties of olive plants while pruning is going on, it must be indispensable for the pruner to know that there are some branches tending to grow up straight, while others incline downward. In the first case the former are not to be forced to grow low in a close shape, but simply prune them yearly, and try to prevent them from growing too high, and allow them to retain all the lateral branches except the dried and faded ones.

(6) The olive plant, according to the ground, its exposition, and the height where it is located, vegetates and bears fruit differently. The quality of the soil has a certain noted influence on the vegetation of the olive tree. If the soil is argillaceous and too rich of vegetal and fertilizing matter, then little pruning is to be done, for the reason that the quantity of strength the plant draws therefrom permits it to maintain a large number of branches. If, on the other hand, the soil is poor—that is, loose silico-calcareous—then it is necessary to cut many branches off, for the reason that the little sap the plant draws from the soil is not sufficient to nourish many of them.

(7) The plants must be divided into three categories, according to where they are located: (*a*) All the plants on argillaceous rich soil of the warm zone; (*b*) all the plants on calcareous soil of the middle temperate zone; (*c*) all the plants on the poor siliceous soil of the high cold zone.

In conclusion, a good pruning consists of (*a*) suppressing all branches tending to grow up straight, as they are very exhaustive; (*b*) cutting down all the parts from the plant, all the dead branches, as well as those broken by the wind, and those growing longer than others; (*c*) suppressing all the sprouts developed in the plant during the year, leaving only some terminal ones, and some others grown near those having

the force to bear. If many new sprouts were left on the branches, the majority of them would fail to bear, because the sap the branches draw could not nourish them all. Pruning in such a manner that the plants would grow in proper form, the branches should be well disposed without confusion, and the lower ones bending down would cover a part of the trunk. Another operation essential for the pruner to know is that if the trunk contains dry bark, knotty and partly detached from the wood, he should cut it off with a well sharpened tool, for the reason that in so doing he cleans the trunk from insects, wherein they lay their eggs. Another advice to the pruner is, that following the years in which the plants bear much fruit, it is always better to shorten them a little, as it is proper to leave others longer, which during the years produced less.

In conclusion, following the rules above stated, the pruner can be sure of his success, provided, however, he will, with sharp eye, carry them on in accordance with the above instructions, always taking into account the local climate and condition of the soil. These rules and modifications are the results of long experience.

Insect Pests.—The olive has the most fearful enemies, which attack it in every way most terribly; in fact, insects, diseases, and inimical causes, more or less, make a slaughter of it.

Arrayed in first line are the insect pests attacking the fruit, while others attack the wood and the leaves, thus hurting it in every way. The most terrible is the *Mosca dell' olivo* (olive fly), or *Daco delle ulive*, known as *Musca oleæ*, *Dacus oleæ*, *Cynips oleæ*, *Stronomus keironi*.

The Dacus is a small fly, about half the size of a common fly. It is an insect with orange yellowish colored head, green eyes, yellow breast, with two black points. The female Dacus has on the extremity of its abdomen a sheath of black color, wherefrom it throws an arrow, piercing the fruit, wherein it deposits its eggs. This insect is so pernicious to the olive culture as to shorten two crops out of three. It works as follows:

As soon as the olives are formed the female Dacus throws its arrow, pierces the olive skin, shakes its wings, and into the pulp lays one egg. This done, the insect takes a rest by cleaning its body as a sign of satisfaction, and then flies away to other olives to perform the same operation, until it deposits from three hundred to four hundred eggs into as many olives. From the egg, in a short time, you see a certain soft whitish larva without feet, which, staying fifteen days in the pulp, digs a vertical gallery through till it reaches the stone, and diverges thereby.

As soon as the larva is fully grown, it gets near to the out fruit by enlarging the canal made by its mother on depositing the egg, so as to let the grown insect come out.

Twelve days from the time the larva is transformed in nymph, grows the fly, and the insect is formed in twenty-eight days, counting the time from depositing its egg.

The *Cocciniglia* (female Coccus) is another insect damaging the olive tree, which stays for several months immovably attached on the branches and on the leaves. When in a state of reproduction it lays thousands of eggs, seeming as excrescences of the trees. The male Coccus looks different from the female.

In the month of May the female lays about one thousand eggs, which it covers and then dies, thus protecting the future progeny with its corpse.

The eggs under such protection open one month later, and precisely in June, giving life to larvæ which develop in the bed formed by the mother skeleton.

The Coccus, attached to the branches and leaves of the tree, not only sucks its juice, but prepares the tree for conditions favorable to the development of a fungus called *Antennaria olæophila*, *Cladosporium fumago*, or *Torula oleæ*, which darkens all the plants with black, and makes it look lurid-like.

In Sicily the olive plants are often invaded by the Coccus, and more especially on coasts fronting the African Sea.

According to the Gasparin and Roches method of destroying the insects, it seems that sulphur sprinkled on the attacked plants, as it is done on the vines for the *Crittogama*, is a good remedy.

La Tignuola (*Tinea oleæ*) is also an enemy to the olive plant. This belongs to the *Lepidottera* family. Its butterflies are very small, with grayish wings, and mostly marked with whitish spots.

The evening moths, which ordinarily come to our house to die, burned at the candle flame, are Tignuola. The grubs are very small, voracious, and cause immense damage. Their generation is as follows: In the spring seasons these insects, derived from the first generation, produce eggs, wherefrom grow larvæ, which voraciously devour the branches and sprouts of the olive tree. When it commences fruiting, the Tignuola reproduce for the third time, after which they deposit their eggs at the base of the fruit, wherefrom new larvæ come out, and stay there until they are in metamorphosis, and as long as the fruit remains on the tree.

The *Punteruolo* is a "Coleottero" belonging to the section of *Xilofagi*, and its botanic name is *Philojotribus oleæ*. It also causes much damage to the olive tree.

Another small Coleottero, *Rosicante dell' olivo* (olive eater), is the so called *Hylerinus oleiperda*, a dark colored insect covered with hair. The larva is white, and nests under the bark of the tree, and sucks the life of the sap branches in the cell which it digs, accomplishes its transformation, and flies away when perfected, about the month of May. It then joins the female, which, having been impregnated, goes upon the branches, which it wounds to deposit an egg, which forms a larva, as above stated. To destroy the said insect some people propose to cut off the perforated branches from the tree, while others recommend, as soon as the insect attacks the plant and weakens it, to manure it, plow and water the same, so as to make it revive again.

La Cantaride (*Cantharide vescicantoria*) is another insect belonging to the Coleottero order, tribic of the *Coleotteri vescicanti*. From the deposition of the egg and its transformation into a perfect insect it undergoes five stages, but only when it is perfected does it damage the olive tree.

La Cantarides appear in the month of June in extraordinary number, when they dart in flight on the olive trees, feeding on the tender sprouts and blossoms, and thus not only destroy the present crop, but even the one of the succeeding year. The Cantharides are very common in continental Italy, but not so numerous, while here in Sicily they cause heavy damage. These agriculturists, however, perform an efficacious method as the only one to destroy the terrible Coleottero. It consists in shaking the branches early in the morning, and precisely when they are asleep, to make them fall on sheets expressly placed under the trees. Thus gathered, they are then sold to apothecaries for making blistering plasters.

La Psylla dell' Olivo (*Psylla olivina*) as well as *l'Afide* (*Aphis adonis*) form a sort of a white down under the armpits of the branches and leaves. The *Aphis abide* under the same, feeding on the humor of the trees, which become sickly, and sometimes die, if the infected branches are not cut off at once. The said aphis—well known in the United States, for I remember my boys used to catch them on trees on Canal Street at New Orleans—is also another dangerous insect to the precious plant. The same is destroyed with lye or lime. The Psylla, when in the state of larva, encircles itself in a sticky whitish matter, and causes the plant to droop.

This disease is generally called here *Malattia del cottone* (cotton disease), and the most energetic remedy is to treat the plant by cutting off all the infected branches.

Finally, the *Caszo perdilegno* (*Coccus legniperda*) is the more terrible insect, damaging the wood. The Coccus, when in a grub state, is bloodish red on top, and white-yellowish under. The butterfly deposits an egg in the bark, wherefrom grows a grub, which bores into the tree—into the heart of the tree—killing it at once; if the tree is young, the Coccus is assisted in its work of destruction by a special liquor of a strong odor, secreted by the insect itself, which softens the wood fiber. This terrible insect is difficult to be destroyed. It lives three years in a state of larva, and the butterfly is found in the spring and summer; consequently at such a time it is necessary to use a certain activity to destroy it. The naturalist, Professor Boisduval, advised the municipal authorities of the infected places to "offer one lire of reward for every Coccus caught, as a good remedy to destroy the same."

Diseases.—Besides the said insects there are also diseases to which the olive plant is subject, such as: (1) *Il Chiodo o Rogna* (the nail or scab), the cause of which is by some growers attributed to insect punctures, and by others to the imperfect assimilation of the juices, which, instead of alimenting the plant, accumulate at certain points, producing deformed excrescences.

Il Chiodo (nail) generally dilates in olive groves propagated by *ovoli* (springs), and greatly prevails where the forced method of propagation has been practiced. The extravasation may be caused by wounds produced by hail, or by the bark cracking while the plants are in active vegetation, or by the ill treatment to the bark while gathering the crop. The cause most common, however, is excessive pruning.

(2) There is *La Fungositá vascolare* (vascular fungus).

(3) *La Lupa* (she wolf), which is a very cancer to the plant, which, although its exterior is sound, it is rotten within, permitting the rain to enter and lodge in the interior.

The lupa may be apparent or not. It is necessary to extract it and thoroughly cleanse the infected part with a sponge saturated with a soap wash.

(4) *Lo Screpolo* (gap) is caused by excessive heat or cold. The gaps caused by the former are superficials, and are also cured with the same wash.

Among the parasitic plants hurtful to the olives are noted the Muschi (musks), the Licheni (lichen), and the Borracina, which establish themselves in the bark of trees, on which they live in part.

The production of musks and lichens is due to the dampness abounding in some olive groves, or on account of the quality of the soil, or little ventilation. To free the plants, therefore, from it, it is necessary to scrape them with a well sharpened spatula, and brush the infected part with whitewash on a winter day, but not cold or rainy.

Besides those there is also *Il Mal nero* (black disease), which is produced by fungus, botanically known as *Antennaria olæophila, Cladosporium fumago*, which sometimes causes the plant to sicken and die. Its multiplication is due to presence of the *Cocciniglia;* hence, by destroying the Coccus you free the plant from the black disease.

Frost and strong winds are also enemies to the plant, and the damage which the former causes may be known only in the month of April or May, just at the time when it can be partly remedied. Sometimes it happens that through intense cold the plant dies at the base. In that case, if it is over thirty years old, the plant must be cut off near the ground so that new springs will grow therefrom, some of which will take the place of the dead plant. A long draught is also hurtful to the olive culture, for the reason that the plant loses its leaves, its vegetation is checked, and it yields no fruit.

Strong winds may also ruin the plants by breaking the branches or dislocating them. Finally, were I to mention other insects, diseases, etc., it might have a depressing effect on the California growers. Consequently, I deem it proper to remind them that notwithstanding all the said insects, contrarieties, etc., in this island of Sicily, in an area of one hundred and four thousand five hundred and eighty-five hectares of olive cultivated land, it yields an annual production of seven hundred and thirty thousand two hundred and thirty-eight hectoliters of oil, at the rate of seven hectoliters per hectare, a good paying industry, besides many quintals of pickled and dried olives for home consumption and for foreign markets.

Therefore, I exhort the California agriculturists to go to work and dedicate themselves earnestly to the culture of that most precious plant, the olive tree, by repeating to them the celebrated Columella's motto, "*Olea prima omnium arborum est.*"

VINCENT LAMANTIA,
Consul, Catania.

CONTINENT OF EUROPE.

FRANCE.

REPORT BY CONSUL TRAIL, OF MARSEILLES.

The Olive Tree in the South of France.

The olive tree (*Olea Europea*) is common to the whole of the south of France, and when nearing the south by rail the traveler can at once detect its familiar green color and its regular shape. For miles it can be seen on either side, sometimes in an uncared for, almost wild state, and sometimes in well cared for, well cultivated, regular plantations. It grows in almost any soil, in rocky or stony ground, and even without

attention produces fruit that is a small, though uncertain source of income to the poor peasant, but when well cultivated and attended to becomes a certain revenue to any farmer who takes the necessary care and trouble.

The olive tree is essentially the tree of warm climates (it is said to originate from Egypt), but not of tropical heat, therefore the Mediterranean district suits it admirably. It succeeds well in places where the mean temperature of the year is from 59 degrees to 61 degrees Fahrenheit. It does not support heat above 104 degrees, nor cold below about 15 degrees. Frost below the latter freezes and kills all the branches, and one is obliged to cut the whole tree down to the ground and wait till it has grown again. It is the greatest calamity that can befall an olive tree, for it takes about ten years to regain its former position, and even then it is often far from being as good. In 1820, almost all the olive trees in this consular district were killed by frost, which was ruin to thousands, oil being then twice the value of to-day.

The olive tree is also essentially the tree of dry, stony, hilly, and undulating ground. Some of the hills and mountains along the coast are covered with olive trees, and inland plains are so planted with them; but the fact must be mentioned, too, that in some districts, notably around Toulon and Hyéres, olives are being rooted out of the plains and vines planted in their place. Calcareous ground is favorable to olives for fine oil; sandstone, schist, and granite soils are less favorable. When the soil is rich the tree itself prospers and grows to a great size, but the fruit is less abundant and inferior.

The best is a mixed, fairly dry, red or calcareous soil, with exposure to the south. The ground must not be too dry nor too moist. Of the two evils, a too dry soil is to be avoided most. Drought is unfavorable to olive trees, as the olives dry and fall off before they have attained maturity; but a good rainy winter or spring suffices to give enough moisture for the following summer. After a very rainy winter season an olive tree will stand excessive heat much better than after a dry one.

Now, olive trees uncared for and left to themselves produce, under favorable circumstances, a light crop about every two years, sometimes oftener even, and sometimes, under favorable circumstances, less frequent; but cultivated and well cared for it becomes an interesting, important, and highly profitable branch of agriculture; one can count upon fairly regular annual crops, and the result is generally satisfactory. The importance of olive growing in countries that suit cannot be over estimated.

In the south of France, and all around the Mediterranean, the olive plays a part in domestic economy of which little is known in other countries. It can be seen on the rich man's table as a relish, or its product, in the form of salad oil or frying oil, is used daily in his kitchen; and a handful of plain olives form at certain times the daily meal of many a poor peasant and farm laborer. In countries and districts where butter is scarce and dear, olive oil, in some form or other, is used in almost every dish that comes upon the table, and a fact that is not generally known is that, in the south of France, olive oil is even preferred to butter for frying purposes.

Varieties.

There are many varieties of olive trees, and many that have simply changed through change of climate, soil, or care, but the chief ones cultivated in this district are these:

(1) The Brown olive tree, a slow growing, hardy tree (especially against cold), that gives few crops, but usually abundant ones. The olives are of a darkish hue, fairly good for pickling, but less good for oil. This variety used to be grown very much, but is less cultivated now.

(2) The Cayon, or white olive tree, a quick growing, small tree, with low branches, is sensitive to cold, but grows again quickly after a frost. It produces olives in its third or fourth year already, and gives a crop pretty regularly every two years. Its olives are reddish, and produce good oil that retains the taste of the olive, a fact that is appreciated in these districts. It is largely cultivated around Marseilles and Toulon.

(3) The Pendoulier, or high growing olive tree, a good sized tree, with large branches that frequently hang down. It produces a good crop rather late in the season, pretty regularly every two years. Its olives are of a dark hue, and produce very fine, tasteless oil, that is much appreciated for export, and which is almost exclusively used in the perfumery trade. This variety is largely cultivated in the Grasse and Nice districts.

The two latter kinds are excellent varieties for profit, and are recommended for general purposes. In many respects the Cayon is preferable, chiefly because, being a lower and smaller tree, it requires less room and is easier to attend to. Its height is usually from twelve to sixteen feet. They can be planted at a distance of, say, fifteen or sixteen feet apart each way; thus, from one hundred and fifty to one hundred and sixty would go on an acre. The Pendoulier, being a much larger tree, requires about thirty feet square to itself in order to fully develop; thus, about forty would go on an acre.

Cultivation.

The cultivation of the olive tree is very simple, and it is this that makes it pay. The chief points are digging, fertilizing, pruning. The ground ought to be well dug up around the tree to at least six feet from the stem, and if possible, kept loose throughout the rainy season. A good plan is to dig a trench around the tree, and on sloping ground, to connect these trenches one to the other by ditches, all to be closed up when the wet season is over. No irrigation is then necessary. Artificial watering would only be called for in spring if the whole winter had passed without any rain at all—a circumstance that rarely, if ever, happens.

Fertilizing.

Fertilizing ought to be done at the same time as digging, that is, during winter and spring. In places and farms where stable manure is obtainable at a reasonable price, it can be used to considerable advantage; in towns, and in the proximity of oil mills, the refuse of these mills is a good fertilizer, and the dirty water that comes from the mills can be used, mixed or diluted with pure water. Powdered oil cake is an excellent stimulant, and ought to be well mixed with the earth. Finally, the dead leaves that fall off from the olive tree itself, and the small branches cut off when pruning, well dug into the ground, are

largely used as fertilizers, and are by no means to be despised. Strong fertilizers must not be used too frequently.

Pruning.

The question of pruning is one that requires study, as it depends a great deal upon circumstances. An olive tree usually gives a crop every second year, therefore it ought to be pruned every second year, and then, of course, shortly after the gathering of the crop, say during January and February. But as cultivation in many cases makes the tree produce a crop every year, it is right in this case to prune the tree slightly every year. When the trees are pruned every year, it must be done carefully and lightly; in fact it must only consist of a slight thinning out. The chief thing to be borne in mind when pruning is, that those twigs that have blossomed and produced fruit once, never do again; therefore, that pruning must consist in cutting away useless twigs and branches to give light and air and make room for fresh and fruitful twigs and shoots.

Pruning depends in a great measure, too, on the position and exposure of the trees. Olive trees exposed to high winds ought to be kept low and rather compact, but those in favorable positions, on sheltered hillsides, for instance, can be allowed to grow larger. Thus it will be found that olive trees along the shores of the Rhone, and, indeed, in all the Rhone Valley exposed to the pernicious "mistral," are little more than bushes, and are kept as such; whereas, toward Toulon and further on, also in Tunis and other parts, the olive tree grows to a great height and size and is pruned accordingly.

Picking and Curing.

The blossoming of the olive tree takes place in April and May, and if the rains have been favorable and no frost occurs the crop may be considered sure.

The gathering of green olives, for pickling, is done from about the twentieth of September to about the tenth of October, and must be done by hand. The date of gathering depends, of course, upon the stage of the fruit, as it ought to be done just when the olive has reached its full size, and before it begins to turn black. Green olives cannot be eaten as they come off the tree, because they are too bitter, but are pickled by the very simple process of soaking them in brine or very salt water. Sometimes ashes are used as well as salt. As soon as they have almost lost their bitter taste they must be taken out of the brine and put into clear water, if possible running water, and washed.* They are then ready to be packed in kegs, barrels, bottles, or jars, but with a little salt water, or water highly seasoned or aromatized, and are fit for export, for storing, or for immediate use.

Black olives for pickling are gathered, as their name indicates, when they are black, say during November. The pickling process of these is left to Nature, *i. e.*, they can be simply spread out on wicker-work hur-

* The usual way in which green olives are pickled in this district is as follows: They are soaked in a solution of potash and water (one pound to one and one half pounds of potash to a gallon of water) for about two hours, then put into clean water, which is changed once or twice a day until the water remains clear. After this the olives are ready to pack in salt water for keeping.

dles or basket-boards, exposed to the sun and wind till their natural water has evaporated, and with it their bitter taste. They can then be eaten in their natural state, but are more palatable well seasoned with salt, pepper, and oil.

The gathering of olives for the manufacture of oil must take place when they are black and quite ripe; generally from the end of November to the end of January. They can even be left to fall to the ground and then gathered up, but as they do not all fall off together, it often takes a long time to gather in the complete crop. Care must be taken not to let them rot on the ground, as such olives would spoil the oil for table purposes. A good plan is to wait till the first good fall has taken place, and then to set about gathering in the whole crop, either by shaking or picking off all the rest. Care and attention must be exercised when gathering in the crop for oil-pressing in not picking them before they are perfectly ripe, and also in not breaking off the young branches that will produce fruit the next year. In positions favorable to the ripening of the olives, that is, where the olives on any one tree ripen almost simultaneously, the trouble of gathering in the crop is rendered easier by stretching out coarse sheets or cloths under the trees, and simply shaking or pulling the fruit off the branches into them.

Now, in order to obtain olive oil of superior quality, there are several primary conditions to be observed. Care should be taken in selecting only sound olives, and picking out all bad ones and foreign substances, such as stones, dirt, leaves, or anything that may have been gathered along with the olives. For superfine oils, it is therefore advisable to press olives that have been gathered by hand only, or, at least, shaken into cloths.

Once gathered, the olives should be looked over, selected and separated, and taken to the mills with as little delay as possible. They should not be left in heaps or in baskets for any length of time, as they are liable to ferment, which is detrimental to the obtaining of really fine oil. In some old-fashioned places peasants pretend that this fermentation facilitates the pressing out of the oil, and even increases the quantity; but this idea is not to be recommended, as the slight gain, if gain there be, in quantity is more than counterbalanced by the difference in quality.*

Cleanliness in the mills is a great point. It is essential that all presses, millstones, casings, recipients, be perfectly clean, so that no bad taste nor color can possibly be given to the oil during the process of manufacture.

The simplest and the primitive way of manufacturing oil consists solely in placing the olives in a mill in which one or two millstones are revolved either by hand, by oxen, or by horses, until all the oil is crushed out. But this altogether primitive and imperfect mode can only be seen now in country places, at great distances from cities and villages, in Algeria, Tunis, and in some parts of France. It has long since been supplemented and superseded by other more perfect and complete processes.

It is, however, seldom that a farmer or olive grower presses his own olives. In centers and districts of olive cultivation there are generally one or more oil mills to be found. Proprietors of oil mills can be

* This custom of allowing the olives to ferment before putting them into the oil presses is still observed in many parts of Spain, and for this reason Spanish olive oil is generally of an unpleasantly strong taste.

divided into two classes, viz.: those that are simply oil crushers, who crush the olives and make the oil for the cultivator who brings his crop to them; and these are paid in kind, *i. e.*, they are not paid in money, but by agreement retain a certain percentage of the olives brought to them. This system often gives rise to certain abuses that are difficult to suppress, and the poor peasant frequently finds that he has been very far out in his calculation of the quantity of oil that his crop ought to have produced. The other class of oil mill proprietors is composed of those that may be called merchant crushers. These buy olives in large quantities from the growers and dealers, manufacture the oil, and sell it themselves. There are several large manufacturers in the city of Marseilles who possess mills in several different centers of olive cultivation in this district, and in Algeria and Tunis. These firms have very naturally acquired a certain reputation for their several marks, and many can command higher prices in the market on the strength of their reputation. Each manufacturer professes to have a special method of his own, but the basis is the same for everybody. The only difference that can exist is in the way of filtering and refining or clarifying the oil before it is finally casked or bottled.

Olive Oil Manufacture.

The process of manufacture is as follows: The olives ready to be pressed are first put into a mill, similar to those formerly used for the whole operation, but the olives are only half crushed, and no oil is crushed out, so that they form a shapeless mass. This mass is then distributed into round flexible kinds of baskets (French name, *Scourtins*) made of sparto grass and horse hair, something in the shape of short sacks with mouths only half closed, containing about fifteen pounds of the crushed olive mass. From ten to twelve of these bags are then placed, one above the other, in a pile under the regular oil press, and in such a way that the base of one bag rests on the open mouth of the one below. The mouth of the bag being smaller than the circumference of the bag, the mere fact of placing one above the other closes them. At the base of the press there is a ledge with an opening on one side, below which the recipient for the oil is placed. When all is in its place, the press is set in motion, in small mills by hand, in large ones by steam, and the oil gradually oozes out from all sides of the baskets and flows into the vessel below.

The oil that flows from this first pressing is the best, and is called virgin oil (*Huile vierge*).

When no more oil flows through the baskets, the press is reversed and the crushed and hard mass of olives is taken out. This hard and apparently dry mass still contains a good quantity of oil, of good, ordinary quality for kitchen purposes, and in order to obtain it, the mass must be broken up and mixed with boiling water. The warm mass or pulp is then placed a second time in the baskets, and the whole is pressed in the same way as the first lot, only, during the operation of pressing, boiling water is frequently thrown over it. The oil and water that flow from this pressing are received and left to stand in large stone vessels or metal tanks, and the oil that gradually mounts to the surface is the second quality of oil.

Now, the mass that is found in the baskets after the second press is either stored to dry and sold as oil cake, or is sold to special mills that extract a third quality of oil by means of acids and other agents. But this quality cannot be used for table purposes; it is, however, very good for the manufacture of soap, and is largely used in this and other industries.

The oil that comes from the first and second presses is not generally sold in its primitive state, but is refined and filtered, and it is in this process that some manufacturers excel above others. The principle of refining and filtering consists in letting the oil remain for a few weeks in tanks or immense jars, during which period a sediment gradually deposits itself at the bottom, and then passing the oil, minus the deposit, through filtering papers specially prepared and sold for the purpose. Some manufacturers even pass their superfine oil through specially prepared cotton-wool, which is certainly an expensive process.

After being filtered, the oil is ready to be casked or bottled for consumption.

Adulteration.

In many places adulteration is carried on to a great extent, and refined cotton oil is largely used to mix with olive oil. Cotton oil being from 20 to 30 per cent cheaper, and being tasteless, lends itself very advantageously to the adulteration of olive oil. It is an open secret, too, that vast quantities of pure cotton oil are shipped and sold as olive oil to those markets that prefer tasteless oil. Cotton oil is, however, used under its own name by many people who prefer a tasteless oil for frying purposes.

Résumé.

From the foregoing, it will be readily understood that olive growing and oil pressing are two distinct professions, and that they are better if kept separate. This explains the existence of professional oil crushers, who do nothing but press oil for the growers; otherwise, unless a grower had a large amount of capital at his disposal wherewith to work a mill and pay the necessary staff, he would never be able to attend to the digging, fertilizing, and pruning of his olive trees with due care, as this ought to be done just at the same time of the year as the all important first-oil pressing.

The olive grower, if he attends to his task properly, has plenty of work to do, and the more he does the better he is repaid. As already mentioned, an olive tree left to itself will produce fruit, but one well cultivated will repay its owner tenfold. Though it does not pay to be too lavish in expenditure, yet an outlay of about $50 per acre per year is considered a sound investment in these regions. Considerably less is spent by many a grower, but if one has the courage to lay out about the sum mentioned, one can generally depend upon being well repaid.

A full grown Pendoulier, well fertilized and cared for, will produce about thirty gallons of olives in a crop; very large and fruitful trees have been known to produce up to one hundred gallons even. A full grown Cayon, under the same circumstances, will produce from seven to eight gallons in a crop, and there are many that can produce twenty gallons.

The value of olives varies according to crop and quality, but, roughly speaking, about $1 per gallon is the average price.

The out-turn of oil varies according to the quality and condition of

the olives, but the average yield is 14 per cent by the two pressings, plus 10 per cent by acids, say a total rough average of 24 per cent.

The olive tree, well cared for, is almost always free from disease and parasites, but it is well to be on the look out for any possible enemies. The branches are sometimes covered with a kind of yellow moss, produced in some instances by too much dampness or moisture, and in others by weakness of the tree. In the first case the ground must be immediately drained, and in the second it must be manured. In both cases it is well to cut off the branches so covered. Sometimes there is no remedy, and the trees must be rooted out, and the ground used for other purposes.

Sometimes a sort of cochineal, the Coccus, attacks olive trees, and in this case a hard brush, dipped in vinegar, is the best remedy.

The *Tinea oleæ* occasionally attacks the leaves, and the *Hylerinus oleæ* occasionally kills the buds, but these are not serious foes. Of all insects that is most to be feared is a fly that deposits its eggs in the wood of the olive; it is the *Dacus oleæ*. The larvæ of this fly eat away and destroy whole branches, and it is extremely difficult to exterminate them. The best way to destroy them is to scrape the branches and apply boiling water or a solution of lime, but even these are not always effectual. Nature, however, sometimes helps herself, and not unfrequently another insect, the Cynips, deposits an egg in the hole bored by the Dacus, and the larva of the Cynips kills and feeds on that of the Dacus, thus saving the tree.

The olive is a tree that attains a great age, and that with care is said never to die. It can, however, be reproduced by cuttings and by seedlings that must be grafted the second year.

CHARLES B. TRAIL,
Consul, Marseilles.

WINTER PROTECTION FOR THE VEDALIA CARDINALIS (AUSTRALIAN LADYBIRD).

The Executive Board at its meeting, August 14, 1890, resolved unanimously to at once erect two glass houses covering large orange trees where the destructive cottony cushion scale (*Icerya purchasi*) can be thickly colonized, and at the approach of inclement weather place a few of the *Vedalia cardinalis* in one of the houses, reserving the other for later use, should the first become overstocked. In this manner the Board hopes to preserve this wonderful insect to the fruit growers of California.

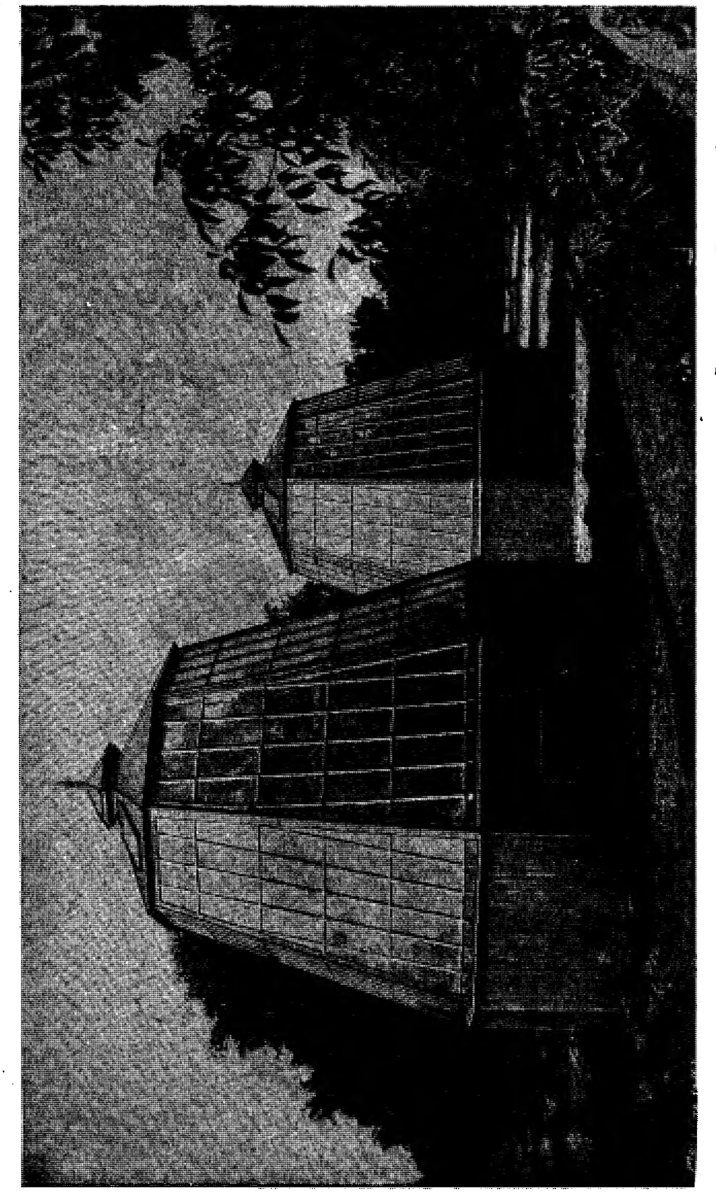
This course was prompted by the experience of last winter. In the spring it was almost impossible to find a living specimen; but the cottony cushion scale reappeared in a number of groves where it was supposed to have been exterminated, having passed through the winter under the ground at the collar of the tree, under a weed, or in some other way secure from the attacks of the Vedalia. At the approach of warm and congenial weather the scales hatched and developed with such rapidity, that it created considerable alarm among orchardists.

The experience of the past few years was too fresh to again allow the scale to become established. In consequence of their reappearance the Board was in almost daily receipt of letters making application for a colony of the ladybirds. Fortunately, several colonies were placed on trees (in 1889) late in the fall in warm localities, where they passed the winter. The Icerya is now very scarce, and the possibility of the Vedalia passing through the winter months is now reduced to a minimum. The Board has had erected at San Gabriel, Los Angeles County, two glass houses, a good idea of which can be had by reference to the accompanying photo-engraving plate. They are octagonal, and so designed that they present a good surface to the sun, and thereby warmer and more suitable for propagation of both scales and ladybirds.

The dimensions are each sixteen feet in diameter by eighteen feet in elevation; every part is well fitted, and the ventilation protected by very fine brass wire mesh, to guard against the entry of any ladybirds before the cold weather sets in, otherwise the scales would be destroyed by them early in the season; and also to prevent the ladybirds from escaping during the time they are being colonized for distribution in the spring.

Many are of the belief that this most important foe to the baneful Icerya "has come to stay," but there are no facts upon which to base such an opinion, beyond the fortunate results of the past winter, when they passed through it unprotected. There is too much at stake, and the risk of them dying out too great to allow this to be again repeated. It is to prevent all possibilities of a failure that these precautions have been taken.

WINTER PROTECTION FOR THE VEDALIA CARDINALIS.



GLASS HOUSES, COVERING LARGE TREES, BUILT AT SAN GABRIEL FOR THE COLONIZATION OF PARASITES AND PREDACEOUS INSECTS.

IMPROVED FUMIGATING APPARATUS.

In our previous reports are to be seen the various appliances then used for the destruction of scale insects (principally the red scale upon citrus trees), by the use of hydrocyanic acid gas. Since then many new inventions have been put into operation, and have served the purpose well to some extent, but on the main, they mostly consist of the general ideas embraced in the various apparatuses as illustrated.*

In the past year, however, more improvements have been made, no doubt due to working with the first built, which were, in many respects, cumbersome. The most approved apparatus now in use throughout Orange County is the one herewith illustrated. The description given, brief as it is, well serves the purpose. There is no patent upon it, and it can therefore be constructed by any one who may choose to do so. The plans are correct, and are appended in a form that will require no drawings or plans for their construction.

FORMULA FOR GENERATING HYDROCYANIC ACID GAS.

The method that has given the most satisfactory results is the following:†

It consists in using one part, by weight, of dry or undissolved potassium cyanide, with one part sulphuric acid, and two parts water. The generator is made of lead, and is somewhat in the form of a common water pail. After the tent is placed over the tree, the necessary quantity of the dry cyanide is placed in the generator, the proper quantity of cold water added, and the generator placed under the tent, near the trunk of the tree; the acid is then added to the materials in the generator, a barley sack thrown over the top of the latter, after which the operator withdraws, and a quantity of earth is thrown upon the lower edge of the tent where it rests upon the ground, to prevent the escape of the gas. After the expiration of fifteen minutes the tent is removed and placed upon another tree.

The following table will aid in determining the proper quantity of each ingredient in treating orange and lemon trees:

Height of Tree—Feet.	Diameter of Tree—Feet.	Cyanide of Potassium—Ounces.	Water—Fluid Ounces.	Sulphuric Acid—Fluid Ounces.
10	8	2¼	4½	2¼
12	10	4½	9	4½
12	14	8¾	17½	8¾
14	10	5½	11	5½
14	12	7½	15	7½
16	14	12	24	12
18	14	15	30	15

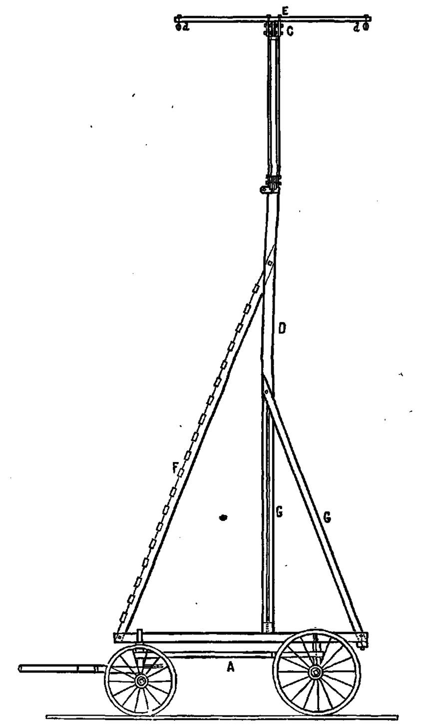
It will be noticed that the proportions are one ounce, by weight, of the cyanide to one fluid ounce of the acid and two fluid ounces of water, or in the proportion of cyanide *one*, acid *one*, water *two*.‡ This being borne in mind, it will be easy to ascertain how much acid and water to use when once the proper quantity of cyanide required for treating any given tree has been ascertained.

*Biennial reports, 1885-6, 1888.

†Prof. D. W. Coquillett, "Insect Life," Vol. II, Nos. 7-8, 1889.

‡ In the report made by Alexander Craw, found in this volume, he gives the following as the proportions: Two and one quarter ounces cyanide of potassium (by weight); two

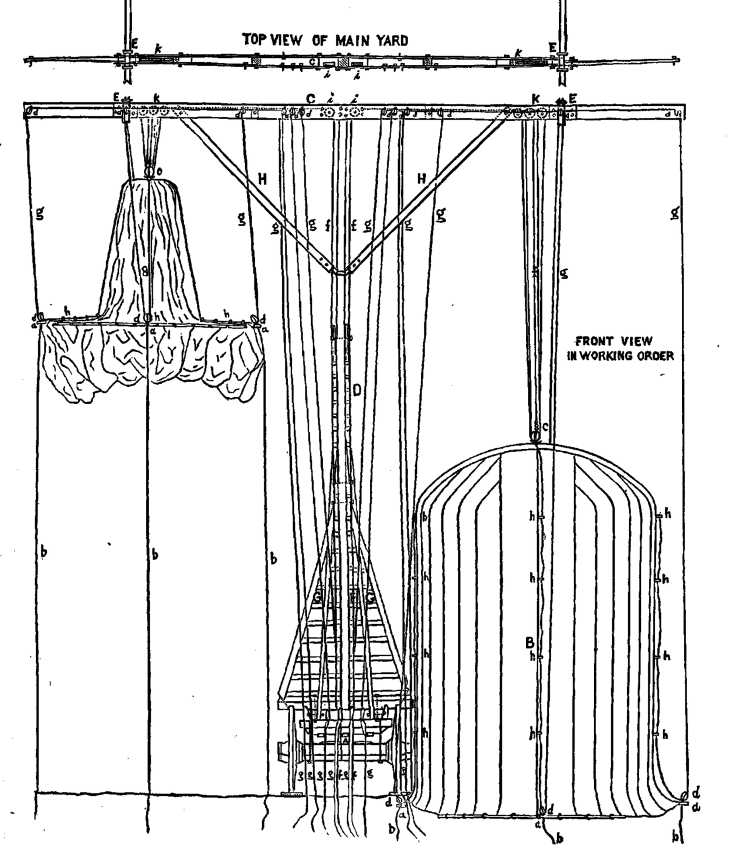
IMPROVED FUMIGATING APPARATUS.



SIDE VIEW OF FRAME.

DESCRIPTION.—*A.* Wagon. *B.* Tents (2). *C.* Main yard. *D.* Mast. *E.* Crossbars (2). *F.* Ladder. *G.* Mast stays (6). *H.* Main yard truss (2). *a.* Trail boards (8), to bottom edge of tents. *b.* Guide lines (8), one half inch diameter to trail boards, thirty feet each. *c.* Six-inch blocks (2), double sheave, for hoisting tents. *d.* Four-inch blocks (20), single sheave, for hoisting trail boards. *e.* Belaying pins (4), galvanized iron, to fasten ropes. *f.* Main ropes (2), three quarter inch diameter, for hoisting tents, one hundred and ninety feet each. *g.* Trail ropes (8), for hoisting sides of tents, one half inch diameter, one hundred and twenty feet each. *h.* Rope thimbles (32), one half inch diameter, galvanized iron, for trail ropes of tents. *i.* Six-inch sheaves (2), brass, in main yard, for hoisting tents. *k.* Five-inch sheaves (6), brass, in main yard, for hoisting tents.

IMPROVED FUMIGATING APPARATUS.



Scale: One quarter inch to the foot.

FRONT VIEW IN WORKING ORDER.

NOTE.—These drawings represent the apparatus built by S. W. Preble, Esq., of Tustin City, Orange County, Cal., and is used in his orange grove. The measurements were taken on the spot by J. A. Shilling. The apparatus, attended by two men, worked most perfect in all its parts.

By using the cyanide dry we are saved the trouble of first dissolving it; the dry cyanide is also easier to transport and safer to handle than the solution is, and if the vessel containing it should be accidentally overturned on the ground, the dry cyanide will not be lost, as it certainly would if dissolved. By thus using the cyanide dry it is not necessary to first pass the gas through sulphuric acid in order to render it harmless to the trees, thereby saving a great deal of labor, and admitting of the use of a much simpler and less expensive generator. By placing the latter beneath the tent there is less liability of the gas escaping while being generated and introduced into the tent from without, thereby also insuring the operator greater immunity from inhaling the gas. I also found that by thus placing the generator under the tent, the blower heretofore used for distributing the gas inside of the tent could be done away with, thereby still further reducing the original cost of a fumigating outfit, besides doing away with the labor necessary in operating the blower. The time during which it is necessary to confine the tree in the gas has also been reduced one half, as compared with that heretofore allowed for destroying the fluted scale (*Icerya purchasi*, Maskell), thereby rendering it possible to treat twice the number of trees in a given time that could be treated in the same time by the old process. I found by experiment that about five minutes were consumed each time in generating the gas. The treatment with hydrocyanic acid gas is the only method known to me whereby the scale insects located upon the fruit can be destroyed by a single operation. My own experience, and that of every other person with whom I have conversed upon this subject, and who has had any considerable experience in the matter, indicates that no liquid preparation at present known will, by a single application, prove fatal to more than 90 per cent of the number of red scales located upon the fruit; and when it is remembered that the Supervisors of many counties in this State have passed laws making it a misdemeanor to sell or expose for sale fruit infested with scale insects, the value of the gas treatment to our fruit growers is made apparent.

The following is an account of the experiments I made with hydrocyanic acid gas as referred to above: The trees operated on were all of them lemon trees containing fruit, and were in a comparatively healthy condition, although very thickly infested with the red scale. Before making these tests, I had the experimental tent painted black, and am strongly of the opinion that when a tent of this color is used the foliage of the trees will be injured less when by inadvertence, an overdose of the materials has been used, than would be the case if a light colored tent were to be used; the light rays, more than the rays of heat, serve to decompose the gas, and, on this account, any medium that will intercept the rays of light will, in a great measure, prevent the decomposing of the gas. In all cases where a blower was used for distributing the gas inside of the tent, the gas entered the blower direct from the generator and was forced into the lower part of the tent through a tin pipe, and the pipe which conducted the air and gas from the tent to the blower, also entered the lower part of the tent and then turned upward, terminating near the top of the tent. By this means the gas and air in the upper part of the tent were drawn out, and, after passing through the blower, again entered the lower part of the tent. This was for the purpose of more thoroughly circulating the gas inside of the tent; but, as will be seen by the later experiments, this arrangement was found to be entirely unnecessary when the generator was placed under the tent. In nearly all of the later experiments too large a quantity of the materials was used, resulting in more or less injury to the tree or fruit, the injury being always the most severe on the topmost portion of the tree. The cyanide solution used in a few of these experiments consisted of five pounds of cyanide dissolved in one gallon of water, each fluid ounce of the solution containing an ounce by weight of the cyanide. The diluted sulphuric acid was composed of two fluid parts of the acid and three of water, and was allowed to become cold before being used.

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and one quarter ounces sulphuric acid (fluid ounces); water, three fluid ounces. Professor Coquillett, in a very recent communication, says:

"In using the materials for fumigating, it is best to add the water first, then the acid, and last the cyanide. The acid is heavier than the water, and when added to the latter becomes thoroughly mixed as it sinks into it.

"Two and one quarter ounces of cyanide require two and one quarter fluid ounces of acid, and four and one half fluid ounces of water, instead of *three* ounces of water, as you have it. This will be sufficient for a tree ten feet high and the top eight feet in diameter."

ACKNOWLEDGMENTS.

Our thanks are especially due to Captain J. D. Young, Superintendent of State Printing, through whose aid we have been able to issue our numerous reports, etc., without delay, and upon a much improved style and arrangement over those previously issued. Our thanks are also due to Hon. Ira G. Hoitt, Superintendent of Public Instruction, to Prof. D. W. Coquillett, of Los Angeles, to Mrs. Leonard Coates, of Napa, to Prof. E. A. Weed, Entomologist Ohio Experiment Station, to Hon. W. W. Morrow, and to Messrs. S. Rae & Co., of Boston, for very kind assistance received at their hands. We also desire to extend warm and sincere thanks to all through whose generous aid our many investigations have been brought to a successful termination.

Very respectfully submitted.

B. M. LELONG,
Secretary.

APPENDIX A.

REPORTS OF THE COUNTY BOARDS OF HORTICULTURAL COMMISSIONERS.

REPORTS OF THE COUNTY BOARDS OF HORTICULTURAL COMMISSIONERS.

REPORT OF THE LOS ANGELES COUNTY BOARD.

The horticultural interests of Los Angeles County have made rapid strides during the past year, and at this date are prosperous and encouraging far beyond anything in the county's history.

The area planted to citrus trees in this time has more than doubled the amount in existence at last report. The short crop of deciduous fruits in the Eastern States has opened up such an active and paying market for our products that it is a great incentive for their future culture, and will result in the planting of an immense acreage the coming season.

Through the personal efforts of this Commission, assisted by the Inspectors, we are able to give an almost accurate census of the fruit trees in the county, with a result far more satisfactory than ever before attained. They are classified as follows:

Orange seedlings, ten years and over	259,038
Orange seedlings, under ten and over five years	24,378
Orange seedlings, five years and under	20,261
Orange budded, ten years and over	68,611
Orange budded, under ten and over five years	123,689
Orange budded, five years and under	491,115
Seedling orange in nursery	1,642,315
Budded orange in nursery	788,409
Orange trees growing in seed bed	4,446,600
Lemon trees bearing	37,106
Lemon trees not bearing	29,524
Olive trees	170,654
Olive trees in nursery	336,594
Acreage of deciduous trees	12,629
Deciduous trees in nursery	287,075
Walnut trees	110,626
Walnut trees in nursery	12,900

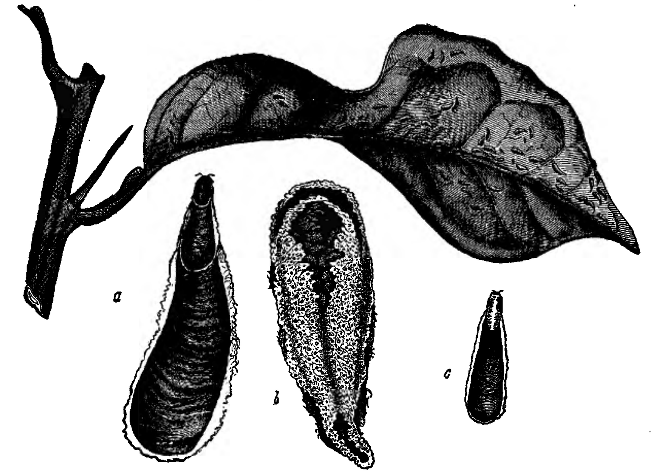
Making a grand total of 22,851,482 trees now in orchard, 3,067,293 in nursery, and 4,446,600 in seed bed.

The Commission has not relinquished its efforts toward eradicating the many insect pests that are ever present with the horticulturist.

As far as the white scale (*Icerya purchasi*) is concerned, the past remarkable work and present existence of the Vedalia in sufficient quantities, gives a feeling of perfect security against any further ravages of a once dreaded pest. The yellow (formerly known as red) scale (*Aspidiotus citrinus*) has, under some influence not yet explainable, decreased in such numbers, and in a few localities entirely disappeared, that up to the fifteenth of August there were bright hopes entertained that it would ultimately vanish before another year. The insect, however, began to show signs of an increase on the date mentioned, and although not in such vast numbers as heretofore, it is still with us. It is interesting to note that the young are not locating on the fruit, only in isolated cases, and scarcely any seem to possess the life and vitality that has been noticeable in former years.

PURPLE SCALE.

Mytilaspis citricola, Packard.



BRANCH INFESTED BY THE SCALES (NATURAL SIZE ON LEAF).

[A purple scale generally found throughout the State of Florida. It resembles *Mytilaspis pomorum* (oyster-shell scale), which is common in many places on old apple trees. In Florida it is a very troublesome pest. (*a*) Scale of female from above. (*b*) Same from below, showing eggs. (*c*) Scale of male. All highly magnified.]

The San José scale (*Aspidiotus perniciosus*) has increased in the past year to an alarming extent, nearly every variety of deciduous tree being attacked by it. With the great interest renewed in fruit culture, aided by public sentiment fast molding, the Commission feels confident that this dread pest will be kept in check.

The same causes will undoubtedly serve to rouse up orchardists to the necessity of a warfare against the codlin moth—an insect that is fast gaining a foothold in nearly every pear and apple orchard in the county. The rejection of such infested fruit by canneries and driers this year, with big prices staring them in the face, will serve as an "object lesson" that even the dullest horticulturist can solve.

The brown soft orange scale (*Lecanium hesperidum*) has appeared in such numbers during and since the spring months, as to cause serious alarm. It appears to affect young trees mostly, literally covering them, giving the whole tree a brown appearance. In past years this insect has not been considered dangerous, appearing in the spring in small numbers, but soon disappearing.

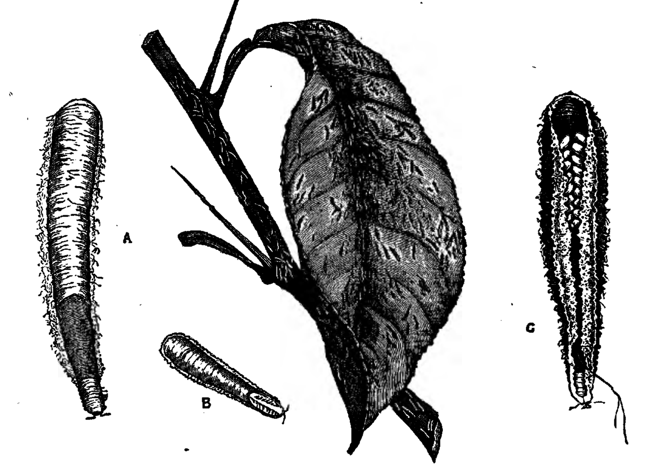
In certain localities great trouble has been experienced this year from the large increase of black scale (*Lecanium oleæ*). The Commission has succeeded in arousing a proper sentiment regarding this pest, and a general warfare is being waged, with most encouraging results.

The brown apricot scale (*Lecanium*—unnamed) appeared in great numbers during the spring months, seeming to prefer prune trees, caus-

ing considerable uneasiness. The warm sun of summer has caused it to almost entirely disappear.

LONG OR GLOVER'S SCALE.

Mytilaspis Gloverii, Packard.



BRANCH INFESTED BY THE SCALES (NATURAL SIZE).

[A light yellow scale varying to dark brown; resembles *Mytilaspis citricola*, but is much larger. (*a*) Enlarged. (*b*) Scale of male, enlarged. (*c*) Female scale and eggs, enlarged.]

The several scales imported on Florida trees demanded much of our attention during the planting season. [We append illustrations of those most liable to be introduced, and in order that they may be more easily identified.—SEC.] The *Mytilaspis Gloverii*, or long scale, and *Mytilaspis citricola*, or purple scale, have been quite generally found together. The *Chaff scale* was also introduced on Florida trees, but in no case has this Commission found this scale propagated in this county. The first two mentioned have been closely watched, but only in one instance found alive on trees planted over one year. In this instance the long and purple scales were both found, the trees having been planted eighteen months, but were undoubtedly imperfectly disinfected before planting.

The Commission has used the utmost vigilance in causing all Florida trees to be disinfected by both dipping and gas treatment. The red scale of Florida (*Aspidiotus ficus*) has been introduced on imported trees, but was without doubt eradicated by the gas treatment which the trees received. This Commission is of the opinion that these four pests introduced from Florida are a serious menace to the citrus industry of the State, and nothing has as yet been adduced to convince us that it is either safe or wise to ignore the danger with which we are threatened. All purchasers of Florida trees should, in justice to the community, as well as to themselves, use every precaution, and aid the Commissioners to the utmost in their efforts to disinfect all imported trees before planting.

This Commission feels greatly encouraged in the results of its efforts to rid orchards of insect pests. In the case of scale that infests citrus trees they recommend first the gas treatment; if that is not applicable, then the spraying with the resin emulsion. For pernicious scale, the wash of lime, sulphur, and salt. All of these remedies have been found effectual when properly applied.

FLORIDA WAX SCALE.

Ceroplastes floridensis, Comstock.

BRANCH INFESTED BY THE SCALES.

[A white scale which appears in and throughout Florida. Has not yet made its appearance in this State, and care should be exercised to prevent its introduction; and in order that parties importing trees or plants may be able to identify it, this description and illustration is given. (*a*) Young female. (*b*) Adult female, enlarged.]

BARNACLE SCALE.

Ceroplastes cirripediformis, Comstock.

[A small barnacle-like scale. The figure represents a branch infested with the scales. (*a*) Female, enlarged.]

In contradiction to our annual report of last year, the seedling orange trees will yield this year nearly a full crop, while the budded orange trees will yield hardly one third of a crop.

The yield of deciduous fruits this year has been immense, while the prices obtained by orchardists for their products have been correspond-

ingly large. The number of deciduous trees that will be planted out the coming fall and winter cannot be estimated, but it will be greater than ever before, provided the supply equals the demand. It will naturally follow that such an increased demand will result in the importation of eastern stock, with accompanying new insect pests and new diseases to be combated by our orchardists.

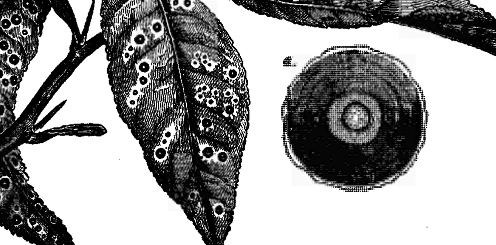
A reference to the English walnut tree census will reveal the fact that a large acreage is already productive, and to this nearly the same number of trees will be added this year.

The large importation of Florida orange stock into the county during the past year, much of which was infested with new insect pests, obliged the Commission to enforce the State law relative to quarantine. It was made effectual in every case, and has certainly proved a protective measure for the fruit growers of the county.

This Commission feels that there is great need of radical change in the present laws relative to horticulture, and that further legislation is necessary to more freely promote the interests of this leading industry of the State.

FLORIDA RED SCALE.

Aspidiotus ficus, Ashmead.

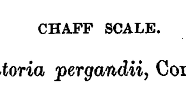


LEAVES INFESTED BY THE SCALES.

[A red scale which infests citrus trees in Florida, settling on the young wood, leaves, and fruit. (*a*) The female scale, enlarged.]

CHAFF SCALE.

Parlatoria pergandii, Comstock.



[(*a*) Scale of female, enlarged. (*b*) Scale of male, enlarged.]

The permanent organization of County Horticultural Commissioners, consisting of the five southern counties of the State, effected in August, will, without doubt, prove of great value to the Commissioners and fruit growers of this county.

Respectfully submitted.

F. EDWARD GRAY,
Secretary.

SEPTEMBER 25, 1890.

REPORT OF THE MENDOCINO COUNTY BOARD.

To the honorable the State Board of Horticulture:

GENTLEMEN: Early in the present year the Board of Supervisors of this county, at the earnest solicitation of many fruit growers, raised the pay of the members of the Board of Horticultural Commissioners from $3 to $5 per day.

Mr. Thomas, of the Second District, did good work during the spring, visiting many orchards and inspecting the same, and inducing owners to take measures for disinfection. The long continued rains made it difficult to examine orchards, and effective work at the proper season impossible.

The principal enemies to fruit found by Mr. Thomas were the San José scale, in and around Ukiah, and the codlin moth found nearly everywhere.

Mr. Purdy, in the Third District, found San José scale near Hopland, in two orchards, and had previously found it in some orchards there, about one fourth being infested. That country is not thickly settled, and the spread of the scale seems slow.

In Anderson Valley he found many peach trees dying; apparently healthy trees, loaded with fruit and in fine condition, suddenly withering and dying. The loss was blamed to a small black beetle which bored into both trunk and leaves, leaving gummy spots on the bark. The same, or a closely allied beetle, has been noticed in prune trees near Ukiah. In this instance, however, the trees have not died, and the boring seems confined to dead wood.

Many trees are being planted throughout southern Mendocino County, pears and prunes leading. In the redwoods a great many apple trees are being planted, and the products show the soil and situation to be admirably adapted to the purpose. Much interest in fruit culture and in protection against insects is shown by growers, and the Commission has everywhere had a welcome and found a willingness to do what is needed.

Respectfully submitted.

CARL PURDY,
Secretary.

UKIAH, August 6, 1890.

REPORT OF THE NEVADA COUNTY BOARD.

To the honorable the State Board of Horticulture:

GENTLEMEN: During the past two years of work performed by this Board we find a gradual decrease of all fruit pests, especially the San José scale, so called. The codlin moth is another enemy to fruit culture, which seems almost impossible to exterminate, the main trouble being that there are many orchards that do not pay the owners to keep clean, as there is no sale for their fruit since the mines have shut down. On this account we have to seek a market outside of our county. This obstacle, we hope, will soon be removed. Where there are better transportation facilities, many new orchards are being planted.

We grow very fine peaches, pears, prunes, grapes, and apples, which always command high prices.

Horticulture is rapidly advancing in every section, and it will only be a short time when we shall stand foremost as a fruit-producing county.

Respectfully submitted.

J. R. VINEYARD,
Secretary.

SEPTEMBER 30, 1890.

REPORT OF THE ORANGE COUNTY BOARD.

To the honorable the State Board of Horticulture:

Orange County is the youngest of the sisterhood, being but little over one year old. It was organized out of the southern part of Los Angeles, and contains a little over seven hundred and fifty square miles.

Its assessed value of property is $9,023,875. Its rate of taxation is $1 65 per $100.

One transcontinental railroad (the Atchison, Topeka, and Santa Fe) passes through it. Another (the Southern Pacific) terminates in it. Its population is thirteen thousand six hundred.

The Pacific Ocean bounds it on the west and the Sierra Madre Mountains on the east.

Two rivers, the Santa Ana and the Santiago, run across it from the mountains to the sea, and furnish water enough to irrigate all lands not irrigable by artesian wells.

The mountains on the east furnish in small quantities, gold, silver, tin, iron, coal, chrome, gypsum, gas, and asphaltum.

Forty miles of coast line furnish two good landings for vessels and steamships—Newport and Anaheim landings.

Its mortgage indebtedness is now $181,032 less than one year ago.

Horticulture is the leading industry of the county. The Assessor's report shows the list of the fruit and nut-bearing trees, as follows:

Quince	2,000	Orange	423,950
Lemon	13,475	Olive	4,500
Apple	96,430	Pear	63,130
Peach	38,480	Fig	7,500
Prune	72,670	Apricot	120,950
Plum	3,640	Nectarine	2,430
Cherry	490	Almond	730
Pecan	120	Walnut	126,640
Chestnut	47		

It will thus be seen that the total number of fruit and nut trees in this county is nine hundred and seventy-seven thousand three hundred and eighty-two, nearly one half of which are orange trees.

The present season is phenomenal for the abundance of all varieties of fruit, and the quality has never been surpassed. It is too early now to give statistics, but we are able to state that some growers have realized as high as $500 per acre for apricots. Peaches and prunes have paid nearly as well. Citrus fruits promise better this year than any former year.

This county has been seriously affected with several varieties of fruit pests. The scales found on citrus trees are: First, red scale (*Aspidiotus aurantii*); second, soft orange scale (*Lecanium hesperidum*); third, black scale (*Lecanium oleæ*). The white cottony cushion scale (*Icerya purchasi*) has not as yet made a lodgment in this county. Nor have any of the Florida scales.

This Board proposes to discourage in every legitimate way the introduction of Florida stock into this county.

The only scale that has seriously affected the citrus industry in this county is the red scale. It has taken us a long time to learn how to treat it, but we think we have two good remedies now—the resin wash and the gas treatment.

Deciduous fruits are badly affected by San José scale (*Aspidiotus perniciosus*), the codlin moth (*Carpocapsa pomonella*), and the woolly aphis (*Schizoneura lanigera*). But little has yet been done for their destruction.

This Board has used all the power given it to quarantine against the introduction of new pests, and has been rewarded with success. During the coming winter we intend to enter a vigorous campaign against deciduous fruit pests. We regard the law as it now stands as too tedious for successful fruit growing.

Scale insects are too swift at destruction for the slow and uncertain forms of law. Police powers given direct to Commissioners is the only way out of the difficulty.

Respectfully submitted.

HIRAM HAMILTON,
President.
S. W. PEEBLE.
F. H. KEITH,
Secretary.

SEPTEMBER 28, 1890.

REPORT OF THE SAN BERNARDINO COUNTY BOARD.

To the honorable the State Board of Horticulture:

GENTLEMEN: Our work the past year has been continued on the lines indicated in our last report. In the field the work of inspection has been vigilantly performed by our staff of twenty-two local Inspectors in the various districts assigned to them. The black scale (*Lecanium oleæ*), the brown scale (*Lecanium hesperidum*), and the San José scale (*Aspidiotus perniciosus*) continue to be the source of our chief trouble. On the Lecaniums we have used the resin compounds most successfully, while on the *Aspidiotus perniciosus* the sulphur, lime, and salt remedy is the only one that has given satisfaction, and the coming season it is our purpose to recommend its use solely, and have very little doubt of being able to eradicate the pest. The fruit growers of this county are fully alive to the necessity of keeping their premises free from insect pests, and when a remedy is once proved to accomplish the beneficial results intended, "eradication" is their watchword. We do not have to contend, in the same degree, with the baneful and pernicious effects of abandoned or unoccupied properties that the Commissioners in some other counties do, but we do feel, in common with them, the need of a law providing a more summary means of dealing with transgressors. In addition to the insects reported in our last report, we have found the brown apricot scale and an unnamed Lecanium, on box elder, which bears a close resemblance to the brown apricot scale. We have also found one case of *Lecanium hesperidum*, on pepper trees. The codlin moth has made rapid strides the past year, owing, we think, to the importation of eastern apples. It has been particularly noticeable on pears. On the other hand, the common species of ladybugs and the lace-winged fly have been very numerous. We very much regret being unable to furnish accurate statistics of the past season's planting; in the aggregate it has largely exceeded any previous year.

Respectfully submitted.

W. E. COLLINS,
Secretary.

SEPTEMBER 29, 1890.

REPORT OF THE SAN JOAQUIN COUNTY BOARD.

To the honorable the State Board of Horticulture:

GENTLEMEN: San Joaquin County is estimated to contain about nine hundred thousand acres of tillable land. Almost every acre of this immense area is suitable for fruit growing in all its varieties. The simple inspection and location of infested orchards in this vast territory is a work of magnitude involving the expenditure of much time and travel in its accomplishment. Only the northern portion of the county, bordering on the Mokelumne River, has received much attention up to this time, but other sections will be visited later in the season, and it is hoped with better results.

The Woodbury and resin washes have been recommended for summer use, while the trees are in full foliage. For fall and winter use the lime, sulphur, and salt preparation (Covell's formula) has given general satisfaction, and is recommended in preference to any other. We have also recommended the Bean automatic spray pump as the best of any seen or used for that purpose.

The young orchards, planted within the past two or three years, were almost universally found in a healthy, thriving condition, free from scale and other insect pests, the trees pruned to low heads, and the land clean and well cultivated, showing care, skill, and good judgment in their treatment, and in marked contrast to the condition of the old orchards, which showed the entire absence of all those important elements of successful culture. The latter were unpruned, the trunks and limbs covered with rough, moss-grown bark, in most instances composed of masses of dead or dying wood, and their unsightly branches almost hidden from sight by loathsome myriads of San José scale, red spiders, and woolly aphis; the foliage distorted by curled leaf, green aphis, and shot-hole fungus; and the fruit showing the presence or ravages of scale, codlin moth, and the above named fungus. These old orchards are a perpetual menace to the prosperity of this great and growing industry, and they should be severely pruned and disinfected, or, better still, destroyed, root and branch, without a moment's hesitation, before they can infect the young orchards in their neighborhood.

In a tour of inspection made through the northwestern part of the city, hardly a place visited, and containing fruit trees, but was found more or less infected. Among the most prevalent were found San José scale (*Aspidiotus perniciosus*), cottony cushion scale (*Icerya purchasi*), black scale (*Lecanium oleæ*), yellow orange scale (*Aspidiotus citrinus*), codlin moth (*Carpocapsa pomonella*), and woolly aphis (*Schizoneura lanigera*). The most dreaded of these, because the most difficult to exterminate, aside from its marvelous fecundity, is the cottony cushion scale, but is very easily destroyed by the *Vedalia cardinalis*.

The pests enumerated above are surely enough to alarm the well-wishers of the horticultural interests of San Joaquin County, and rouse them to action before they are utterly destroyed by neglect.

Reports were received by the Board regarding experiments made in pruning apricots in August and February of each year—same variety, on same soil, standing alongside each other and receiving the same care and cultivation. The results were that those pruned in August blossomed ten days earlier and the fruit ripened two weeks sooner. The late sap that formed wood in February formed more fruit spurs in the August pruning. The crop was larger and the heads of the trees made a more uniform and compact growth.

Some complaint has been made—though not more than was to be expected—because the San Joaquin Commissioners were apparently alone in their efforts to secure a compliance with the law by excluding infected fruit from the local market, while the same found ready sale in San Francisco, and the dealers there defied and disregarded it. The bugs have come to stay, and we shall always have to fight them in future. That will hereafter be one of the conditions of successful fruit culture.

Among other things noted may be mentioned the fact that the persons in charge of the fruit exhibits at the State and District Fairs placed on the tables fruit pitted and spotted with marks, showing the presence of scale and other insect pests. This in itself ought to have barred their entrance, and certainly should deprive them of any chance of competing for premiums in the opinion of competent judges in such matters.

During the early part of the past month the work of the Commission was confined to the inspection of infested places in the city and its immediate vicinity, the determination of species brought to the office, and the distribution of the reports and bulletins of the State Board, of which it has received a liberal supply.

It gives us great pleasure to be enabled to report the successful introduction of the deadly insect foe of the fluted scale (*Icerya purchasi*). Commissioner Robinson went to San Francisco on the twelfth and spent several days in endeavoring to procure the new species of *Coccophagus*, the neuroptic parasite of the yellow orange scale (*Aspidiotus citrinus*) and the *Vedalia cardinalis*, the parasite of the cottony cushion scale, from Secretary Lelong.

The cottony cushion scale had already secured a strong foothold in the gardens of this city, under circumstances fraught with damage and disaster to both fruit and flower. Among economic entomologists this is the most intensely dreaded of all insect pests, not only on account of its filthy habits, disgusting appearance, rapid increase, and deadly effects, but its omnivorous characteristics, no fruit or ornamental tree, shrub, plant, or flower claiming immunity from its ravages. No remedy had been found adequate to the task of its extinction, and the ultimate destruction of every species of plant life subject to its attacks seemed assured before the advent of this important auxiliary. The Vedalia was colonized at two places where the scale was very abundant, and destroyed the scale in a very short time; the city is now entirely free from this pest.

The portion of the county east of the Southern Pacific Railroad and north of the Calaveras River was set apart as a district to be known as the Lockeford Fruit District, and George W. Wise assigned as local Inspector thereof.

Inspector Wise reported that during October he visited many orchards in his district, and gave the owners what information he had, so preparations could be made in due time for exterminating the pests, which were found everywhere.

Insect pests are preserved and propagated by old neglected orchards in various parts of the county, that have thus become breeding places of all manner of injurious insects, infesting new orchards in their immediate vicinity and spreading thence over the whole State, through the various channels of transportation by land and water, threatening the annihilation of the whole fruit industry. To counteract this alarming condition of affairs needs the most strenuous efforts and hearty coöperation of the friends of horticulture everywhere, and a rigid enforcement of the provisions of the amended law by the officers whose duty it is to adopt stringent measures for the extirpation of those insect pests. With a thorough inspection of the orchards throughout the county, and a vigorous and regular supervision of the fruit stands in the city, this can be done, and the objects for which the law was framed accomplished.

The success attained by the system of the daily inspection of fruit stands, wagons, and boats encouraged the County Board of Horticulture, also believing it to be the best and most effective method of securing the result aimed at—the exclusion of infested fruit from the city markets. The Inspector assigned to that duty reported fruit cleaner and freer from insect pests and diseases than ever known during the past ten years, for the whole of which period he has been officially connected with the Commission, thus amply justifying the wisdom of the course pursued.

The demand for California fruit for shipment East, and the very high prices paid this season, will certainly lead to the planting of numerous young orchards in every county of the State, where fruit raising can be made remunerative. The unprecedented continuous rain storms of last winter interfered with all kinds of nursery stock, and left the land in such an unfit condition that nursery stock will be very scarce and high priced, and immense numbers of young trees will be imported from nurseries east of the Rocky Mountains.

It is the duty of this and other Boards of Horticulture to raise a note of warning and establish a strict quarantine against localities known to be infested, and carefully guard their respective neighborhoods from the introduction of new fruit pests and diseases. Besides the insects infesting the orange groves of Florida, about which Secretary Lelong has warned us, we cannot too diligently watch for the destructive curculio infesting the plum and the mysterious yellows of the peach—both yet unknown in this State—the latter being a dread disease, whose origin is unknown, and for which no remedy has yet been found.

Respectfully submitted.

W. H. ROBINSON,
Secretary.

SEPTEMBER 30, 1890.

REPORT OF THE SANTA BARBARA COUNTY BOARD.

To the honorable the State Board of Horticulture:

GENTLEMEN: Herewith we beg to submit the annual report of the Santa Barbara County Board of Horticultural Commissioners:

The work of this Commission has been pushed with considerable vigor by each member of the Commission, the whole work up to date having been done without the aid of any deputies.

That portion of the county lying north of the district consisting of the Santa Ynez, Santa Monica, and Lompoc Valleys, with their tributary valleys, has been thoroughly inspected, discovering a vast amount of infected trees as a consequence of no previous attempt to look for injurious insects.

We found something over two hundred thousand deciduous and olive trees, with here and there an occasional small planting of citrus trees. The deciduous trees in a large percentage of the orchards are found to be affected with San José and greedy scales, red spider, and a limited quantity of black and brown scales. Woolly aphis was also found in two or three instances where there can be no question of the economy of uprooting trees. One instance is reported by a private party, who, finding woolly aphis in his small orchard, after trying American concentrated lye in various ways, concluded that a solution strong enough to kill the insects would kill the trees; he therefore, without further ceremony, uprooted the last tree, and made up his mind to plant anew in other ground.

Powdery mildew was found to be making considerable headway in small orchards, as also the pear blight. Rose rust was found on many of the choicest roses.

The Norfolk Island pine scale has been found in one instance, and it is a rare thing to find a clean Texas umbrella tree. The black scale is in a general way confined to the olive, although in the lower end of the county a large amount of the same is found on the apricot, peach, and pepper trees.

A new insect of the geometer type made its appearance at the ranch of Hon. Ellwood Cooper on many of his walnut trees. He controlled them principally by the use of Paris green.

The cottony cushion scale is very nearly exterminated by our blessed little friend, the *Vedalia cardinalis*.

Very much good has resulted from the application of the wash prescribed by Professor Coquillett. Fruit half grown, after spraying with this solution, developed smooth and clean. The apples and pears are particularly fine after this treatment.

Considerable apathy is manifested by small orchardists where trees will soon be completely overrun by the red spider, and there is no question in the minds of our Commissioners that what we really need, and must have, to do effective work in this direction, is the passage by our Board of Supervisors of an ordinance similar to Ordinance No. 26, passed by the Board of Supervisors of San Bernardino County, to whom be it said all praise is due for the diligence with which they are coöperating with the Horticultural Commissioners of said county. A great deal of our work was, in consequence of such continuous and heavy winter rains, necessarily crowded into the early summer months, but everything demonstrates the increasing necessity for active, vigorous work from one end of the county to the other, until this county (in conjunction with others) is rid of these vicious insect pests.

The common ladybug has been observed feeding upon the woolly aphis, but it is worse than useless to rely upon such a means of ridding ourselves of this, one of our worst enemies.

The codlin moth is found in considerable quantities in the lower portion of the county.

Respectfully submitted.

ROWLAND MACHIN,
Secretary.

SEPTEMBER 25, 1890.

REPORT OF THE SONOMA COUNTY BOARD.

To the honorable the State Board of Horticulture:

GENTLEMEN: This Commission was organized November 4, 1889, consisting of J. H. Bailhache, M. L. McDonald, and E. A. Rogers. The Supervisors set our compensation at $1 per day. We have been unable to find any one to serve as local Inspectors on account of such meager allowance.

We find the San José scale in the majority of the orchards that we have inspected in the county. In some localities we found they had sprayed last winter with the salt, sulphur, and lime remedy with good results. In some cases, where the scale was left to increase, the orchards were nearly destroyed by their attacks. In some orchards the codlin moth has been found, and is very destructive, and little is done to destroy them; some orchardists are using the band system.

The woolly aphis appears very numerous in old orchards away from the coast; in those near the coast I found but very few. Very little or no attention is paid to this pest.

We have found the cottony cushion scale in one orchard, and also on shrubs in flower gardens. We have placed a colony of *Vedalia cardinalis* wherever infested.

We have sprayed Winter Nelis and Easter Beurre pears and Winter Pearmain apples with the Bordeaux mixture for fungoids, with good results. The spraying was done April twenty-fourth.

We recommend the salt, sulphur, and lime remedy for the San José scale. It was used very extensively last winter in some parts of the county, and where thoroughly used good results were obtained.

Respectfully submitted.

E. A. ROGERS,
Secretary.

SEPTEMBER 25, 1890.

REPORT OF THE SUTTER COUNTY BOARD.

To the honorable the State Board of Horticulture:

GENTLEMEN: We beg leave to submit this the first annual report of the Sutter County Horticultural Commission:

The Board of Supervisors of Sutter County appointed R. C. Kells, J. C. Gray, and H. P. Stabler a Board of County Horticultural Commissioners, on September 4, 1889, and fixed the compensation at $3 per day for the time actually engaged in the service. The compensation of the local Inspectors was not fixed at this time, as the law requires, but the Commission was given to understand that the Inspectors would receive the same per diem.

The Commission organized on September 16, 1889, by the election of R. C. Kells as President, and H. P. Stabler as Secretary, and decided to hold regular meetings on the third Saturday of each month.

A circular was at once prepared and sent to all fruit growers in the county, advising them of the appointment of the Commission, urging them to observe the law in regard to pests, and requesting correspondence on all matters pertaining to the suppression of pests. Another circular was addressed to nurserymen throughout the State, warning them to send no infected trees to Sutter County the coming season. The Secretary was instructed to purchase the necessary books and stationery. When the bills for the minute book of the Commission, the stationery, and the printed matter were presented to the Board of Supervisors, that body absolutely refused to pay them, and the bills remain unpaid to the present day.

In due time the Commission divided the county into seven fruit districts, appointing an Inspector for each district. The first work done by the Inspectors was the work of examining the local nurseries, assigned to J. B. Wilkie, of the Yuba fruit district. In his report he informed the Commission that there were thirteen nurseries in the district; and all of them were infested with the San José scale. The time consumed in making the examination was seven days, and the Supervisors appreciated the importance of the work by allowing the Inspector *one dollar a day* for his services, thus establishing a rate of compensation for the local Inspectors throughout the county. The local Inspectors throughout the county at once tendered their resignations, and the Commission has been in a very awkward position during the year. Under the circumstances, the Commission decided to make as many inspections as possible and publish in the local papers the most approved remedies and their manner of application. Accordingly, the "lime, salt, and sulphur wash," the "resin wash," the "Paris green mixture," and the "whale-oil soap and sulphide of soda" remedies were published at the proper season in the local papers, and by using the same type, the above remedies were printed in circular form and five hundred copies of each remedy sent, without expense to the county, to every fruit grower in Sutter County.

The correspondence in regard to these subjects has become quite large and has been promptly attended to.

We feel very much the need of active local Inspectors, and have several times gone before the Supervisors and asked that the compensation of the Inspectors be increased to a reasonable sum, but in every case they have refused to do anything in the matter.

At the present time many orchards in Sutter County are infested with San José scale, red spider, codlin moth, and pear slug. The importance of horticultural interests demands that something be done to stop the spread of these depredating pests. The fruit growers of the county recognize the need of thorough and systematic spraying of their orchards, and have always been ready to use the remedies recommended by the Commission.

Respectfully submitted.

H. P. STABLER,
Secretary.

SEPTEMBER 25, 1890.

REPORT OF THE TULARE COUNTY BOARD.

To the honorable the State Board of Horticulture:

GENTLEMEN: We have the pleasure of submitting to you our annual report for Tulare County.

This has been a prosperous year with our people, and there is so much to report connected with our work we find it difficult to be brief enough.

The valley of Tulare is distinct from the San Joaquin Valley. All the waters of this valley run into Tulare Lake, and has no outlet to the sea, while the waters of the San Joaquin Valley run into the bay of San Francisco.

The soil is different from anything in the State. Artesian boring shows the soil to be alluvial for at least twelve hundred feet, apparently as fertile on the bottom as the surface.

Tulare Valley embraces about half of Fresno, and all of Tulare and Kern Counties, and is as large as the States of Rhode Island, Connecticut, and Massachusetts.

Tulare County is the center of this valley, and is watered by Kings, Kaweah, Tule, White, and Kern Rivers. These rivers rise in the high Sierras, whose tops are covered with snow all summer, and furnish a never failing supply of water for irrigation, and run west and south to Tulare Lake, traversing the county from east to west, so that the whole area may be irrigated. Running from these rivers are deep sloughs traversing the whole country as they meander toward the lake, making all these rivers like the Mississippi, which empties its waters into the Gulf by many mouths. These sloughs are deep and drain the country when irrigated, so that our lands will never become impregnated with alkali as the lands of India, and even portions of our own State. A large portion of the land of Tulare County is irrigated by percolation.

This can be done nowhere else so perfectly in this State as here. This reduces the expense of irrigation almost to nothing; a ditch full of water will wet the land for half a mile. This is considered a dry country, five and one half to six inches being our average rainfall, and until within the last ten or twelve years the waters of our rivers were not used to irrigate.

Herds of cattle and horses roamed over the plains of Tulare County, and the rearing of these was the only industry known to the people.

First, what farming there was, met with such poor success that the land became known as the "Land of the Devil." This is all changed now. The county this year has exported over two million sacks of wheat, being the banner wheat county in the State. But fruit culture is taking the lead, and the wheat fields, with their steam harvesters, are rapidly disappearing, and the orchard and vineyard is dotting the plains.

It is almost impossible to give even an approximation of fruit shipped from this county. From Hanford there were shipped this season eight hundred thousand pounds of dried fruit, and three hundred thousand of green. Tulare shipped two hundred thousand pounds of dried, and one hundred and fifty thousand pounds of green fruit. Visalia, two hundred and eighty thousand pounds of dried, and two hundred thousand pounds of green fruit.

In this county all deciduous fruits do well, and along the foothills oranges and lemons grow as well as anywhere in the State. The olive will grow anywhere in the valley, and the English walnut does moderately well in the foothills.

Last season five thousand five hundred acres were planted to raisin grapes in the Lucerne District of Tulare County, and perhaps as many acres in the other portions of the county. This next season many more acres will be planted to vines. More vines are rooted this season than at any time, and many of them are sold already, to be planted next spring.

The French prune on peach stock does exceptionally well all over Tulare County. One tree, six years old, at Visalia, yielded this year *one thousand one hundred and two pounds.* One at Grangeville, seven years old, yielded *one thousand one hundred and forty pounds* this season. Prune orchards will yield in Tulare County from five hundred to seven hundred pounds per tree when six years old, grafted on peach stock, and this season have produced $1,000 per acre.

Peaches do better here than in any other part of the State, yielding this season from $400 to $600 per acre, some weighing as high as twenty and one half ounces.

Insect pests, for some cause not clearly defined, have disappeared almost entirely in the western part of the county. The lime, sulphur, and salt compound has been used unsparingly against the San José scale, and orchards not sprayed are as clean as those that were. The season and parasites likely have done most of the good work.

All along Tule River, and around Porterville, the San José scale is still doing its deadly work. All the apples and pears are spotted with scale. But little has been done to destroy the insect. The woolly aphis and codlin moth are both very troublesome in this district.

Around Visalia, insect pests are kept in check, and the fruit is clean. The same may be said of Tulare.

It is difficult to predict the future of this county. Unless some calamity befalls our fruit and raisin industry, within the next five years this will be the center of the fruit and raisin industry of the State.

Respectfully submitted.

N. W. MOTHERALL,
I. H. THOMAS,
I. N. WRIGHT,
Commissioners.

REPORT OF THE YUBA COUNTY BOARD.

To the honorable the State Board of Horticulture:

GENTLEMEN: During the latter part of the month of September, 1889, the appearance of the orange trees in the Marysville yards was truly revolting; the leaves were yellow and withered, and seemed to be in the last stages of dissolution. Some of the trees had died. The trouble continued to grow until the attention of some of the prominent citizens was called to the matter. A meeting was held, and the result of which was the presentation of a petition to the Board of Supervisors, asking for the appointment of a Board of Horticultural Commissioners to look after the fruit industry of Yuba County. A Commission was appointed at the October, 1889, session of the Board of Supervisors, as follows: G. W. Harney, President; J. W. Mills, Vice-President; F. W. Johnson, Secretary.

A year has gone by since the appointment of the Commission, and if proofs of its value to the county of Yuba are needed, they can be found in the condition of the Yuba County orange orchards. Infested by, and nearly dead from, the ravages of the yellow scale, those orchards were taken in hand and treated in such a thorough manner that to-day they stand in their glossy, beautiful green coats, monuments to the wise laws that provide for Horticultural Commissions.

Our annual report to the State Board of Horticulture can best be prepared by writing a synopsis of all our reports to the Board of Supervisors of Yuba County. In January, 1890, the following report was made:

"During the month of November, 1889, notice was served on about one hundred owners of infested citrus trees, which resulted in the spraying and cleaning of about twelve hundred large trees—nearly all the infested trees in the city of Marysville. The wash used was a resinous compound manufactured under the supervision of Commissioner G. W. Harney. By means of this wash we believe that 95 per cent of the scale was destroyed. The work of spraying was discontinued on account of the heavy storms, but will in all probability be resumed in the spring. A number of inspections were made of country orchards.

"During the month of December the Board held meetings to determine the best means to be adopted to prevent nurserymen from bringing in infested trees or nursery stock. Placards were posted cautioning the public against the danger of insect pests, and every care will be taken to prevent the importation of any more pests.

"There are very few places where fruit trees are grown in this county that do not show some traces of insect pests. As the fruit industry of Yuba County is yet in its infancy, it is quite essential that this evil be checked now, and that the people be educated as to the proper means to be used. The Commissioners are about to prepare printed slips and posters giving the proper remedies for the different pests; these will be sent throughout the county and distributed gratuitously to those interested."

In April, 1890, a report was prepared as follows:

"During these months a series of inspections were made and notifications served in all the infested districts. Meetings of the Commissioners were held, at which the following remedies were adopted: Remedies for pernicious scale, winter and summer; remedy for pears and apples infested with perniciosus; remedy for early ripening apples and pears infested with codlin moth; remedy for woolly aphis; remedy for flowering shrubs and plants infested with woolly aphis; remedy for yellow scale on citrus trees; remedy for aphis on rose bushes; remedy for black smut on roses; remedy for borers.

"*Regarding Beneficial Insects.*—Whenever beneficial insects or parasites are decreasing the spread of scale and other pests, no spray or wash should be used."

Orchardists are requested to pay particular attention to the colonization of these beneficial insects. We find that it is not always necessary to import them; that Nature oftentimes places them just where they are needed without the intervention of man. An inspection made a short time ago by one of our Commissioners will illustrate this point:

A seedling orange tree, imported some two years ago, after being planted six months, developed a large number of black scales. These insects lived and thrived on the trees, and after a short time began to exude quantities of black smut over the limbs and leaves. No effort was made by the owner to rid the tree of the pest, but an inspection this spring shows that not a scale is left, and that the tree is in the possession of a colony of ashy-gray ladybirds, who have eaten up every vestige of the black scales. In this case Nature has stepped in and prevented the spread of a pest that might have caused great loss.

The citrus trees in and about the Marysville yards were sprayed with a resin wash. We have no hesitancy in pronouncing these trees to be in a better condition now than at any time during the past six or seven years. Very few of the yellow scales are now active, some 95 per cent of them having been destroyed.

A row of elm trees on D Street was discovered to be infested with filbert scale. During the month of March they were sprayed with a caustic wash under the supervision of the Commissioners, which resulted in the partial destruction of the pest.

At a meeting of the Commissioners, Messrs. Harney and Johnson were appointed to represent Yuba County in the convention of Horticultural Commissioners at Los Angeles, March 11 to 16, 1890.

A series of inspections of the fruit kept for sale in the Marysville fruit stores have been made. Circulars and letters have been sent to the fruit men, asking them to refrain from purchasing infested fruit.

On July twenty-third we found on all the fruit stands a small quantity of infested pears. Prompt notice was served on the seller, who promised to destroy the fruit and not to offer any more for sale. Therefore, no suit was commenced against him.

Careful inspection of the Marysville orange trees have been made; few traces of live yellow scale were found.

Inspections in the latter part of July show, however, that under the influence of the warm weather the scale is becoming active. Some Marysville citizens have kindly reported to us their observations, which bear out our conclusions.

Inspection of the Colmena orange grove was made, and no trace of scale was discovered there.

Inspections of the fruit being handled by the Marysville cannery were made; it was all found to be in good condition.

The cannery managers report that fruit properly protected from the

ravages of scale pests is bound to bring a better price than neglected fruit. Incidentally the following information concerning the work of the Marysville cannery was obtained:

During the season they give employment to about two hundred people. They expect to put up this year about one hundred and thirty tons of apricots, one hundred tons of cherries, four hundred and fifty tons of peaches, two hundred tons of Bartlett pears, and one hundred tons of plums, etc. In all probably one thousand tons of first grade canned fruit will be shipped from here branded "Marysville Fruit."

During the spraying season our Board had printed, at their own expense, a series of remedy slips for distribution among the fruit growers. These slips were diligently circulated, and have, no doubt, been productive of much good.

Inspections of the orchards in the southeastern portion of the county have been made from time to time, and where the scale has been found to exist the attention of the owner was called to the trouble, and remedies prescribed for the eradication of the pests.

GEORGE W. HARNEY,
President.

MARYSVILLE, August 14, 1890.

APPENDIX B.

CHERRY CULTURE—ROSE CULTURE—PREPARATION OF THE CALIFORNIA PRUNE.

CHERRY CULTURE.

To grow cherries successfully it is necessary to comply with certain conditions. Those which I consider the most important I will notice:

FIRST—SELECTION OF SUITABLE TREES.

Cherry trees are now generally propagated on Mazzard seedlings grown in France. They drill the seeds in rows, and at the end of the first season's growth take them up and assort them into three or four sizes, viz.: Extras, No. 1, No. 2, and No. 3. They vary all the way in size from that of a small straw to one half inch at collar. They use the extras at home and export the other grades. If we take the No. 1 grade (about one fourth inch in diameter at the collar) and plant in a good, loamy soil, in the coast and bay counties, grow without forcing by irrigation, and bud the first summer or graft the first winter, at the end of the second year we have what we call a one-year old tree; and we should have at least two thirds of a planting running from three to five feet in height. We call such a production first class trees, and not being stimulated by irrigation, they form the terminal bud in the latter part of the summer and early fall, and have the balance of the growing season to ripen and harden the wood. This class of trees I consider suitable to start with in planting a cherry orchard. On the other hand, if we take the third class stock mentioned above, plant it in the interior of the State, where the spring growth commences early and the summers are clear and warm, irrigate it thoroughly—by September we will have the stock large enough to bud; in all probability larger than the first class stock grown without irrigation, and if we follow with a plentiful supply of water the second season, we can produce trees, two thirds of them or over, ranging from four to six feet in height, straight stalks, and smooth bark, and to the inexperienced eye better looking trees than the No. 1 described above. But this class of trees would be an unsuitable one to select in planting a cherry orchard. The foundation (the stock) is inferior to commence with, the wood will be coarse and unripe, the trees will not bear the transplanting as well as those we have designated as suitable. They will go back on the planter in their future growth compared with the suitable trees.

The above remarks will apply to all of our stone fruits, especially the apricot and peach. Peach trees and apricots grown on peach stock are propagated by planting the seeds in the nursery (where they are to stand until the trees are ready for sale), and budding the first season those which grow large enough. The smaller ones are pulled out and thrown away (or should be); but suppose we take the small ones, about the size of a straw, transplant, and force them up to a budding size the second season, force them the third, and we may grow a fine looking tree in this way, but it would be one that I could not be induced to plant under any consideration. Yet this is precisely what has been done to a large extent in this State with the apricot on Myrobolan plum stock. In discussing the growing of the cherry, as well as other fruits, I cannot lay too much stress on the quality of the stock used. I have no objection to irrigated trees from the simple fact of irrigation, for no trees will grow without moisture in the soil; but too much water is generally used, and too late in the season to produce well ripened wood, suitable for transplanting. If the nurserymen who irrigate will use none but first class stocks and less water, so as not to produce overgrown trees, they will confer a lasting benefit on their customers. Now, to the fruit grower let me say: Buy your trees direct from the grower and demand a guarantee that they are grown on first class stocks; for there is more difference in the growing of a successful and lasting orchard, between trees started on first class stocks and those on third, than the average fruit grower is aware of.

SECOND—SOIL AND SITUATION.

The cherry does best in a sandy loam, but it should be of good depth and well drained. In my district but a small portion of our lands is suitable for cherry growing. The character of the soil is all right—a sandy loam, good potato soil—but the depth and drainage are not sufficient. I have been growing the cherry for thirty years with varying results. A portion of my first planting proved a success, while the other portions were a failure, and in places the trees are all gone. There is something about our land that I do not fully understand. It seems to be spotted. We may plant, say five acres in a body, to cherry trees, *apparently* all the same quality of land. In the course of two or three years they will commence to die out, and at the end of twelve or fifteen years perhaps two thirds of them will be gone, and the balance will be standing in groups here and there over the five acres. To the superficial observer there would appear to be no difference—no reason why the trees should not do as well on one part of the tract as on another. In digging ditches, I find a difference in the depth and appearance of the soil below. Those spots where the trees die out the most are generally the shallowest, and below of a more grayish cast. I do not believe that it is the shallow soil alone that kills the trees, because I have one spot of near one half acre at the top of a ridge, sloping to the north (the most favorable position for the cherry), where none of the stone fruits will last for any length of time. I have planted the plum, apricot, peach, and cherry. The soil is as deep as any in the orchard. I do not know for a certainty, but I suspect that alkali has something to do with causing our spotted orchards. In selecting suitable land in my district for planting the cherry, I would select land sloping north to northeast, and on the highest land to be found. I would dig prospect holes in various parts of the tract, and if it proved to be of a less average depth than three feet I would reject it as unsuitable for the cherry. The Cassidy orchard is located at the top of the high land on the northwest of Petaluma, sloping to the north and east, and the best paying portion of my cherry orchard is located near the top of my highest land, with quite a steep descent to the north; the highest part one hundred and fifty feet above the lower parts of the place.

THIRD—THE CARE OF CHERRY TREES.

After planting is as simple as that of any other deciduous fruit trees. They should be headed low, trained in the vase form, and pruned regularly the same as other fruit trees, but do the pruning early; the month of November is the best time to do the work on trees in orchards not irrigated. I have made a success in the past three years in reheading some old cherry trees. I did the grafting in the month of November, commencing about the first of the month, and cutting away half of the top the first season, and the remaining half the second season. This fact satisfies me that the pruning should be done early in the season. The cherry is well adapted to the cool, moist climate of our coast counties, but the need of thorough drainage is the greatest drawback to cherry growing in the coast counties. The cherry can also be grown successfully in the interior of the State under favorable conditions. Marysville is one among the hottest places in the State. The old G. G. Briggs cherry orchard, on the Yuba River above that place, was one of the most successful cherry orchards ever planted in the State, until the river filled with debris from the mines and overflowed it. But what were the conditions? The most favorable that we can imagine—a rich, alluvial soil, twenty to thirty feet to low-water mark, no hardpan or other strata to prevent the free passage of water up or down, and when the trees are dormant the water in the river would generally be below the level of the roots. The river would rise from the melting snows in the mountains, and bring the water to a higher level in midsummer, supplying the trees all the moisture needed, and then recede in August, which would give the ground a chance to dry somewhat, and allow the trees to ripen and harden the new growth.*

*W. H. Pepper, in an essay read before the State Horticultural Society, 1890.

FLORICULTURE.

ROSE CULTURE.

Perhaps there is no country in the wide world where the rose can be grown to greater perfection than in California; yet many here grow the queen of flowers with but indifferent success. This is partly owing to lack of knowledge, partly to lack of proper attention, and sometimes to unfavorable soil or climatic conditions; for even here some localities are too hot and dry, and some too cold and damp to hope for the best results in rose growing. But these two latter difficulties can be largely overcome by intelligent culture and a proper selection of varieties. Right here we desire to raise a voice of caution against reliance on the eastern books and catalogues as guides to rose culture on the Pacific Slope, for experience has demonstrated that many rules and directions therein given do not apply here, and many sorts that succeed well on the other side of the Rockies do but poorly with us, and vice versa. Perhaps this statement needs a little qualification, however, for possibly no sort will grow more poorly in most sections of this State than at the East; but as a rule the many sorts do so much better with us that by comparison the one is a failure and the other a success. So it comes to pass that we must be governed by our own experience. Again, many sorts succeed well only under glass, while others succeed well only when grown in the open air. We like best those that do well in either situation.

PRIMARY REQUIREMENTS.

Canon Hole has said, beautifully and truly, that "he who would have beautiful roses in his garden, must have beautiful roses in his heart."

No plant responds more generously to good and loving care than the rose. True, in rare cases it will grow with great luxuriance and beauty in spite of neglect, but kind and intelligent treatment seldom fails to bring its sure reward.

It is the purpose of this essay to give some hints that may assist the devotee at the shrine of the lovliest of all the floral kingdom, so that he may see our queen in the glory of her most regal splendor; but remember that the best gifts rarely come to us of their own accord. They must be hoped for, sought for, and worked for, and that, too, not by blind faith, but by intelligence, reason, and experimental effort. Read and learn from others all you can, reason all you can, do accordingly, and then watch the result, profiting by any hint which experience may give. The outcome cannot well be otherwise than gratifying and satisfactory.

It is the masses that need instruction, therefore this essay will be devoted to the matter of growing roses in the open air, leaving that of greenhouse culture to the gardeners of the wealthy and the professional florists, who are already posted.

LOCATION.

Let your rosary slope to the east or north; let it be securely sheltered from the rude winds, and let broad shadows be cast athwart it at midday to protect the beautiful children of your care from the scorching rays of the summer sun. All this is easy enough to say, but in practice not so easy to have and do. Most people must plant where they must, and that is usually in a limited area near the dwelling. Let them plant there whether the ground slope this way or that way, or not at all. Let them protect as best they can, and get shadow from house or fence, or vine-covered trellis, or hedge (a rose hedge, if possible). But it is useless to put your roses close to an ever-hungry eucalyptus, Monterey cypress, or the like, that will consume the milk and honey and oil, and bread and butter, and pork and beans of the soil, leaving the poor plants to perish of thirst and starvation. Better no shadow at all than the shadow of death. The broad sunshine is not to be despised, and if your plants be given a little extra manure—solid and fluid—and a little extra cultivation, the lack of the other advantages will be largely compensated for.

SOIL AND PREPARATION.

The rose loves best a pretty stiff, loamy soil, with a gravelly or sandy subsoil. Stiff adobe is better than a sandy soil, but a mixture of the two is to be preferred. If these conditions do not exist naturally, they can generally be approximated artificially at a moderate expense. Sometimes underdraining has to be resorted to, which is somewhat costly, but this rarely happens. Generally deep preparation of the ground is all that is required, but this must in nowise be neglected. Do it with the plow if you can, for that is by all means the best instrument ever devised for thoroughly breaking up and pulverizing the ground. But it must run deep—clear down to the beam—and if this cannot be done by plowing once, plow till it is done. If the plow cannot be used, then the spade or digging-fork must be made to answer in its place; and the work can be well done by the usual process of trenching, which is so well known as to need no description here.

The proper time to do this work is in the autumn, or beginning of winter, immediately after the first rains have thoroughly soaked the soil. A good guide is the farmer. See when he begins to plow, and if the soil breaks up loose and friable, then is the time to prepare your rose garden, and do it at once.

MANURING.

First of all manure your land, and do it generously. The rose is a gross feeder, and few soils are naturally rich enough for its voracious appetite. If you are to plow and can do it with one operation, first spread the manure thickly—not less than three or four inches deep if the manure be short or well rotted, and still deeper if it be coarse—so deep that it will require to be raked into the furrow behind the plow. Manure from the horse stable containing little straw is usually the best, for when put into the ground it affords a certain degree of bottom heat that is very beneficial to the plants. If you must dig, coarse manure of any kind will not answer. It must be fine. If free from straw, horse manure is to be preferred for the reason before stated, but that from the cow stable or corral will answer a good purpose. Many prefer well rotted manure in any case. It is stronger, and so undoubtedly best for very poor soil, but such soil is not promising of the best results under any kind of treatment. Again, if planting for any reason be deferred till late in the season, fresh manure should in no case be used, its heating qualities being then a detriment. Nor will it have sufficient time to thoroughly rot before the dry season comes on, and then it will go hard with the plants unless they are well and systematically irrigated. Finish the preparation of the ground with a fine toothed harrow or garden rake, and you are ready for

PLANTING.

This must not be done when the ground is so wet as to be sticky, for it will pack into a mass so solid that the air cannot penetrate nor moisture properly distribute itself to meet the necessities of the growing plant. If the soil be very dry, it is generally better to wait for rain; but if planting be done as hereafter directed, there need be no fear as to a successful result. If there be delay in planting after receipt of plants, dig a trench and "heel them in," wetting the roots before covering them with earth. Be careful never to expose the roots of the plants to dry air or wind any longer than is absolutely necessary. If the size and plan of your garden will admit of it, set the plants in rows, straight, curved, or serpentine; the rows to be not less than four feet apart, and the plants not closer than three feet in the row. The more vigorous sorts should not be so close. For instance, Magna Charta, John Hopper, Safrano, and several other sorts often grow to cover a space six to eight feet in diameter, and should have room accordingly. Dig holes big enough to receive the roots without bending them. Now take your plant and cut smooth the ends of all broken roots, with a slanting cut, upward and outward, so they may callous and throw their new rootlets downward. Until the rootlets form anew, the plant can make no growth, for the process of transplanting is almost certain to destroy any that may be then in existence, and these alone gather sustenance and feed the plant, and hence are appropriately called "working roots." Consider what portion of the roots must necessarily be destroyed in transplanting, and cut away the top to correspond. It is a law of plant life that there must be a certain correspondence between root and top. If you cut away the top, the root will stop growing until a corresponding amount of top is again restored, and vice versa. Therefore, fully one half the top must be pruned off. Leave from one to three main stems, as taste or the necessities of the case may require, and then trim and cut back till you think you have about the correct proportion between root and top, so they may start off evenly together. In pruning, use a sharp knife, or pruning shears that are likewise sharp. Dull tools do bad work. Old wood, as a rule, should not be cut back; but if disturbed, should be taken clean away.

The plants being prepared, set them in the holes, a little deeper than they grow in the nursery, and draw in sufficient earth to cover the roots, and then pour in water enough to cover the loose earth and settle it about the roots. Then fill the hole full of earth and press it down firmly. Set in this manner, not one in a hundred will fail.

IRRIGATION.

Roses will grow anywhere without irrigation that an orchard will, but they must be thoroughly cultivated to retain the moisture in the soil. If a cultivator be used, go through at least every two weeks; if a hoe, as much oftener as can be conveniently done. But where no water is given they will cease to bloom in July, and rest till after the first rains in autumn, when they will put forth again with great vigor, and unless there be heavy frosts, will continue to bloom all winter, and in fact till July again. Where irrigated, many sorts will bloom without ceasing, but the flowers are not quite so fine as on non-irrigated plants, especially in the autumn.

PRUNING.

If roses are to be grown in the form of trees, of course but one stem will be allowed to grow, and laterals and suckers must be cut away as they push forth from the stem or root, and only such branches be left as will form a symmetrical top. The bush form, however, is most natural, and hence usually produces the best results; and if so grown, it is best to allow two or more stems, cutting away the old and keeping the new and more vigorous as occasion may require. Cutting back will induce new growth of stems and more flowers, but it will dwarf the plants; so, if large plants are desired, spare the knife in this direction, and confine the work to cutting away old and weak wood, only shortening-in such branches as make the plant unshapely. Climbing roses should not be cut back, but such branches as are not wanted should be cut clean away. The only exception to this rule is at the time of planting, when the top should be shortened on account of the loss of the roots. Pruning is best done in the fall, just as the new growth begins.

QUALITY OF PLANTS.

Always get good, strong plants if you can. Those grown from cuttings, without irrigation, are by far the best. One such is worth a dozen hot-house imbeciles, or pot-grown, stunted starvelings; and, if possible, *have them on their own roots*. A few sorts are so difficult to grow from cuttings that it may be necessary to get budded or grafted plants. Again, if you buy standards—that is, those grown in the nursery in tree form—they must have large and vigorous stems. Therefore, as a rule, the stem will be of one sort and the top of another—budded on. These are desirable for a lawn, but for most other places the bush form, as before stated, is far preferable.

Nurserymen sell large numbers of pot-grown roses, for two good and sufficient reasons. Many people will not buy a rose till they see it in bloom, and then they want it right away. The pot plant fills the bill. It shows a bloom, and it can be transplanted at at any time. Such a plant may some time become a good, strong, out-door specimen, but the process is a long and tedious one; whereas, one strong and inured to hardship from the beginning, will at once go down to business, so to speak, and cheerfully respond to any little favors you may give it. The one will find all it can do to live without blossoming, perhaps for a whole season, while the other will show its appreciation of the change by at once covering itself all over with a blaze of glory. Don't blame the nurseryman. He must please his customers or go out of business. He will prefer to furnish you the best plants if you will have them, and have them at the proper season.

AFTER-TREATMENT.

The treatment of roses after planting consists principally of pruning, cultivating, and mulching. Having already given some hints on pruning, we dismiss that part of the subject. The importance of thorough cultivation has also been referred to. In the fall, mulch your roses with strong manure, covering the ground all over.

Scrapings from the henhouse are best, and a coat half an inch deep of this will be quite as efficient as three times the amount of that from the barnyard, even though it be ever so well rotted. But any kind will answer a good purpose, gauging the quantity by its strength. Coarse litter may be put on four inches deep, and will be found excellent, especially for adobe or heavy soil, making it loose and friable; but for sandy soil it is of little use. In the spring, the mulching should be forked into the ground, or worked in with the cultivator. An occasional treatment with bone meal or other artificial fertilizer is to be commended. In the dry season, liquid manure will be found of great benefit. Leach it from a barrel as ashes are leached for lye, and pour it in a little trench around the bush, filling the trench again with earth when it has soaked into the soil. It should be of the color of weak tea.

If you irrigate, do it thoroughly, but not often. Once in a week or ten days is better than oftener, and if the periods be a fortnight apart it is better still, provided the ground be thoroughly soaked. After irrigating, don't touch the ground again till the surface is dry, and then it must be stirred to prevent baking.

CLASSIFICATION.

Roses may be generally divided into three principal classes, that is to say: Summer roses—those that have but one season of blooming; Hybrid Perpetual, or Remontant roses—those that bloom in the spring, occasionally during the summer, and more or less profusely in the autumn; and Ever-blooming roses—those that bloom continually, unless interrupted by drought or frost.

These general divisions are again usually separated into numerous subdivisions, but the limits of this essay will not admit of their being mentioned in detail. We may say, however, that among the most important divisions of the Summer roses are the Common or Provences, the Prairies, and the Mosses; among the Hybrid Perpetuals are the Hybrid Chinas, Hybrid Bourbons, and Hybrid Noisettes; and among the Ever-bloomers, the Teas, Bengals, Bourbons, Noisettes, Hybrid Teas, and Polyanthas.

There seems much looseness and inconsistency in the classifications on the part of various authors, but we can only allude to the fact here.

As a rule, the strongest growers, most highly scented, and finest finished roses are found among the Hybrid Perpetuals; the most delicate and varied tints among the Teas (so called because of their peculiar fragrance); the finest climbers among the Noisettes, and the most distinct, and perhaps most beautiful, among the Hybrid Teas. It is with

regret that the subject of classification must be dismissed with the little here said.

WHAT SORTS TO PLANT.

The rosarian who has time, pecuniary means, and plenty of room, usually wants nearly every variety that is at all desirable, but the great mass of people are not so situated. They can have but a limited quantity. They should have only the very best. It is hard to select from more than a thousand sorts a set of twenty-five or thirty that are better than any other set of like number. In fact it may be quite impossible, but we can select that number that will be sure to give satisfaction.

Below will be found a list of about double that nnmber, any one of which is excellent, and selections can be made to suit the taste or requirements of the buyer. There are many others equally good, some better for special purposes, but these will answer admirably for a beginning. I give the prevailing color.

HYBRID PERPETUALS, OR REMONTANTS.

Alfred Colomb, scarlety crimson.
Marshall P. Wilder, almost identical with A. Colomb.
General Jacqueminot, deep crimson.
Baronne de Bonstetten, very deep velvety crimson.
Paul Neyron, deep pink.
Magna Charta, deep pink.
Mrs. John Laing, deep pink.
Annie Marie Cote, white.
Coquette des Alpes, white.

TEAS.

Marie Von Houtte, pale yellow, pink-edged petals.
Catherine Mermet, pink.
Madame Lambard, bronze-red.
Madame Welche, cream, with pink center.
Safrano, apricot.
Rubens, light pink.
Baronne de St. Triviers, bronze-red.
Isabella Sprunt, light yellow.
Coquette de Lyon, light yellow..
Madame de Watteville, yellow tinge, with pink-edged petals.
Perle des Jardins, deep yellow.
The Bride, white, sometimes pinked.
Comtesse de la Barthe, pink.
Papa Gontier, brilliant crimson.
La Sylphide, light peach.
Sunset, light apricot.
Edith Gifford, white, with pink center.
Niphetos, pure white.
Comtesse Riza du Parc, bronze-rose.
Bougere, pink.
Souvenir d'un Ami, pink.
Climbing Devoniensis, white, flesh center.
General de Tartas, carmine.
Bon Silene, pink.
Gloire de Dijon, cream, pink, and salmon (climber).

NOISETTES (ALL CLIMBERS).

Maréchal Niel, yellow.
Lamarque, white.
W. A. Richardson, orange.
Gold of Ophir, salmon.
Reve d'Or, apricot.
Celine Forestier, white, with yellow center.

HYBRID TEAS.

Reine Marie Henriette, cherry red (climber).
La France, silvery pink.
Capt. Christy, silvery pink.

Wm. F. Bennett, brilliant crimson.
Puritan, pure white.
Pierre Guillot, deep red.
American Beauty, deep red.
Countess of Pembroke, bronze-red.

BENGALS.

Agrippina, deep blood-red.
Cels Multiflora, blush.
Madame Bosanquet, light flesh.
Archduke Charles, variable, crimson, and white.

BOURBONS.

Souvenir de la Malmaison, flesh.
Climbing Hermosa, pink.

POLYANTHAS.

Cecile Brunner, deep pink.
Perle d'Or, light orange.

MOSSES.

Princess Adelaide, deep pink.
Gracillis, pink, very mossy.

All of the above are good growers here, not excepting Niphetos, which, by the way, is the most beautiful of all white, as Maréchal Niel is of the yellow roses; and most of them are fine, both in bud and open flower, and with few exceptions exceedingly sweet.*

*Horace G. Pratt, in essay before State Floral Society, 1890.

PREPARATION OF THE PRUNE.

When I bought my place, fifteen years ago, or thereabout, I found there an old almond orchard of the Languedoc variety, which never bore well, and never paid me for my work and care. These almonds were all on peach and plum roots, and were quite old trees. Five years ago I budded these almonds with French prunes of the best type I could get, and the buds grew and have made very fine tops. This is the reason the standards are so high. While thus the roots are peach and plum, the intermediate trunks are almonds; the tops are Prune d'Ente, and the very best I have seen anywhere—better than the common d'Agen

I believe in giving plenty of room, and plant my prune trees twenty-four feet each way, although twenty feet might do. Air and sun are good for prunes, and I give them all they want. As to the proper root for the prune, my old trees are doing so well that I consider peach root a very good root, especially for sandy and well drained soil. For wet and heavy soil, I prefer the Myrobolan plum-root, as this root never rots, and is, besides, a strong and healthy grower. Most of my lately planted trees are on this root. While my old trees are high standards, so that the teams can go underneath without chafing the branches, my younger trees are headed very low. I believe eighteen inches is high enough, and I cut off my trees at that distance from the ground when I plant them.

PRUNING THE TREES

Every year I cut back heavily, in order to get large and fine fruit. The first year after planting I cut back, leaving only two or three spurs, in order to shape the tree, and on each spur I leave five or six buds—never more. The next or second year after planting, I leave about five or six spurs, each one of them eighteen inches long, which gives to each from ten to twelve buds; and so on, every year increasing the number of spurs until the tree attains its age. Trees treated in this way are goblet shaped, with open crowns, in which air and sun have free access, to the great benefit of both tree and fruit.

The soil is deep, and rich in substance as well as in color, the latter being dark chocolate, retaining its natural moisture received from the rains all through the summer. My orchards are all on rolling lands, one above the other, on the slopes of the Sonoma Mountains; they are as well drained as any place can be, and the trees freely respond to the soil and the care they get.

My prunes bear at four years of age, and I calculate that when six years old they will have paid for themselves. I work the soil well and often, and manure with stable manure at least every second year. The soil should never be allowed to get poor. There are several reasons why the ground should be plowed well. One of them is that when the ground is soft and free from any clods, the ripe prunes will not be bruised when they fall to the ground.

The trees require but little care, if once properly headed and pruned. It is, however, of importance to keep the hot sun away from the trunks, as the latter are apt to sunburn. The rabbits are also bad, and gnaw the bark off from young, unprotected trees. In order to prevent both the former and the latter, I put two stakes close to each tree, and one on each side, respectively. Around these stakes I wrap a strip of burlap, which has been previously soaked in whale-oil soap and sulphur. The burlap keeps both sun and rabbits away, and, as it does not touch the tree, injures it in no way.

RIPENING AND PICKING.

The prunes ripen with me in the middle of August. The first prunes, when fully ripe, fall to the ground by themselves; but a little later on it is necessary to shake the trees. If the ground then is cloddy and hard, the prunes are apt to break, and the juice will run out and spoil the prunes; but when the prunes fall on soft ground, this is not the case. For this reason I spread no canvas or anything else under the trees; the finely pulverized soil is the best for this purpose. When the prunes fall they are only partially dried; and to become perfect and salable, they must now undergo several processes, such as grading, dipping, drying, sweating, and packing. As soon as the prunes are picked, they are taken to the curing house in boxes weighing about forty pounds each.

THE IMPORTANCE OF GRADING.

The first work is now to grade them in several sizes, generally three, but four would be better. There are several reasons for grading before dipping; but the most important one is that prunes of unequal sizes take different lengths of time to dry, and should therefore be exposed in different trays. If the various sizes are placed promiscuously on the same trays, some will dry at one time, others at another time, and we must then either pick out the dried ones by hand, or be contented to have the smaller ones all dried to chips when the larger prunes are ready. It is therefore necessary that they should be assorted as soon as they are picked. There are several different graders in the market which do the work more or less well.

DIPPING.

When the prunes are graded they must be dipped into a caustic solution. The dipping is a most important and essential proceeding, which requires considerable judgment to perform well. The object of the dipping is to give the prunes color, to crack the skin, and to enable the prunes to dry quickly. I put the prunes in wire baskets which will hold about fifty pounds each; but I hardly ever put in more than forty pounds; this is heavy enough to handle. The dipping tank is a double one, made of galvanized iron, and divided into two compartments, one for the lye solution, the other for hot water. Each one of these tanks is thirty inches square, and holds about one hundred gallons of water. In the left hand tank, which I use for the lye solution, a coil runs along the bottom; and the same is connected with a five horse-power boiler, in order to heat the solution without reducing its strength. The adjoining hot water tank is heated by steam directly; and the pipes are so

arranged that the water is continually changing. The lye solution is made from one pound of lye to every twenty gallons of water; but the proper strength cannot always be gauged by the proportion of lye, as some prunes have thicker skins than others, and accordingly require a stronger solution than those with thin skins. The length of time for dipping varies some. Generally it lasts only one or two seconds. Just dip the prunes in and out; and, if the solution is strong and hot enough, the work is done. It is necessary to have the solution boiling hot; and the proper gauge from the appearance of the skin is that the latter must, when taken, be covered with fine cracks, something like the lines in a cobweb.

Immediately take the prunes out and immerse the bucket again into the adjoining tank with the boiling water, in order to rinse off all lye that may adhere to the prunes. Too long immersion in the lye would spoil the flavor of the prunes; and too little rinsing in the pure water would allow the lye to penetrate too deeply into the meat, which also would spoil the quality. As soon as dipped, the prunes are ready to be spread on trays and to be laid out in the sun to dry.

DRYING THE PRUNES.

The most economical trays are long trays made of split shakes, twelve feet long by three feet wide, and held together on three sides by strips of pine one by two inches. The fourth narrow side is left open to allow the prunes to slide out. I have used paper trays, but they are not a success, and caused too much labor. These trays are of the right size for two men to handle, and when full contain eighty pounds of freshly dipped prunes each. The prunes are placed on the trays in one layer only, and must never be heaped one on the top of the other, as they would then not dry evenly. Place the trays directly on the ground. That is by all means the best way. One year I experimented by raising some trays up; but they took a longer time to dry. Properly dipped prunes dry in from four to seven days; but I have had them to dry even in two days. Hot weather is, however, not good for prunes; they dry then too quickly, and do not cure as well as they should. The slow process is much to be preferred. As we have no dew nor fog here during the drying time, it is not necessary to cover over the trays in the night-time. This is the great beauty of our climate.

The prunes are properly dried when shriveled, and when the water in the meat has all evaporated. The meat should look fresh and have a golden color, just as it has in fresh prunes before they are dried at all. They should also be soft and pliable, and should not rattle.

After the prunes are partially dried, we empty two trays into one, so as to save trays; but when trays are plentiful, this is, of course, not needed at all. The emptying of trays may generally be done after two days of exposure to the full sun.

SWEATING.

The prunes should be handled as little as possible. The trays are, therefore, brought directly back to the sweating house (packing or store-room); and there the prunes are simply dumped into the sweating bins. The sweating is done to properly soften and cure the prunes. The sweating bins are large enough to hold four tons of prunes each, and are of various sizes, so as to suit the space. The best size I have found is five and a half feet high by four feet one way and five feet the other. The bin is made of matched and steamed lumber; and between each bin is a hollow axle in which the air can circulate freely, else the prunes are apt to heat and, of course, spoil. The bins are open at the top, so as to let in air; and the circulation of the latter is promoted by now and then turning over the prunes in each bin. This turning and handling of the prunes is done with wooden shovels, as any other would bruise the prunes. At the lower end of the bin is a sliding door like those in corn bins. By raising it the prunes fall out by themselves. The time for keeping the prunes in the bin is about fifteen days. After that time they are ready to steam and pack.

GRADING AND STEAMING.

After the sweating is over, the prunes must be graded again. Nothing is more important really, and it should be done well. The buyer will only pay according to the smallest fruit in the lot, no matter what size is the majority of the fruit. I remember once I had my fruit graded and ready for sale, and was requested to send a sample of what I had. Instead of sending a sample of different grades, I took a handful from each grade and mixed all up in a bag. The merchant only offered me the price of the very smallest prunes as the price for the whole lot. If they do not do this, no one would care to grade. Large prunes are much better than smaller ones, both as regards flavor and sweetness; it therefore stands good reason why large prunes should be worth more than smaller ones. Hence, the necessity to grade again before packing. But before packing is in order, the prunes must be steamed. For this purpose we have the steaming chest. The steaming is done to give the prunes a fine color, to soften them, and to kill insects and their eggs. I never dip the prunes before packing in glucose, or syrups of any kind. Steaming does away with all this, and produces also a much nicer prune. The prunes should not be shining and glossy, but should have a fine, deep color; and the meat should be golden and transparent and jelly like, not black, spongy, and hard. Prunes prepared according to my method have all these qualities; and, moreover, their kernels, if the stones are cracked, are found full of juice and not dried up. This is also said to be the difference between the imported French and the California prunes. My steaming chest is about five feet by three, and contains ten shelves, with one galvanized iron pan on each. Each pan is furnished with a small pipe, through which the condensed steam runs out, as otherwise, if it should drip from one prune to another, it would discolor the prunes and injure their quality. The time for steaming depends upon circumstances, and cannot always be specified. The prunes must be well heated through, and then immediately packed while yet hot.

PACKING.

Before steaming, but after sweating, the prunes should have been finally graded in at least three grades. First grade is forty-five to fifty prunes per pound; second grade, fifty to sixty per pound; third grade, sixty to seventy per pound. Any smaller prunes than these had better be thrown away, as they would only spoil the other grades. There are

about two hundred pounds of such prunes in every twenty tons. The bulk of the prunes in a good orchard should be the No. 2 grade. Of No. 3 there will always be many more than No. 1. The object of every grower should be to get as many prunes of the highest grade as possible. The packing is simply done. The boxes should contain twenty-five pounds each, as heavier boxes are not liked by the trade. I pack top down; that is, the top is nailed on first, and the prunes packed in, and the bottom nailed on last. First put white paper on the sides, and fold it over the top; then place over this a wax tissue paper, which will not absorb moisture nor get sticky; and then put in the first layer. This should consist of flattened-out prunes, which have been worked flat by hand.*

* Col. Geo. F. Hooper, in "California"—1890.

INDEX.

A

B

C

ERRATA.

Page 347, read "yellow" scale insect, instead of "citrus."
Page 286, Figure 10, read M(e)gilla vittigera.
Page 258, Figure 29, read Philampel(u)s pandorus.
Page 178, read author's name (A. F.) Kercheval.
Page 181, under Legislation add "The President appointed the following as the standing advisory committee on legislation: B. M. Lelong, W. H. Aiken, S. F. Leib, W. E. Collins, and S. J. Stabler.

Errata in 1889 Report.

Page 384, twelfth line, read "midnoon," instead of "sundown."

ANNUAL REPORT

OF THE

Board of State Viticultural Commissioners,

FOR 1889-90.

SACRAMENTO:
STATE OFFICE, : : : : : : : J. D. YOUNG, SUPT. STATE PRINTING.
1890.

OFFICERS AND MEMBERS OF THE BOARD.

ISAAC DeTURK, President..Santa Rosa.
Commissioner for the Sonoma District.

J. DeBARTH SHORB, Vice-President........................ ....San Gabriel.
Commissioner for the State at Large.

JOHN T. DOYLE, Treasurer..San Francisco.
Commissioner for the State at Large.

CHARLES BUNDSCHU..San Francisco.
Commissioner for the San Francisco District.

GEORGE WEST.. ....Stockton.
Commissioner for the San Joaquin District.

R. D. STEPHENS ....Sacramento.
Commissioner for the Sacramento District.

E. C. PRIBER..Napa.
Commissioner for the Napa District.

L. J. ROSE..Los Angeles.
Commissioner for the Los Angeles District.

G. G. BLANCHARD..Placerville.
Commissioner for the El Dorado District.

WINFIELD SCOTT..Secretary.

CLARENCE J. WETMORE ....Manager of Hall and Experimental Cellar.

CHARLES A. WETMORE............Chief Executive Viticultural and Health Officer.

Office of the Board:
317 Pine Street, San Francisco.

REPORT OF I. DeTURK,

President of the Board of State Viticultural Commissioners, 1890.

San Francisco, Cal., September 29, 1890.

To his Excellency R. W. Waterman, *Governor of the State of California:*

Sir: As required by law, I herewith transmit the financial report of the Board of State Viticultural Commissioners, showing the receipts and expenditures of the Board during the forty-first fiscal year.

Inclosed you will find a statement from Charles B. Turrill, as Secretary, in which the report will be found in detail.

Respectfully,

I. DeTURK,
President of the Board of State Viticultural Commissioners.

San Francisco, June 30, 1890.

To the Board of State Viticultural Commissioners:

Gentlemen: I respectfully submit the following report of receipts and disbursements for the forty-first fiscal year, ending June 30, 1890, as taken from the books in this office:

RECEIPTS.

Amount appropriated by the Legislature for the forty-first and forty-second fiscal years, from July 1, 1889, to July 1, 1891		$35,000 00

DISBURSEMENTS.

Salaries	$2,850 00	
Lectures	600 00	
Experimental work	2,794 21	
Commissioners' expenses	64 80	
Conventions	387 50	
Library	110 00	
Statistics	72 50	
Distributing information	30 00	
Office expenses	9,970 76	
State Analyst	600 00	
Total		17,479 77
Balance available for the forty-second fiscal year		$17,520 23

Respectfully,

CHARLES B. TURRILL,
Secretary.

REPORT.

Sir: I herewith submit my annual report as President of the Commissioners. Accompanying it will be found reports from the various District Commissioners, and other documents necessary to set forth the work of the Commission for the fiscal year ending June 30, 1890.

During the past year several changes were made in the membership of the Board. The terms of Charles A. Wetmore as Commissioner for the San Francisco District, Charles Krug as Commissioner for the Napa

District, W. S. Manlove as Commissioner for the Sacramento District, and J. DeBarth Shorb as Commissioner for the State at Large, expired by limitation. Commissioner Shorb was reappointed to succeed himself, but the other vacancies were filled by new appointments. Chas. Bundschu was appointed as Commissioner for the San Francisco District, succeeding Mr. Wetmore; E. C. Priber was appointed for the Napa District, succeeding Mr. Krug; and R. D. Stephens was appointed for the Sacramento District, succeeding Dr. Manlove.

Charles A. Wetmore, having held the office of President of the Board, as well as that of Commissioner for the San Francisco District, the former office became vacant with the expiration of his term as Commissioner. At the annual meeting, held June 9, 1890, I was elected to fill the office of President. J. DeBarth Shorb was elected to fill the vacancy created by my election as President, and Commissioner John T. Doyle became Treasurer in place of Charles Krug. At the same time Winfield Scott was elected Secretary in place of Charles B. Turrill.

No other changes in the personnel of the Board or in its officers have taken place. With the retirement of Chas. A. Wetmore from the Board and the Presidency of the Board at the same time, he retained his connection with us as Chief Executive Viticultural Officer, which position he still holds.

The retiring Commissioners, Messrs. Wetmore, Krug, and Manlove, carried with them the best wishes of all the members of the Board. Two of them—Messrs. Wetmore and Krug—had been with the Board since its organization in 1880, while Dr. Manlove had been identified with it since 1887. Their faithfulness and earnest work did much to foster the viticultural industry in every portion of the State.

The wine industry is just recovering from a period of over three years of depression caused by the largely increased production consequent on the extensive planting in the years prior to 1886. Experience during the past decade has proved that while the demand for our wines is growing, it is not growing at such a rate as to warrant any period of extensive planting, such as has in the past been indulged in from time to time. It must be borne in mind that Americans are not a wine-drinking people, as neither soil nor climate in the most thickly populated portions of the country are suited for wine growing. Those of our countrymen east of the Rockies who do not drink whisky, drink beer, to which they are more accustomed than to wine. The people are, however, gradually recognizing the merits of our wines, and from this time forth there may be expected a steady increase in the consumption of vinous liquors. This, and the fact that comparatively no new vineyards of wine grapes can come into bearing for at least four years to come, is a sufficient guarantee of prosperity for the producers in the next few years.

The planting of wine grape varieties has been almost totally suspended since 1888, though a few vineyards have been set out here and there. On the other hand, large areas of these vines have been destroyed by various diseases. The Anaheim disease has cleared out between ten thousand and twelve thousand acres of vines in Southern California, and in Napa and Sonoma Counties many vineyards have succumbed to the phylloxera. These losses in the total area of land set to vines have been counterbalanced many times over by the extensive areas that have been planted to varieties suited for raisins and for table purposes.

Confidence, however, is being restored among the growers of wine grapes and the makers of wine. An era of planting must soon begin under the increased demand for our wines. Experience with the phylloxera has taught the most progressive vineyardists that in all cases resistant stocks must be used, and experience in the wine markets shows the absolute necessity of grafting on only the finer varieties of grapes. We must and will have something better if the wines are to be accorded the degree of excellence for which all should strive. The importance of having only the finest varieties cannot be stated too strongly.

It must be remembered, too, that we have already had one great period of depression consequent upon overproduction, and that after it was past, viticulturists enjoyed their greatest years of prosperity. I refer here to the depression in the early seventies, which became so great that many vineyards were either abandoned or uprooted and replaced by grain fields or orchards. Yet in the early eighties, when the eastern market for our wines was only in its infancy compared to what it is now, prosperity prevailed in every section devoted to grape culture. The same will be true during the next few years, because there will be more drinkers of wine than there will be wine for them; and this period will last until the production once more reaches the ever increasing consumption in the States east of the Rocky Mountains.

This time, I believe, is far in the future. Our wines, which a few years ago were unknown, save by name, in nearly every eastern city of importance, can now be found in every city of size in the Mississippi Valley and on the Atlantic Slope. New York, Chicago, and New Orleans have become important distributing points, and branch houses or agencies have been established in those places by the principal producers and merchants. Not only this, but our wines and brandies are handled by wholesale dealers in cities of less importance. In a word, the facilities for distributing and selling our wines are infinitely better than ever before, and consequently our products are placed on sale in better form than ever before.

WORK OF THE COMMISSION.

The work of the Commission since the last report has been chiefly directed towards promoting the demand for and aiding the sale of our viticultural products. This policy has been pursued in every legitimate manner, and everything that could make friends for California wines and brandies has been done. But it must not be supposed that the other branches of our work have been neglected; on the contrary, we have continued to send out information on subjects connected with viticulture in all its branches. Not only this, but the Commission has continued its work in the experimental cellars, and has pursued several special investigations, notably the investigation conducted at San Gabriel by Prof. Ethelbert Dowlen into the causes and cure of the Anaheim disease. His report, to which especial attention is called, appears elsewhere.

Acting on the central line of policy, the Commissioners have had a series of lectures delivered in the principal eastern cities by Miss Kate Field, and have established a permanent exhibit in San Francisco, in connection with which a café is operated, in which wines and brandies of the producers and merchants can be sampled or compared.

Regarding the lectures of Miss Field, it must be said that they have exerted a very beneficial effect in stimulating the eastern demand for the best qualities of wines as well as for the ordinary grades. This talented lady gave us all the benefits of her ability as a lecturer, and her personal influence. She was bitterly attacked by the Prohibitionists, as might have been expected, but her able efforts in inducing interest in and drinking of wines were productive of excellent results.

EXHIBIT AND CAFÉ.

A persistent and determined attempt is being made in some quarters to decry the value of the public exhibit in San Francisco, as a means of increasing interest in wines; and the café attached has been the subject of bitter and relentless attack without cause.

The Commissioners had several objects in view in establishing the permanent exhibit, and now, at the end of two years, it has proved an unqualified success.

I would call attention, in the first place, to the history of the exhibit, as bearing on its efficiency in carrying out the objects for which it was established.

At the meeting of the Commissioners, held June 11, 1888, the President, Charles A. Wetmore, brought up the subject, and after a full explanation by him, and a discussion by the members present, a committee was appointed to investigate the subject and report at a subsequent meeting. This committee, which consisted of Commissioners Wetmore, Shorb, and DeTurk, met at once, and on the following day reported their plans for the operation of such an exhibit.

The details for the display of wines and brandies were easily arranged, but the matter of providing a sampling department, free from all possible objection by the public and by the producers of wine, or wine merchants, was a more difficult matter.

It was finally decided that all producers and dealers should have equal rights and privileges in the exhibit; that their wines should be sold at the prices fixed by themselves; that after deducting necessary cost of retailing in the café (corkage, etc.), the money realized from the sale of the wines should be returned to the exhibitors; *that no exhibitor be allowed to fix his prices so as to come into unfair competition with the ordinary retail trade; that all undercutting of fair trade prices be discouraged by strict rules, and that visitors be guided solely by the catalogue in making selections of wine.*

At the same time it was decided to enlarge the scope of the experimental cellar.

These rules have been strictly adhered to in all cases.

At a meeting of the Board, held October 26, 1888, President Wetmore stated that the arrangements looking to the establishment of the exhibit in a room in the Mechanics' Institute building, on Post Street, had fallen through, in lieu of which he had engaged Platt's Hall, at 216 Montgomery Street. This action was indorsed. Considerable time was spent thereafter in making the necessary alterations in the hall so as to adapt it to the purposes of the Commission. The last months of 1888 were spent in gathering exhibits, and in January, 1889, the hall was opened with a fine representation of wines and brandies from every section of the State, and with a café attachment, which was managed with the ends of the Commission constantly in view.

Since the opening, the hall has been visited by thousands of sightseers from California, the East, Europe, Australia, China, and Japan,

Mexico, and Central and South America. These visitors have been shown every courtesy, and the café has proved a most valuable adjunct in this connection in introducing them directly to our wines and brandies. It is only fair to state that in our rooms—and in them only—have intending buyers of California wines and brandies been able to find a representative collection of our products, for not only are the merchants represented, but the producers from every section.

In the operation of this feature of our work, we have left behind every consideration of personal gain, and acted solely for the interests of all, no matter of which class. The café to-day is not and never has been a money-making institution, either for the Commission or for those whose wines are on exhibit. But its influence in fostering a demand for our wines, in showing visitors and buyers what each producer or merchant has to offer, in generally stimulating interest in California products, whether at home or abroad, has been so marked that I would most earnestly recommend that the means be provided by which a similar viticultural exhibit be opened in New York, with a café attached, and, if possible, in Chicago and London.

No better means of advertising the products of *all* without favors being given to *any* could possibly be devised, and while the expense would not be large the advantages which would accrue would be great beyond measure.

It was not to be expected that the Commissioners could inaugurate this valuable adjunct to the viticultural industry without violent opposition from those who object to the popularization of producers' brands, but the successful operation of the exhibit and café has caused most of this opposition to die away. Time and experience have sanctioned the wisdom of the step.

At present, the café is leased to capable restaurateurs, who supply only the wines and brandies from our exhibits to their patrons. The money received from the sale of these wines is returned to the exhibitors. The exhibit and café are visited by producers, merchants, the general public, and visitors and buyers from the East and abroad. In showing what the producers and merchants of the State have, it has proved itself invaluable.

As an educational medium for wine makers and merchants, the exhibit has done excellent service. It has created among all classes a desire to attain certain types, which are better understood than ever before. For instance, in the case of Sauternes, it has instructed the most progressive men what a Sauterne should be, and has stimulated a worthy desire to reach a high type. This is equally true in the case of other wines. A most marked and gratifying improvement has been made, too, in the bottling, labeling, and packing of wines since the display was opened. The first wines that were shown were, as a rule, badly bottled—bottled indiscriminately, would perhaps be a better term. Clarets were sent in Rhine wine bottles; sweet wine, in Rhine wine bottles; white wine, in claret bottles; Burgundy, in claret bottles, and every possible combination of errors in this respect could be noted. The labels were not as neat and tasty as those that are on the bottles now sent for exhibition. In a word, the principal merchants and producers have learned more about the proper manner of bottling and labeling wines in the past two years than in the whole period preceding in which wines were produced in the State.

An objection has been raised by unthinking or prejudiced persons against the privilege of sampling wines in the café. It must be remembered that if the exhibit is to have its greatest value as a means of disposing of wines, there must be facilities where they can be tasted. In connection with a restaurant this can be done without the least objectionable features being introduced. There is no indiscriminate bottle-opening on the premises; no wine is sold by the glass; and none can be *obtained except in the original unbroken packages*. This is a rule which is insisted on by every officer of the Commission, and is never broken. The unthinking, the prejudiced, and the ignorant who have joined collectively in an attack on our exhibit as the "State Saloon," therefore have nothing on which to base their assertions.

The operations of the café, and the disposition of the wines sent by exhibitors to the rooms of the Commissioners since the opening of the permanent exhibit, are shown by the following statement prepared by Mr. Wm. H. McNeil, the storekeeper:

RECEIPTS OF BOTTLES.

From all exhibitors from January 15, 1889, to June 30, 1890		15,596

DISPOSITION.

On exhibit	744	
Used as sample	238	
Used by exhibitor	414	
Sent to Paris	56	
Broken	44	
Returned	853	
Sold	8,255	
On hand June 30, 1890	4,992	
		15,596

The statement of sales from January 15, 1889, to June 30, 1890, is as follows:

Bottles sold	8,255
Bottles other disposition	2,349
Bottles on hand	4,992
Total	15,596

Amount received from sales, $4,081 15.

The money received from the sale of the wines was disposed of as follows:

Corkage and café	$1,145 25
Reserve Fund	377 30
Amount paid exhibitors	2,558 60
	$4,081 15

The variety of wines on exhibit in the hall of the Commissioners is limited only by the variety of wines produced in the State. The appended statement will show how varied and complete the exhibit is in every sense of the word.

WINES ON EXHIBIT.

SPARKLING.

Champagne	2

WHITE WINES (DRY).

Burger	2
Chablis	1
Chateau Yquem	1
Chasselas (Golden)	5
Gutedel	16
Hock	8
Haut Sauterne	3
Riesling	27
Sauterne	18
Semillon	2
Sauvignon Vert	4
Traminer	2
White wine	1
	90

RED WINES (DRY).

Beclan	1
Burgundy	23
Cabernet	10
Carignan	1
Chauche Noir	1
Chambertin	2
Claret	18
Grenache	1
Gros Mancin	1
Malbec	1
Margaux	1
Mataro	2
Pineau	2
Petit Syrah	1
Zinfandel	24
	89

SWEET WINES.

Angelica	11
Frontignan	1
Madeira	3
Malaga	5
Muscatel	15
Port	28
Tokay	2
	65

SHERRY.

Sherry	19

BRANDY.

Brandy	33

RECAPITULATION.

Sparkling	2
White (dry)	90
Red (dry)	89
Sweet	65
Sherry	19
Brandy	33
	298

VITICULTURAL CONVENTION.

The Seventh Annual Viticultural Convention was held under the direction of the Commissioners and in our hall, on August 13–17, 1889. In spite of the discouraged feeling then prevailing among the grape growers and wine makers, the Convention was well attended and the meetings were marked by spirited discussions.

The Convention was opened with an address by Charles A. Wetmore, then President of the Commissioners. Following his remarks, the committees to sample the wines sent for examination were announced. These committees were composed of the following gentlemen:

White Wine Committee.—George Husmann, of Napa County; Julius P. Smith, of Livermore; William Rueff, of San Francisco; H. A. Merriam, of Los Gatos; Capt. J. Chamon de St. Hubert, of Fresno.

Red Wine Committee.—A. G. Chauche, of Livermore; Dr. John A. Stewart, of Santa Cruz; N. E. Rose, of St. Helena; Richard Heath, of Napa County; E. Dichman, of New York.

Sweet Wines and Brandies.—S. McCullach, of New York; George Johnston, of San Francisco; R. J. Harrison, of San Francisco.

These committees at once set about the examination of the wines submitted to them. It had been specially provided in the call for the Convention that old wines, as far as possible, be sent for this purpose and the vineyardists readily complied with this request. In all, two hundred and six samples of dry and sweet (fortified) wines and brandies were tasted and classified.

The opening session on the thirteenth was devoted to a discussion of the subject, "The Conditions now Prevailing in the Markets for Viticultural Products and the Causes of Depression in the Prices of Wine." I. DeTurk, of Santa Rosa, led the discussion, contending that distillation should be resorted to to dispose of the poor wines. The good wines would take care of themselves.

At the evening session Professor E. W. Hilgard, of the University of California, delivered an address in favor of the electric process of aging wine and advocating the pasteurization of all wines before shipping. This address provoked a long discussion between Professor Hilgard and President Wetmore, ending with an address by E. Dichman attacking both processes.

On the fourteenth, "The Present Prosperity of the Raisin and Table Grape Industries and Possible Dangers in the Future" was announced as the subject for discussion. B. N. Rowley read a paper showing how California raisins had crowded the Malaga raisins from the American markets. The evening session was devoted to a consideration of the proposition to dry wine grapes, W. P. Bartlett leading the discussion.

The subject discussed at the first session on the fifteenth was "Remedies for Present Difficulties, including Drying of Wine Grapes, Distilling, Coöperative Organizations, Popular Agencies in Eastern States and Foreign Countries, Improvement in Quality of Products, and Notable Defects that may be Overcome." The session was marked at times by sharp discussions. A paper on "Fermentation," bearing on the subject of the day, was read by R. E. Wood. In the evening, Arpad Haraszthy addressed the Convention on "Brandy Distillation." Prefacing his remarks with a review of the labors of the committee appointed by the Grape Growers and Wine Makers' Association, to organize a joint stock company to distill brandy, of which Mr. Haraszthy was Chairman, he referred to the fact that $100,000 had been subscribed by capitalists, but he had found that capital generally was not inclined to take hold of the enterprise unless the producers showed faith in the scheme by supporting it. The local wine merchants, he said, were in favor of the plan, but the wine growers must be up and doing if they wanted it to succeed. One drawback to securing capital was the fact that the Brandy Union could not at present be assured a sufficient amount of grapes

and wine to carry on business on a large scale. In order to overcome this difficulty, Mr. Haraszthy suggested that growers might insure the Union the delivery of a quantity of grapes sufficient to meet the demand in the various districts in which distilleries might be operated. He also suggested another plan to meet the approaching emergency, by proposing that growers contract to furnish one hundred thousand tons of grapes, to be distilled on small margins with the limited capital available. Another plan had been proposed, and that was to divide the vine-growing sections into districts, organize a local company with a practical man as President, erect a distillery, and have the surplus grapes of these districts made into brandy. If this were done, Mr. Haraszthy was confident that the Brandy Union could be formed and operated for a bottom figure. He further stated that the eastern market was fully supplied with wine, the cellars throughout the State were comparatively full of wine, and it was plain to be seen that it was useless to attempt to put this wine with that of the coming vintage upon an overstocked market. On the other hand, there was a wide market for brandy in this country, and in Europe as well, where there was a large demand for grape spirits for use in the manufacture of cologne.

The first business before the Convention on the sixteenth was the reception of the reports of the Committees on Wine Exhibits.

The Committee on Red Wines submitted the following:

Your committee would report that they found the wines submitted to them almost unexceptionally of good character—indeed, some wines deserve the highest praise.

We would add that the number of Medoc types was almost a surprise to your committee for the number and quality, causing them to note that we have already entered into a new era of wine production—the era of wines of the best Medoc types.

Among the large number of exhibits it was a subject of remark that there were only one or two specimens that did not come up to the standard.

The judgment of the committee on the samples submitted to them is as follows:

Zinfandel, 1888.—No. 1, J. P. Smith, Livermore. No. 2, George A. Bram, Santa Cruz.

Zinfandel, 1887.—No. 1, Purity Wine Co., San Francisco. No. 2, Los Gatos and Saratoga Wine Co., Los Gatos.

Zinfandel, 1886.—No. 1, I. DeTurk, Santa Rosa. No. 2, A. G. Chauche, Livermore.

Zinfandel (old).—No. 1, I. DeTurk, Santa Rosa. No. 2, I. DeTurk, Santa Rosa.

Burgundy, 1888.—No. 1, C. A. Wetmore, Livermore.

Burgundy, 1885.—No. 1, I. DeTurk, Santa Rosa.

Burgundy (old).—No. 1, C. A. Wetmore, Livermore. No. 2, C. A. Wetmore, Livermore.

Petit Bouschet, 1888.—No. 1, C. C. McIver, Mission San José.

Medoc, 1888.—Extra, George West & Son, Stockton. No. 1, C. A. Wetmore, Livermore. No. 1, C. C. McIver, Mission San José. No. 1, George West & Son, Stockton. No. 1, J. A. Stewart, Santa Cruz.

Medoc, 1887.—No. 1, Los Gatos and Saratoga Wine Co., Los Gatos. No. 2, C. C. McIver, Mission San José.

Medoc, 1886.—Extra, John T. Doyle, Cupertino. No. 1, C. A. Wetmore, Livermore. No. 1, C. C. McIver, Mission San José. No. 2, C. A. Wetmore, Livermore.

Cabernet Franc, 1888.—No. 1, C. C. McIver, Mission San José.

Malbec, 1888.—No. 1, J. P. Smith, Livermore.

Mataro, 1888.—No. 1, T. L. Fowler, Livermore.

Petit Pinot, 1888.—No. 1, H. B. Wagoner, Livermore.

Mondeuse, 1888.—No. 1, C. C. McIver, Mission San José.

Beclan, 1888.—No. 1, C. C. McIver, Mission San José.

Petit Syrah, 1888.—No. 1, C. C. McIver, Mission San José. No. 2, Charles Krug, St. Helena.

Tannat, 1888.—No. 1, J. P. Smith, Livermore.

Mataro and Zinfandel, 1887.—No. 1, J. L. Beard, Warm Springs.

Mondeuse (blend), 1888.—No. 1, C. C. McIver, Mission San José.

Respectfully submitted.

J. A. STEWART.
A. Y. CHAUCHE.
P. KLEIN.
RICH. S. HEATH.
E. DICHMAN.

The report of the White Wine Committee was as follows:

The committee appointed by you which had the white wines under consideration beg leave to submit the following report:

As an introduction, allow us to state how we proceeded in this difficult but pleasant task.

The wines were brought to us singly, numbered, and with name or type they represent, or are intended to represent, and also with the date of vintage; but without any indication of the owner's or maker's name. They were divided into three classes; one the Riesling, Gutedel, and Hock; the second, the Sauterne; third, miscellaneous or new varieties.

Thus the Rieslings of one vintage were compared and tested by themselves, and the same with each other variety and vintage; each member of the committee making his own mark and voting for the sample found first, second, and third best, while the inferior or defective wines were left out altogether. We are thus in the dark, as yet, who produced the best, but let us say that in most cases the committee was nearly unanimous on the best numbers, while they found several or a few instances, several samples that they had to class as No. 1, being about equal in quality. And here let us say that it affords us much pleasure to state as our unanimous opinion that we were surprised and delighted with the quality of most of the samples, showing great progress in the making and handling of the wines, as compared with the samples of former years, and foreshadowing a bright future for our white wines. Such wines as it was our privilege to taste are bound to make a market anywhere sooner or later, and to bring good prices.

The committee's classifications were as follows:

Riesling, 1888.—No. 1, C. C. McIver, Mission San José.
Riesling, 1887.—No. 1, C. C. McIver, Mission San José. No. 2, Charles Krug, St. Helena.
Riesling, 1886.—No. 1, H. W. Crabb, Oakville.
Riesling (old).—No. 1, I. DeTurk, Santa Rosa. No. 2, M. M. Estee, Napa.
Orleans Riesling, 1888.—No. 1, C. C. McIver, Mission San José.
Orleans Riesling, 1887.—No. 1, J. P. Smith, Livermore. No. 2, C. C. McIver, Mission San José.
Orleans Riesling, 1886.—No. 1, J. P. Smith, Livermore.
Hock, 1886.—No. 1, H. W. Crabb, Oakville.
Gutedel (old).—No. 1, H. W. Crabb, Oakville. No. 2, M. M. Estee, Napa.
Sauvignon, 1888.—No. 1, H. W. Crabb, Oakville.
Sauterne, 1888.—No. 1, H. W. Crabb, Oakville. No. 2, C. C. McIver, Mission San José.
Sauterne, 1887.—No. 2, Los Gatos and Saratoga Wine Company. No. 3, C. C. McIver, Mission San José.
Sauterne, 1886.—No. 1, C. A. Wetmore, Livermore. No. 1, A. G. Chauche, Livermore. No. 1, J. P. Smith, Livermore. No. 2, H. W. Crabb, Oakville.
Sauvignon Blanc, 1888.—No. 1, J. P. Smith, Livermore.
Muscadelle du Bordelais, 1888.—No. 1, J. P. Smith, Livermore. No. 2, Geo. Husmann, Napa.
Louisiana, 1888.—No. 1, Geo. Husmann, Napa.
Semillon, 1888.—No. 1, George A. Bram, Santa Cruz.
Semillon, 1887.—No. 1, George A. Bram, Santa Cruz.
White Burgundy, 1888.—No. 1. C. A. Wetmore, Livermore.
Chauche Gris, 1888.—No. 2, George A. Bram, Santa Cruz.
Chauche Gris, 1886.—No. 1, George A. Bram, Santa Cruz.
Burger, 1888.—No. 1, C. C. McIver, Mission San José; No. 2, H. B. Wagoner, Livermore.
Golden Chasselas, 1887.—No. 2, J. L. Beard, Warm Springs.
Golden Chasselas, 1888.—No. 1, Charles Krug, St. Helena.
Sauvignon Blanc, 1888.—No. 1, J. P. Smith, Livermore.
White Wine, 1887.—No. 2, Purity Wine Company.

(Signed):

CAPT. J. CH. DE ST. HUBERT.
N. E. ROSE.
WILLIAM RUEFF.
GEORGE HUSMANN.
J. P. SMITH.

The report of the Committee on Sweet Wines and Brandies was as follows:

Port, 1888.—No. 1, George West & Son, Stockton. No. 2, Mrs. De Wiederhold, Healdsburg.
Port, 1887.—No. 1, George West & Son, Stockton. No. 2, H. W. Crabb, Oakville.
Port (old).—No. 1, George West & Son, Stockton.
Sherry, 1888–1887.—No good samples found.
Sherry, 1886.—No. 1, George West & Son, Stockton.
Sherry (old).—No. 1, George West & Son, Stockton. No. 2, I. DeTurk, Santa Rosa.
Frontignan, 1888–1887.—No. 1, George West & Son, Stockton.
Muscatel, 1887.—No. 1, F. L. Fowler, Livermore.
Muscatel, 1886.—No. 1, Charles Krug, St. Helena.

Brandy, 1888.—No. 1, J. P. Smith, Livermore. No. 2, George West & Son, Stockton.
Brandy, 1887.—No. 1, George West & Son, Stockton. No. 2, Charles Krug, St. Helena.
Brandy, 1886.—No. 1, George West & Son, Stockton. No. 2, I. DeTurk, Santa Rosa.
Brandy (old).—No. 1, George West & Son, Stockton.

A collection of samples submitted by E. J. Baldwin, not for competition, consisting of Angelica, Muscatel, Madeira, Port, and Brandy, was highly commended.

Following the committee reports, John T. Doyle read a paper on "Legislation" as pertaining to the wine industry. He recommended that a law be passed permitting wine growers to use a pure wine-stamp for their wines. By this means, the purchaser would be sure of receiving wholesome wine, and there would be no sale for impure or adulterated products. Congressman W. W. Morrow, ex-Congressman C. N. Felton, and others spoke of the probabilities of securing legislation in the direction stated by Mr. Doyle, and in the way of securing free brandy for fortification of sweet wines. In the evening, the Anaheim vine disease was considered, and Professor Ethelbert Dowlen, who has had charge of the investigation of the malady, delivered an address in which he recounted the progress and work of the disease, the experiments that have been made to discover its cause and find a remedy, etc., all of which have heretofore been published. Mr. Dowlen also exhibited specimens of the diseased vines with and without the microscope.

The seventeenth was devoted to discussion on the subject of "Possible Coöperation betweeh Producers to Maintain Production on a Profitable Basis." T. V. Munson, of Denison, Texas, addressed the Convention on the native American wines, which he has studied for ten years. The Convention then adjourned *sine die.*

PRODUCTION OF WINE.

The production of wine has not increased to any extent since the final report made in 1887 by Arpad Haraszthy, formerly President of the Commission, nor is there any reason to anticipate any great increase within the next three or four years. During the years 1885, 1886, and 1887, the annual yield was increased to a great extent by reason of the vineyards planted after the revival of the wine industry consequent on the formation of this Commission, and the steadily increasing demand from the East. The yield of 1886, 1887, and 1888 was above the normal demand for those years, but the demand now equals the supply. The vintage for the past three years, beginning with where Mr. Haraszthy left off in his report, has been as follows:

1887	15,000,000 gallons.
1888	17,000,000 gallons.
1889	15,000,000 gallons.
1890 (estimated)	15,000,000 gallons.

Appended will be found a statement of the price of wine grapes paid during the vintage of 1889. These prices are perhaps as low as will ever be paid, the reaction in the wine market this year precluding such low prices during the season of 1890. Of course, the prices varied in different localities, but the following may be taken as representing average prices when local causes had no disturbing effect:

Cabernet	$25 00 to $40 00 per ton.
Petit Pinot	15 00 to 25 00 per ton.
Meunier	15 00 to 23 00 per ton.
Riesling	12 00 to 15 00 per ton.
Mataro	8 00 to 12 00 per ton.
Zinfandel	8 00 to 12 00 per ton.
Charbono	8 00 to 10 00 per ton.
Malvoisie	8 00 to 10 00 per ton.
Mission	8 00 to 10 00 per ton.

PRODUCTION OF BRANDY.

Within the past two years the production of brandy has assumed a relative importance in viticulture never before attained in the history of the development of the industry in California. Circumstances made the opportunity for distillers to compete with the foreign product exceedingly auspicious. Not only were the vineyards in the Charentes in France weakened by the attacks of phylloxera, rendering the French distillers almost unable to supply their own home market, but the price of grapes fell so low in California that the distillers were able to seize the opening which was presented. At present we are not only supplying the home market, but the East, and Germany and England are drawing heavily on our supplies. The distillation of brandy appears to have no limit except the inability of the distillers to obtain material upon which to work at sufficiently low prices to enable them to operate at a profit. Aside from the ordinary grades of brandy which are produced, the distillers are reaching for the better grades. The success of the State Viticultural Commissioners in securing a gold medal at Paris in 1889 for brandies, shows conclusively that the finer grades are within the reach of the careful and painstaking distiller. We have already produced brandies which challenge the admiration of the most noted experts who have examined them.

The records of the Internal Revenue Department afford the best statement of the total production of brandy. Prior to 1864, the department did not keep its records of brandy separate from the records of the production of whisky and other spirits. Even up to the present time no separate classification of the fruit brandies is attempted, and so the records for California include the distillates of peach and other fruit brandies as well as of grape brandy. These are so small, however, as not to materially affect the value of the following statistics of production, which were furnished through the kindness of Hon. John W. Mason, United States Commissioner of Internal Revenue:

Fiscal Year Ending June 30.	Proof Gallons.
1865	20,415
1866	74,773
1867	47,303
1868	152,418
1869	286,753
1870	169,791
1871	157,107
1872	211,916
1873	118,605
1874	99,680
1875	297,147
1876	142,799
1877	157,159
1878	318,071
1879	158,393
1880	238,928
1881	351,206
1882	502,513
1883	324,717
1884	295,039
1885	383,756
1886	402,121
1887	742,445
1888	953,580
1889	915,573
1890	1,072,957

It will be noticed from the above figures that there have been periodical increases and decreases of the production in this time of twenty-five years covered by the statistics. There is only one exception to this rule, and that is in the case of the past four years. Though the distilling interest increased enormously in these years, the demand was fully up to the supply, and the distillation of 1889–90 was undoubtedly the heaviest ever known.

Anticipating a trifle on the report of 1891, which is yet to come, I will state that up to the first of September of the present year one hundred and forty-nine distilleries had registered at the offices of the Internal Revenue Collectors for the distillation of fruit brandy during the season of 1890. These distilleries are found in twenty-eight counties, showing how widely spread the production has become. The distillers who registered up to that time, as furnished by Revenue Collectors W. H. Sears of the First District, and H. W. Byington of the Fourth District, are as follows:

FIRST DISTRICT.

No.	Name of Distiller.	Post Office.
3	F. Joost	Martinez.
4	Pironi & Slatri	Los Angeles.
5	Eugene Paris	Livermore.
11	L. J. Rose Co. (limited)	Los Angeles.
21	C. O. Rust	Anaheim.
29	Cucamonga Vineyard Co.	Cucamonga.
46	Secondo Guasti	Los Angeles.
51	Fernando Bessolo	Camulas.
71	Wm. Palmtag	Hollister.
101	Henry Lefranc	San José.
120	George West	Stockton.
141	Demarteni & Cereghino	Clayton.
158	Charles Stern	Los Angeles.
164	John Jasprizza	San José.
168	Baldwin Distilling Co.	Santa Anita.
172	Joseph Merithew	Cupertino.
175	Eisen Vineyard Co.	Fresno.
177	Charles Francois	Gilroy.
180	James Hennessy	San Francisco.
211	Timm J. F. Boege	Anaheim.
214	Nicholas Baravich	San José.
217	Herman C. Eggers	Fresno.
218	San Gabriel Wine Co.	San Gabriel.
220	Reinert & Weis	San Bernardino.
225	Fresno Vineyard Co.	Fresno.
226	Barton Estate Co. (limited)	Fresno.
228	Alexander Henry	Anaheim.
230	Hermann Boettcher	Los Angeles.
233	Gotlob Bayha	Yorba.
234	George Yung	Orange.
236	Pomona Wine Co.	Pomona.
237	Emile Vache	Brookside.
240	N. Anticovich	San José.
243	Joseph Young	Orange.
246	Gottardo Bustelli	Livermore.
248	Bernard Distel	Fremont.
250	Downey Vintage Co.	Downey.
251	Jacob Rudel	San Gabriel.
252	George Betz	Ramona.
254	Louis Schorn	Anaheim.
257	Sierra Madre Vintage Co.	Lamanda Park.
260	A. Poulain	San José.
261	Henry Wehmeyer	Anaheim.
263	C. K. Kirby	Fowler.
264	Hermann Granz	Fresno.
266	Paul O. Burns Wine Co.	San José.
267	Emerson W. Scott	Santa Clara.
277	A. Delpech	Patchin.
279	C. G. Anderson	Fresno.
282	Webster & Sargent	Minturn.
284	J. B. J. Portal	San José.
287	Los Gatos and Saratoga Wine Co.	Los Gatos.
288	Florence Winery	Florence.
289	Los Gatos Coöperative Winery	Los Gatos.
290	Paul Wack	Los Angeles.
291	Roscoe Winery	Los Angeles.
293	Pacific Wine Co.	San José.
297	Henry Mel	Glenwood.
299	Sierra Vista Vineyard Co.	Minturn.
303	Pacific Wine Co.	San José.
306	Henry B. Wagoner	Livermore.
307	Charles Detoy	Mountain View.
308	A. Zicovich	San José.
313	Santa Cruz Mountains Wine Co.	Santa Cruz.
314	Glen Terry Wine Co.	Clayton.
315	Buhach Produce and Manufacturing Co.	Atwater.
318	Theodore Beck	Santa Cruz.

FOURTH DISTRICT.

No.	Name of Distiller.	Post Office.
7	A. Douet	Amador County.
9	F. Borreo	Napa.
11	S. C. Hastings	Lakeport.
13	James Sweeney	Placerville.
14	J. Kimmer	Green Valley.
20	G. D. Endriss	Coloma.
21	George Hood	Santa Rosa.
22	J. D. Winters	Sonoma County.
24	P. & J. J. Gobbi	Healdsburg.
25	C. J. Dunn	Sonoma County.
26	George Lang	Calistoga.
33	E. C. Priber	Napa.
40	L. Rasmussen	Coloma.
42	Martin Feusier & Co.	Santa Rosa.
43	Henry Mette	Mormon Island.
45	B. Dreyfus & Co.	Sonoma County.
49	Kohler & Van Bergen	Guthrie's Station, Sac'to Co.
53	J. Laurent	St. Helena.
57	M. M. Estee	Napa.
58	E. M. Grimes	Napa County.
73	J. Dowdell	St. Helena.
78	J. Zentgraf	Shingle Springs.
82	Kortum & Fulcher	Napa County.
84	G. Sieber	Marysville.
85	G. M. Wubbina	Mormon Island.
87	C. P. Adamson	Rutherford.
90	Leland Stanford	Vina.
98	H. Hugot	El Dorado County.
103	California Distillery Co.	St. Helena.
104	J. M. Ramm	Camptonville.
108	Italian-Swiss Agricultural Society	Cloverdale.
113	A. Lancel	Occidental.
122	E. G. Furber	Cloverdale.
129	Kohler & Frohling	Glen Ellen.
131	J. F. Miller	Shasta County.
133	William Hill	Sonoma County.
137	M. J. Azeveda & Co.	Sacramento County.
142	A. B. Dresbach	Grass Valley.
148	A. Isoard	Nevada City.
152	C. Hellwig	Grass Valley.
158	M. S. Nevis	Sacramento.
159	J. Kaiser	Penryn.
161	E. A. Hood	Santa Rosa.
167	G. Engler	Sonoma.
168	Wm. Goldstein	Napa County.
169	Charles Krug	St. Helena.
171	L. Ponlin	Sonoma County.
186	A. Domeniconi	Sonoma.
187	Stamer Bros.	St. Helena.
192	E. W. Davis	Santa Rosa.
193	G. Groezinger	Yountville.
195	Walden & Co.	Geyserville.
196	C. Aguillon	Sonoma.
200	J. Oberti	Cordelia.
202	John Thoman	St. Helena.
207	C. Carpy	Napa.
208	J. Chauvet	Glen Ellen.
215	James Finlayson	Sonoma County.
216	Joseph Simi	Sonoma County.
219	R. F. Tilveria	Butte County.
221	G. F. Hooper	Sonoma.
222	Natoma Vineyard Co.	Natoma.
223	I. DeTurk	Santa Rosa.
224	La Roza & Nevis	Sacramento.
225	J. A. Prien	Napa County.
232	Orleans Distilling Co.	Orleans.
234	Beringer Bros.	St. Helena.
235	H. E. Weinberger	St. Helena.
237	J. Lonnibos	Sonoma.
240	C. Gundlach	Sonoma.

FOURTH DISTRICT—Continued.

No.	NAME OF DISTILLER.	Post Office.
243	Bouchou & Batemale	Cordelia.
245	H. Bolle	Sonoma County.
247	G. F. Fisher	Sonoma.
249	J. H. Wheeler	St. Helena.
251	Lay, Clark & Co.	Santa Rosa.
255	F. Sciaroni	St. Helena.
258	A. Korbel	Sonoma County.
261	P. Bieber	St. Helena.
263	John Benson	Oakville.

PRODUCTION OF RAISINS.

The planting of raisin grape varieties is going on at a rapid rate, and the time has come for the raisin producers and those contemplating becoming such to inquire whither this unusual haste to secure vineyards of this description will lead. A very careful study of the whole subject is being made by George West, the Commissioner for the San Joaquin District, with a view of ascertaining what the probable product will be when the many thousands of acres of new vines in the counties of Fresno, Kern, and Tulare are in bearing. His studies are directed towards averting, if possible, any over-planting, so that the raisin producers will not have the same difficulties to overcome as were encountered by the wine makers in 1887, 1888, and 1889. I desire at this point to call the attention of the raisin makers and the producers of grapes suited only to raisins, that up to the present there has been but little increase in the total consumption of raisins in this country—certainly none over what might be expected with the normal increase of population—and that practically every box of raisins from California has merely crowded out a box from abroad. In other words, there has been but little increase per capita in the United States in the consumption of raisins. Unless the prices of raisins become lower than at present, there is little prospect of there being any such increase. From the best sources of information obtainable, the following statement of the production of raisins in the State since 1873 is given:

1873	6,000 twenty-pound boxes.
1874	9,000 twenty-pound boxes.
1875	11,000 twenty-pound boxes.
1876	19,000 twenty-pound boxes.
1877	32,000 twenty-pound boxes.
1878	48,000 twenty-pound boxes.
1879	65,000 twenty-pound boxes.
1880	75,000 twenty-pound boxes.
1881	90,000 twenty-pound boxes.
1882	115,000 twenty-pound boxes.
1883	140,000 twenty-pound boxes.
1884	175,000 twenty-pound boxes.
1885	470,000 tweuty-pound boxes.
1886	703,000 twenty-pound boxes.
1887	800,000 twenty-pound boxes.
1888	950,000 twenty-pound boxes.
1889	1,250,000 twenty-pound boxes.
1890 (estimated)	1,400,000 twenty-pound boxes.

From the statistics of the United States Bureau of Statistics of the Treasury Department have been collected the following figures showing the total imports of raisins into the United States, in pounds. These,

for purposes of comparison, have been reduced to twenty-pound boxes, though the bulk of foreign raisins come in twenty-two-pound (ten-kilogram) boxes. No figures can be obtained prior to 1884, at which time the Bureau separated raisins from the classification of "dried fruits." The imports for the fiscal years ending June 30th were:

YEAR.	Pounds.	In 20-lb. Boxes.
1884	53,702,220	2,685,111
1885	38,319,787	1,915,989
1886	40,387,946	2,019,397
1887	40,673,288	2,033,614
1888	40,476,763	2,023,838
1889	35,091,139	1,754,557
1890	36,914,330	1,845,716

Adding the California product in twenty-pound boxes, and the imports from abroad in the same unit, the result is the total American consumption. It results as follows:

YEAR.	Imported in 20-lb. Boxes.	California—20-lb. Boxes.	Total American Consumption—20-lb. Boxes.
1884	2,685,111	175,000	2,860,111
1885	1,915,989	470,000	2,385,989
1886	2,019,397	703,000	2,722,397
1887	2,033,614	800,000	2,833,614
1888	2,023,838	950,000	2,973,838
1889	1,754,557	1,250,000	3,004,557
1890	1,845,716	1,400,000	3,245,716

With these statistics in hand, the work of Commissioner West becomes doubly important. The investigation which he is making will place this Commission and the public in the possession of reliable statistics of the extent of planting in the three counties named, and supplemental to this will be the work of Commissioner Stephens in the northern raisin-producing districts, and Commissioners Rose and Shorb in the producing districts in the southern portion of the State.

DRYING WINE GRAPES.

During the vintage of 1888 a considerable quantity of wine grapes were sun-dried in various portions of the State, in the hope that a market could be found for them in the French establishments, which were making wine from dried grapes from Turkey and the Levant; and to a less degree in the eastern markets for dried fruit. These experimental lots were slow of sale at first, particularly in the East, but they were sold at prices that amply repaid the driers for their time and pains, considering the then low price of wine grapes.

Throughout the winter of 1888–9 the feasibility of opening new markets abroad was thoroughly discussed by the viticulturists, and in the spring of 1889 the Commissioners delegated Mr. J. B. J. Portal, of San José, then on his way to Europe on a business and pleasure trip, to investigate the French markets for dried grapes. Mr. Portal's several reports will be found in detail in another part of this report. While not at all encouraging, the Commissioners, in having the investigation made, contributed largely to the knowledge of the importance to which the manufacture of such wines has attained. Early this season the Commissioners received a communication from a London commission merchant, offering $50 a ton for all the dried grapes laid down in French or North German ports. This offer was never accepted by the grape driers, who found that they could do better in their home markets.

The season of 1889 saw grape drying carried on on a far larger scale than in 1888; and early in 1890, when it was learned that there was a heavy shortage in the eastern fruit crops, the inquiry for these dried grapes rose to proportions never anticipated in the beginning. The demand has become so great as to seriously reduce the wine yield, but it is my own opinion that the culmination has been reached for the present. Grapes for wine making from the present outlook, will command a sufficiently high price at the wineries in 1891 to deter any extensive contracts for drying, such as were signed in the season of 1890.

THE ADVANCE OF THE PHYLLOXERA.

In the counties of Napa, Sonoma, and Solano, the phylloxera has continued its progress, and in many of the sections devoted to vine culture no efforts, beyond a few half-hearted and spasmodic attempts, have been made to check its ravages. Alameda County has a new center of infection, aside from the one at the University at Berkeley, at Mission San José, where, however, strenuous exertions are being put forth to prevent any rapid extension.

The full extent of the ravages during the past two years in the counties of Napa and Sonoma can scarcely be appreciated by those not familiar with the situation. Thousands of acres have been affected, and the loss of the vines will be the more severely felt now that the demand for our wines has caught up with the supply. Those vineyardists who neglected their vines on account of the temporary depression in the wine market, will have cause to regret their shortsightedness, now that the rise in wine has come.

I cannot too strongly urge upon vineyardists the absolute necessity of meeting the emergency the moment that the insects are discovered. All affected vines should be promptly pulled up and burned on the spot and resistant stocks of approved varieties substituted after the spot, where the vine has been, is left uncultivated for a year or two. If this plan is conscientiously adhered to, there is no reason why the reconstitution of attacked vineyards should not be carried on while the death of the old vines is in progress. This would make the change vastly easier on the vineyardists than to wait until all the vines are dead before replanting.

Years of experience have proved with us, as with the vineyardists of France and other countries, that the substitution of resistant stocks for the old vines is the only radical remedy. It appears impossible to secure unanimous and effective action in the application of bisulphide of carbon, or sulphocarbonate of potassium, without which action all attempts to check the disease must prove abortive. Submersion, with us, is generally impracticable or too costly in the sections where the phylloxera now exists. Were the pest to reach Fresno, for instance, or any other county where irrigation is practiced, this remedy would, with-

out doubt, be largely resorted to. In connection with this discussion about phylloxera, I would call attention to the recommendation of E. C. Priber, Esq., the Commissioner for the Napa District, to the effect that the Commissioners undertake to supply resistant stocks to all vine growers who desire them.

SWEET WINE BILL.

The passage of the long desired "Sweet Wine Bill," by which the producers of sweet wines are permitted the use of brandy for fortification free of internal revenue tax, is a subject for congratulation; and it is meet at this time that due recognition be given to Hon. Joseph McKenna, Congressman from the Third District, and others, for their long and persistent efforts to secure this boon for the sweet wine producers, and all wine makers generally. The clause permitting the use of grape spirits for fortifying dry wines for export must necessarily foster shipments of wines abroad, particularly to Europe, and there will soon arise a demand for neutral grape spirit to meet all wants in this respect.

The Commissioners have had a leading part in securing this desired legislation. The original "Sweet Wine Bill" was drawn by Hon. Charles A. Wetmore years ago, and on his first draft all other measures of the same sort have been based. The greatest victory was in obtaining the exclusive use of grape spirits for fortifying. This Commission has stood at times almost alone among all organized bodies, in resisting all overtures permitting the use of corn spirit, wheat spirit, or any other spirit not produced from the grape. This is one of the most important features of the bill, and by maintaining this position from the first to last in the five years' struggle to secure the passage of the bill, a substantial advantage has been gained for the wine makers, and for the industry generally.

WORLD'S FAIR.

It is proper at this time to call attention to the necessity of action this winter in taking the preliminary steps toward having the viticultural products of California represented at the World's Fair, in Chicago, by a suitable display. A petition should be sent to the Legislature from the Commission and other organized viticultural bodies, urging coöperation in all measures looking towards a satisfactory and creditable exhibit. This is a matter which should receive earnest attention from all classes concerned in viticulture, and the earlier that active work is begun the better it will be for us. It must be recognized that a suitable display cannot be picked up haphazard in the course of a few months.

DEMAND FOR PUBLICATIONS.

The demand for the publications issued by the Commission from time to time since 1880 is constant. Many of these publications are out ot print and still the inquiry for them never relaxes. The Commission is in almost daily receipt of letters from California, and also from the East, Australia, France, Germany, Mexico, and other places, for complete sets of our reports and other printed matter. In view of this, I would recommend that many of these valuable documents, now unobtainable, be again put into print, that the work of the Commission shall be as thorough as possible.

STATISTICAL.

In his annual report to the Governor, filed April 12, 1888, Mr. Arpad Haraszthy, then President of the Commission, presented a very complete and exhaustive statement of the exports of California wines and brandies to various foreign countries by sea, to New York by water, and to the East by rail. These statistics have been carefully kept up since Mr. Haraszthy's complete statement was prepared, and the statistics corrected up to the first of January, 1890, will be found appended:

Receipts of wine and brandy from the interior were as follows:

Year.	Wine—Gallons.	Brandy—Gallons.
1887	8,496,344	256,104
1888	8,852,611	227,585
1889	10,523,504	517,243

The extent of the increase is shown by the fact that in 1875 the wine receipts were but 1,995,629 gallons, and the brandy receipts but 52,036 gallons.

The total wine shipments by sea and rail were as follows:

Year.	By Sea—Gallons.	By Rail—Gallons.	Total—Gallons.	Total Value.	Average Price.
1887	1,958,032	4,943,739	6,901,771	$3,140,305	$0 45.2
1888	*3,344,550	3,875,232	7,235,994	3,022,392	41.7
1889	†3,945,235	4,341,207	8,286,442	3,774,258	45.5

The total brandy exports, foreign and domestic, were as follows:

Year.	By Sea—Gallons.	By Rail—Gallons.	Total—Gallons.	Total Value.	Average Price.
1887	60,572	412,180	472,752	$774,313	$1 64
1888	85,120	365,960	451,080	690,152	1 53
1889	296,265	294,000	590,265	985,742	1 67

The exports of brandy are thus increasing at an enormously rapid rate, and were we to be permitted to bottle in bond, as was recommended by Mr. Haraszthy in his report, the exports would at once leap to such enormous quantities that the State's present production would be wholly inadequate to meet the demand that would at once spring up.

The detailed statement of the destination of the wines shipped by sea is as follows:

To New York.

Year.	Gallons.	Cases.	Value.
1887	1,680,227	1,335	$696,412
1888	3,052,755	1,244	1,266,200
1889	3,603,315	697	1,535,893

*And 6,485 cases, valued at $25,940.
†And 5,659 cases, valued at $24,971.

To Central America.

Year.	Gallons.	Cases.	Value.
1887	31,260	2,534	$34,654
1888	45,683	3,026	46,077
1889	44,769	2,781	43,639

To Mexico.

Year.	Gallons.	Cases.	Value.
1887	30,391	290	$20,023
1888	51,084	641	31,403
1889	52,358	767	33,543

To British Columbia.

Year.	Gallons.	Cases.	Value.
1887	13,313	215	$9,717
1888	12,782	342	9,563
1889	12,800	471	11,388

To Hawaiian Islands.

Year.	Gallons.	Cases.	Value.
1887	71,150	612	$62,377
1888	66,667	492	56,434
1889	99,537	501	77,159

To Japan.

Year.	Gallons.	Cases.	Value.
1887	28,378	526	$16,401
1888	30,266	214	14,106
1889	22,710	117	10,571

To Europe.

Year.	Gallons.	Cases.	Value.
1887	26,355	1,642	$20,562
1888	62,662	248	36,112
1889	51,305	260	25,304

To All Other Countries.

Year.	Gallons.	Cases.	Value.
1887	57,404	669	$29,138
1888	22,660	278	12,404
1889	28,441	65	15,489

The total exports of brandy to foreign ports by sea were as follows:

Year.	Gallons.	Cases.	Value.
1887	26,899	639	$36,154
1888	30,308	263	21,450
1889	82,102	----------	55,697

It is not out of place to give here the imports of foreign wines and brandies at San Francisco during the past three years. It will be noticed that there has been a decrease in the quantity of still wines imported in casks, showing that California wines in bulk are slowly driving out the imported article. The imports of still wines in bottles, and of brandy, show a slight increase. Champagne imports have increased heavily, not that the sales of the domestic article are suffering, but on account of the enormously increased competition and activity of the agents of the foreign producers. Appended are the figures:

STILL WINES IN CASKS.

Year.	Gallons.	Value.
1887	102,628	$70,464
1888	106,127	75,320
1889	91,954	72,239

STILL WINES IN BOTTLES.

Year.	Dozen.	Value.
1887	15,083	$58,201
1888	17,078	73,098
1889	23,848	84,587

CHAMPAGNE AND ALL SPARKLING WINES.

Year.	Dozen.	Value.
1887	10,617	$135,492
1888	20,116	274,213
1889	19,747	270,911

BRANDY.

Year.	Proof Gallons.	Value.
1887	20,253	$50,330
1888	29,494	66,067
1889	33,001	73,785

NEEDS OF THE COMMISSION.

At this time, when the tide has turned favorably for the wine makers, the Commission is in a position to do valuable service for those engaged in this branch of the viticultural industry. The Commission, as the recognized head of the classes who cultivate the vine, is looked to for information of all sorts, technical and other, for advice regarding legislation, whether State or national, and for information for the general public. It has the confidence of the vineyardist in every section and every valley, and its labors are appreciated by every class of producers.

To enable us to continue our work in behalf of the grape industry during the two fiscal years beginning July 1, 1891, the same appropriation as was passed by the last Legislature, viz.: $35,000, will be required.

Respectfully,

I. DeTURK,
President.

PROGRESS REPORTS

OF

JOHN H. WHEELER AND CHARLES A. WETMORE,

Chief Executive Officers.

REPORT OF JOHN H. WHEELER.

Read at the annual meeting, held June 9, 1889.

To the Board of State Viticultural Commissioners:

GENTLEMEN: In accordance with your instructions given me at the last regular meeting of the Board, I have made inquiry and investigations to determine the existence and extent of the vine disease, now commonly called the Los Angeles disease (now the Anaheim disease), in the northern vineyards of the State. At the time of this writing it seems safe to so denominate this evil, for its ravages, so far as I can learn, have been confined to Los Angeles County.

Soon after your last regular meeting, I sent circulars of inquiry to the vineyardists of the north, describing, in popular language, the manifestations which characterize the dying vines in Los Angeles County, warning vineyardists at the same time to carefully examine their vineyards and report to me any trouble similar to that described. Specimens from the diseased vines were asked for, to be sent me accompanying such reports.

In answer to these circulars, my attention was called to many other minor troubles encountered in the vineyards, but very few reported anything similar to the disease sought. Samples were sent from Sonoma, Napa, and Santa Clara Counties, which I forwarded to Professor Dowlen, the duly appointed specialist of the Board. He found on all the specimens a fungus identical with that existing on the diseased vines of the south.

My interpretation of Mr. Dowlen's reports, as a whole, leads me to understand that this fungus, which is common to all of the diseased vines of Los Angeles County, is the agent which performs the finishing work of destruction, though, perhaps, rendered more potent by antecedent causes not yet known or described.

The theory is amply proved:

First—In that the application of a fungicide arrests the decline of the affected vines, causing an apparent revival of the plant, which, however, falls again into a decline if left too long without a renewal of the application.

Second—In further support of this theory, I visited a number of our northern vineyards, from which samples were procured from apparently healthy vines—vineyards which at this time are in a magnificent state of vegetation and production. The samples, however, were taken from vines suffering from known causes or weakness, induced by causes other than disease. For instance, the canes growing from a spur nearly severed from the vine by the cultivator formed one sample; a late growing sucker lying on the ground, and consequently frosted before maturity, made another; a rank eucalyptus invaded a small part of the territory of an otherwise healthy vineyard, thus weakening a few vines growing near. Samples were taken from these impoverished subjects, etc. On all of these specimens the fungus common to the diseased vineyards of the south was found, thus proving that the final agent of destruction exists in the north, awaiting only to succeed to other weakening causes to accomplish destruction similar to that produced in the south. The primeval cause may not, however, and it is to be hoped that it will not, ever come to the vineyards of the north.

In order to reconcile my work in the northern vineyards with that of your special committee, Commissioner J. DeBarth Shorb, of Los Angeles County, I have recently visited the vineyard districts of the southern counties, and examined the work of Professor Dowlen, who is making special investigations at San Gabriel. This gentleman I must, in passing, commend to the Board as an earnest, conscientious student, whose efforts are characterized thus far by a manifest determination to be accurate, and to sacrifice all hypotheses and theories to an absolute determination of facts by systematic analysis.

With Professor Dowlen I visited many vineyards in Los Angeles County, and inspected the other districts alone. A careful examination of the vineyards of San Diego County failed to reveal any cause for alarm in that section. The raisin vineyards of El Cajon possess unusual vigor and show no sign of suffering from any cause, except be it want of system in pruning.

The vineyards of San Bernardino County were also found in a very magnificent state of early vegetation, with no manifestations of disease. I carefully inspected every vineyard about Riverside, for the fungus mentioned before in this paper had been found at Riverside, but found no deathblow dealt by it in this section.

In Los Angeles County, however, a close inspection was not necessary to reveal the common prevalence of the malady throughout its whole extent. I found no vineyards exempt from the trouble, and an examination of the wild vines near San Gabriel confirmed the report of Professor Dowlen as to their perishing in like manner with the cultivated vines.

In my judgment, the first cause of the evil is yet to be found, and until then vineyardists must operate with the Bordeaux mixture or the powder proposed by Mr. Shorb, to prevent the fungus found from accomplishing its final work.

The report of one vineyardist examined is terse and significant. During the summer this proprietor had noticed the languishing of the terminal leaves and buds of his vines, in a manner that signalized the approach of the evil. The prompt application of the weak Bordeaux mixture of lime and copper immediately revived them. Two weeks after they were noticed to languish again. A repetition of the first treatment again completely resuscitated them. This and other similar experiences noted and reported by Commissioner Shorb are sufficient to bring about a common reliance on the proper fungicides for ameliorating the condition of the suffering vineyards.

I found that the reports of the extensive ravages of the evil in Los Angeles County had not been exaggerated. The Santa Ana Valley, which once blossomed over with over five thousand acres of healthy and profitable vineyards, possesses less than five hundred acres to-day, and these in a suffering and apparently despondent condition. Commodious wineries, which once sounded with the busy hum of the joyful vintage, are now idle and silent. Professor Dowlen has already given to the public the order of resistance of many varieties of vines, one instance of which we observed together, and which I regard as worthy of special mention. The American varieties show a handsome growth and continue in good bearing in the midst of *viniferas* which have entirely perished.

If desirous of growing grapes of such quality, the proprietors may safely plant the Lenoir or Isabella in the affected region, securing healthy stocks, and favoring the vines with deep, heavy soil, choosing spots where summer irrigation is unnecessary.

The vineyardists of the afflicted region will be slow to replant their land to vines, though many are anxiously waiting and expecting to do so. For the benefit of these, I would suggest to Mr. Shorb and the Board the advisability of planting and maintaining an experimental vineyard in the midst of the diseased region, selecting for propagation those varieties which have proved most resistant, and are alike desirable, being careful to obtain all vines used for the purpose from districts totally exempt from damage by this cause. For whatever may be the original cause of the vines weakening, another century may now elapse without its recurrence, the probability of which is attested by the fact that the old vineyards have not before suffered from its attack.

Returning to my report proper, I can see no cause for general alarm in the north about this particular evil, for a diligent search has failed to reveal any vineyards, or even parts of vineyards, affected in the manner of those in Los Angeles County.

It was my desire and intention to visit the vineyards of Fresno and other central regions of the State, after becoming familiar with all phases of the disease in the south, but the limited time accorded me for completing this work proved insufficient.

In closing, I will state concerning the methods of producing tannin for the use of wine makers—which I was instructed to investigate—that I have written to proper authorities in France to secure their experience in the matter, the response to which letters will doubtless soon reach my successor for your use. For reports on other matters I must refer you to the appendices which have been issued from time to time, and to the correspondence had with vineyardists and newspapers, which of late has become more voluminous than I have known it before. The latter, if examined, will show a proper and commendable reliance on the Board in its labor of assisting vineyardists to overcome their many obstacles.

Very respectfully,

JOHN H. WHEELER,
Chief Executive Officer.

San Francisco, April 30, 1889.

REPORT OF CHARLES A. WETMORE.

Read at the semi-annual meeting, held December 9, 1889.

To the Board of State Viticultural Commissioners:

Gentlemen: A regular meeting of this Board is now in progress. Questions relating to the proposed legislation affecting viticultural interests will necessarily come before you for consideration, and in anticipation thereof I respectfully submit a brief discussion of our past efforts and the nature of difficulties encountered, together with suggestions as to future demands and policy of action.

THE SWEET WINE BILL.

This measure commands immediate attention and most careful consideration of policy.

The object to be attained should always be clearly stated and kept distinct from all possible complications. Stated simply, the producers of pure sweet wines desire to be relieved from internal revenue taxes on the pure grape spirits necessarily used in fortification at the place of original production. The fortification of any wines, free of tax, for exportation to foreign countries, only at the time of departure is another question much simpler in dealing with.

Our producers have in the past considered the several side issues raised when presenting their demand for relief on sweet wines, and have repeatedly announced the policy which our delegation in Congress should pursue. The whole industry is in sympathy with the producers of sweet wines, yet it demands that no concession to other interests shall be made in order to procure the desired relief, if such concession will be injurious to the permanent prosperity and welfare of all concerned. The principles on which all can stand and work together must be positively adhered to, and advice should be so given in unmistakable words to our Representatives and Senators in Congress. The most important of these principles are the following:

1. Every effort must be made to resist any attempt to abolish the Internal Revenue system.

2. No reduction in the general tax on distilled spirits, intended for use as beverages, should be permitted, with the single exception of the possible partial reduction on fruit syrups—so limited, however, as only to equalize cost of production for grain and fruit spirits. The abolition of the tax on fruit brandies should be religiously opposed as a measure dangerous in the extreme.

3. That an increase in the tax on distilled spirits would greatly benefit not only all pure wine producers, but also the moral tone of the entire liquor traffic, should be constantly remembered.

4. That the market value of alcohol controls the average market value of all ordinary wines should be considered a fixed principle not to be overlooked at any time.

5. The relief demanded by sweet wine producers should be granted, but strictly limited to producers at the original places of fermentation, to a stated quantity not exceeding 14 per cent of alcoholic strength; wines so fortified not to exceed 24 per cent and not to contain less than 4 per cent of saccharine matter; no use of saccharine matter other than the

pure product of the grape to be recognized as legitimate, excepting pure crystallized cane sugar, and no spirits for fortification to be free from tax excepting pure grape distillates. These limitations are absolutely necessary to prevent demoralization of the whole industry through the temptations to fraud, deceptions, and adulterations. Producers of pure wines who ferment their own products should be permitted to procure grape brandies out of bond for fortification, subject to careful supervision of Internal Revenue officers to prevent fraud; this provision being necessary to satisfy wine makers who have no distilleries, and especially to promote harmony between producers in different States.

6. The advantage to be gained by obtaining the privilege to fortify sweet wines free from taxation would not compensate for the harm that would be done by violation of any one of the principles stated above, or by failure to enforce any of the limitations and restrictions mentioned.

The present condition of affairs is a lamentable one, but the difficulties under which we suffer, and the advantages to be gained by relief for sweet wines, should neither be exaggerated nor carelessly stated.

Under the laxity of the revenue laws applying to distillers of grape brandies, fraud in fortification of sweet wines can only be partially suppressed, and collusion with revenue agents can be practiced without fear of detection. The justice of the demands of the producers and a liberal interpretation of true intent of the law have in the past influenced the national administration to such an extent that very little attempt has been made to prevent the use of brandies by distillers in legitimate fortification of sweet wines. This overlooking of the strict letter of the law has, however, done more to demoralize the industry than strict enforcement can do harm. The majority of wine makers have not dared to assume the risks of acting under implied, but unauthorized, permission to do otherwise than as the law requires. Producers have not reaped profit from the situation. Wines have been offered in competition of trade in accordance with the cost of production. Those who have fortified at least cost have sold correspondingly low, and thereby made it impossible for others, who have been more scrupulous, to enter the market or to purchase tax-paid brandies for fortification. In some cases wine makers who were compelled to make sweet wines owing to over-ripeness of grapes, have been equally compelled to purchase grain alcohol for fortification, because it has been cheaper than tax-paid brandy. If the law had been strictly and continuously enforced, no doubt there would have been some diminution in the production of sweet wines; but the quality on the market would have been finer, different producers would have been engaged in it, and the prices would have been higher. The low prices of the past have benefited only the eastern jobbers.

The stringent enforcement of the law under the present administration has caused some good as well as some bad results; but worst of all is the tendency towards a general attack on the Internal Revenue system.

It has done good in compelling sweet wine producers to unite in demanding a change of the present law; also in bringing up the price of sweet wines so that legally made products may be profitably offered. This of itself, if continuously and honestly adhered to by the Government, will partly relieve our wine makers from necessity to use grain alcohol when they have no distilleries. The increase of price will, however, without doubt limit our production by rendering competition more difficult; the increase of revenue to the Government is not desired by

the people; in fine, the situation, while better than under unauthorized license, is not one of which Congress may feel proud. There is, however, no confidence in the permanency of the present policy of the Government, and there can be no guaranty of honesty on the part of its agents. Even now, doubts are freely expressed as to whether all wineries where sweet wines are made are equally supervised. The opportunity for collusion without fear of detection is certain to produce fraud, and no matter how pure the intentions of the Washington office may be, the people will believe that agents appointed through political influence will exercise favoritism more or less.

We cannot continue under these conditions of affairs without either one of two remedies being applied, viz: to enforce the letter of the law impartially, the Government must assume greater control of all fruit distilleries, appoint storekeepers, etc., or the right to fortify without tax must be granted. The first of these remedies would be costly to the Government and would necessarily restrict the number of distilleries, and so break up all the small producers for the benefit of a few rich men. Rather than to permit this result, viticulturists would prefer that the Government should simply tax all wines for the proportion of alcohol contained exceeding 14 per cent, taking no account of grape spirits at distilleries reconverted into wine. This might in some respects be the best of all remedies, because no tax-paid grain spirits could be used. The Government will not, however, give any consideration to new laws having in view the increase of internal revenue collections, as such are not needed.

Revision of Customs and Internal Revenue laws is the avowed policy of all parties, and the object is reduction of revenue; therefore, the present demand of sweet wine producers is in full accord with the governmental policy of the country, and no unreasonable opposition need be feared if our industry does not carelessly disturb other interests and political systems.

It is not because we ask relief from taxation that serious opposition is encountered, but because in asking such relief the method of obtaining it involves complications that are apparently difficult to harmonize.

In the first place, the system of collecting internal revenue is easily jostled by changes that give cause to fear openings for fraud. It is therefore absolutely essential that experts in the service shall be fully satisfied that the provisions of any new law relieving one class of producers from taxation shall not contain loopholes for a perversion of its true purposes. To this end the Commissioner of Internal Revenue becomes necessarily, by being called upon by committees of Congress, an important factor in framing the new law to suit the new demand. When our Commission presented the Sweet Wine bill and Pure Wine bill to Congress, it was the advice of Commissioner Miller and his assistants that was first demanded by both the Democratic House and the Republican Senate. With his aid bills were framed, which he was ready to approve as "operative for the purposes intended"—leaving no suspected loopholes for fraud, notwithstanding he objected to the general policy of passing them. During the future terms of Congress our producers must meet this same difficulty, for it is practically impossible to secure the assent of Congress to a bill which is reported by experts to be "inoperative," although Congress may override the opinion of the administration on a question of policy.

There is no reason to suppose that any organized hostility exists anywhere in this country against our industry, unless it be in the ranks of Prohibitionists. There is no reason to believe that a Republican protective tariff party desires to enlarge the scope of internal revenue influence. There is in reality no whisky ring; no ring of any kind to fear, although there may be in some parts some conflicts of interest. The Fractional Gallon bill, to which the first draft of the Sweet Wine bill was attached as an amendment, was favored by the distillers of Peoria, opposed by those of Cincinnati, and was a matter of indifference to those of Kentucky. Our Sweet Wine bill was warmly favored by Kentucky, Tennessee, and Maryland distillers, also by the pure wine makers of Virginia, North Carolina, and New York; opposed by the neutral spirit producers of Illinois, and the compounders of bogus wines of Ohio, and was a matter of practical indifference to the distillers of Cincinnati. The Peoria distillers happened to have special influence over Mr. Morrison through their local Representative, and that is the only reason the bill was not concurred in as an amendment to the Fractional Gallon bill. A very little trouble in conference with the Peoria distillers would have convinced them that they had nothing at stake worth fighting for; but the usual Granger fight occurred here just at the critical time, and nothing was done to complete a victory more than half won. The situation has not changed, except for the better. Now the committees of both Houses of Congress and the Treasury Department are in harmony politically, and it would be folly for our producers to work up a false excitement directed against the motives of the Administration, or in sympathy with those who would be glad to gain strength in favor of the abolition of the internal revenue system.

Recollect that when a Republican Congressman advocates abolition of all taxes upon distilled spirits, he is making more friends among Prohibitionists than among wine makers or distillers. Recollect, also, that when a serious outcry is made against the entire internal revenue service, it is very pleasing to a certain extreme school of Protectionists, who see in such a policy an easy road to overcome threatened dangers to the tariff.

It is more than probable that the demand for a rigid enforcement of internal revenue laws applicable to sweet wine came from some of our own producers, who found themselves unable to compete with illicit production. And we have more men to fear in this State who view vine growing and wine making only as a temporary speculation than we have active enemies among whisky distillers. There is now a disposition among some who are influential to trifle with the principles upon which our permanent prosperity depends. The man who would please both the Prohibitionists and the wine makers in such questions must be considered an unsafe leader for us. The man who will risk the greater interests of the whole industry to gain temporary relief for a small branch of our work must be invited to counsel with the whole body of producers before he is permitted to announce our policy.

I would suggest, therefore, that this Commission should call a Convention as soon as possible to determine, first of all, what general principles must be preserved at all hazards, and to lend collective aid to the sweet wine producers; also, that the sweet wine producers form an association to further their special wants in harmony with the interests of the whole, and that such association shall first disavow any intention of fostering any party opposed to the maintenance of the internal revenue service.

Respectfully submitted.

CHARLES A. WETMORE.

REPORT OF CHARLES A. WETMORE.

Read at the annual meeting, held June 9, 1890.

To the Board of State Viticultural Commissioners:

GENTLEMEN: By limitation of office, my term as Commissioner for the San Francisco Viticultural District has expired, and with it my position as President of your honorable body, although I still remain your Executive Officer by election of the Board of Commissioners. I desire to express my most sincere appreciation of the courtesy and confidence with which I have been uniformly treated as your presiding officer during the past two years.

As retiring President, I have no report to offer; as Executive Officer, I shall be ready to file my report as soon as I have completed certain revisions now being made, which pressure of other matters has delayed.

The most important question which has recently arisen requiring your serious attention is that involved in the late decision of the United States Supreme Court and the legislation now pending in Congress relating to interstate control of fermented and alcoholic liquors in unbroken packages passing into States where prohibition laws prevail. Very urgent appeals have been made to secure the influence of California against the passage of the pending bill to relegate to the States the entire control of this so called temperance question. Upon retiring from office as your President, I can think of no more important suggestion than this, viz: that the State Viticultural Commission of California should immediately direct its officers to urge the California delegation in Congress to favor the passage of the pending bill authorizing the several States to control the sale of fermented and alcoholic drinks, free from all interference on the part of the National Government. This question should be one of State control, and all differences of opinion should be suffered to be subject to State legislation. The defeat of the pending bill would result in national agitation, unwholesome and unnecessary.

A very general demand has been made by producers for an extension of the system of exhibiting viticultural products and private brands to important trade centers, such as New York, Chicago, and London. The plan adopted for the Platt's Hall exhibit, might, with some modifications, be followed in those cities as rapidly as the funds of the Commission permit. This method of popularizing our products is exceedingly popular and useful, and is opposed only in the interest of a few wholesale dealers who desire to monopolize all the profits of the industry. I am of the opinion that a special committee should be appointed as early as possible to take this question under consideration, or special instructions should be given to the Executive Committee expressing the future policy of the Commission in this respect.

Considerable indignation has been expressed by producers against the public charge, made by the California agent of the Agricultural Department of the National Government, Mr. George Husmann, reflecting upon the future prospects of California clarets. At a public Convention in San Francisco, from a written paper, he made the statement that "California would never excel in her clarets." This assertion, coming from one supposed to be in authority, in the face of the great success already achieved by our growers, is exceedingly offensive, as well as unjust, and should be repudiated by the United States Department of Agriculture.

In conclusion, I am happy to be able to congratulate producers upon their improved prospects for profitable markets. New elements in trade are being developed rapidly, and foreign markets are being tested by public spirited merchants, whose policy will be to grade and purchase our wines in accordance with relative merits. The depression that has prevailed during the last two years cannot continue much longer.

CHARLES A. WETMORE.

REPORTS OF CLARENCE J. WETMORE,

Manager of the Hall and Experimental Cellar.

FIRST REPORT.

Read at the annual meeting, held June 11, 1889.

To the Executive Committee of the Board of State Viticultural Commissioners:

GENTLEMEN: As Manager of the Permanent Exhibit and Experimental Cellar, I respectfully submit the following report, showing the work that has been accomplished up to the present time.

When the Commission decided to open a permanent exhibit of viticultural products, the store under the Mechanics' Library, on Post Street, was selected as the place for holding such an exhibit. After consulting with the Trustees of the Mechanics' Institute, the idea of taking the store mentioned was abandoned, owing to the many restrictions placed upon us, which if agreed to would have made it impossible to carry out our plan of work. After looking around for some time for another place, your committee decided to rent Platt's Hall, at a rental of $350 per month. Upon receiving word from the Attorney-General that it would not be lawful for the Commission to sell wines or brandies on its own account, your committee decided to lease a portion of the hall for a café, in which wines on exhibit would be sold to those wishing to sample them.

Acting on instructions from you, I had the hall fitted up for occupancy. On the right of the hall offices were made for the use of the Commission, and a portion partitioned off for an exchange. On the left a portion was partitioned off for a café, and back of it a place was made to store the samples for use in the café. In the main center of the hall wire frames were placed, on which the samples sent by exhibitors were displayed. The cost of fitting up the hall was as follows:

Fixtures	$445 00
Carpenter's bill	1,419 00
Plumbing	152 38
Painting	263 85
Vineyard scene	125 00
Wire frames	176 00
Furnace, etc.	283 91
Total	$2,865 14

While the hall was being fitted up I sent out a circular to all the leading wine makers and merchants of the State. In answer to the circular thirty-five exhibitors have placed their wines and brandies on exhibition, and thirty-three of them have them on the wine list used in the café. Besides the samples of wines and brandies, there are exhibited a continuous still, fermenting and storage tanks, vineyard plow, wine pumps, combined stemmer and crusher, wine presses, elevator, corking machines, bottle-washing machine, capping machine, corks, capsules, bottles, clarifying material, demijohns, etc.

Before opening the hall the café was leased to Mr. Pierre Klein, proprietor of the Occidental Restaurant, at a rental of $50 per month. The hall was opened on January fifteenth, and Mr. Klein paid $25 for the half month ending January thirty-first. It was then found that the profits derived from the sale of wines, being 10 cents for pint and 20 cents for quart bottles, was not sufficient to warrant him in paying such a rent; so no rent has been charged him since February first. The business of the café has been slowly but steadily increasing, but the profits are not yet sufficient to warrant the lessee in keeping it up, and a short time ago he signified his intention of leaving. A meeting of your committee was called on March thirtieth, and you agreed to allow him 20 per cent of the case prices on all sales made in the café, and to be allowed on sales from August first; this 20 per cent to be in addition to the service charge. On these terms Mr. Klein agreed to stay, and the café is still running.

You will see from the following figures that the popularity of the café has not decreased, but rather increased:

Bottles Sold in—	Number.	Corkage.	Cash Receipts.	Reserve Fund.
January	504	$60 10	$180 30	$42 50
February	572	61 40	196 10	
March	606	62 85	200 45	24 55
April	634	65 45	235 25	29 80

The Reserve Fund is the difference between the price per single bottle, after deducting the service charge, and the case price charged for one dozen bottles; out of this Reserve Fund the bills for printing the wine list are paid. About three hundred a month are printed and distributed to persons visiting the hall. Since the opening of the café, a great many eastern wine merchants have visited it, and have found out, by sampling the wine there, just the wines they wished to purchase. Others have been surprised at the fine wines exhibited there and have decided to go into the wine business. Residents of this city and Oakland, by visiting the café, have found out the brands of wine that suit their tastes, and are now regular customers of the exhibitors of those wines. One party ordered a pint bottle of nearly every wine on exhibition and had the lot sent to New York to be sampled there. These few instances show the good work the café is doing and demonstrate plainly that it must be kept up. The money received from the lessee of the café is deposited in the Anglo-Californian Bank. An account is rendered to the exhibitors every two months, and a check given for the amount of their sales.

Those parties who take an interest in the success of the café and come there often with their friends are the ones that reap the most benefit from it, as is shown by the sales made of their wines. Some of the exhibitors never enter the café, and seem to give it the cold shoulder. They do not seem to realize the fact that we are furnishing the best advertising medium possible, and at no expense to them. Those that try to make the place a success will reap the benefit in the end.

The plans for operating the Exchange Department have not as yet been perfected. Your committee appointed a special committee, consisting of Arpad Haraszthy, H. W. Crabb, and I. Landsberger, being one merchant, one producer, and one broker, to draw up such rules as they thought best for operating this department. This committee met several times, but could arrive at no conclusions. It is hoped that something will be done soon to place this department in running order. A number of producers have made use of the lockers in the Exchange, and have placed their samples in them, and a few have effected sales. In this department I am prepared to test, free of charge, the amount of alcohol or acids in wines. So far I have tested twelve samples for alcohol.

READING—ROOM.

In the center of the hall a place is laid off for a reading-room. Country newspapers and periodicals are kept on file for the convenience of those wishing to use them.

EXPERIMENTAL CELLAR.

In the cellar connected with the hall a place was fixed to store the wines we had collected, and which, up to the time of occupancy of this hall, were stored in a cellar at Clay and Leidesdorff Streets. Most of the wines are in good condition, but the dry cellar is showing its effect on the white wines, and some of them are taking on a slight sherry flavor. It is very evident that white wines cannot be aged in such a cellar. I have no doubt but that good sherries can be made in our cellar, and would suggest that a room be fitted up for that purpose where the temperature can be raised above what it is now. Most of the wines in the cellar will need to be bottled before the end of the year, and for that purpose several thousand bottles will be required.

Last January I sent to the Paris Exposition, through the Department of Agriculture at Washington, D. C., two bottles each of the following wines and brandies in our cellar:

Zinfandel—1886 and 1887.
Mataro—1886 and 1887.
Carignan—1886.
Mondeuse—1886 and 1887.
Petite Syrah—1886.
Cabernet Franc, Cabernet Sauvignon, and Verdot (blend)—1886.
Cabernet Franc, Cabernet Sauvignon, and Merlot (blend)—1886.
Cabernet and Tannat—1886.
Burgundy—1886.
Petit Pinot—1887.
Johan. Riesling—1886.
Franken Riesling—1886.
Sauvignon Vert—1886.
Chablis—1886.
Sauterne—1886.
Semillon—1886.
Chauche Gris—1886.
Meunier—1886.
Port—1886.
Brandy—1883 and 1886.

The samples were all labeled and marked No. 1, 2, 3, etc., with a record kept showing what wines corresponded to the numbers, so that if any mention is made of number due credit can be given the proper one.

Respectfully submitted.

CLARENCE J. WETMORE,
Manager.

SECOND REPORT.

Read at the semi-annual meeting, held December 9, 1889.

SAN FRANCISCO, December 9, 1889.

To the State Viticultural Commissioners:

GENTLEMEN: As Manager of the Hall and Experimental Cellar, I beg leave to submit the following report:

It is now eleven months since the Permanent Exhibit and Viticultural Exchange was established in Platt's Hall, and I am happy to say that the undertaking has been a great success. Since making my last report six more exhibitors have placed their wines and brandies in the hall, while not a single exhibitor has withdrawn his exhibit. There are at the present time forty-one exhibitors, of which thirty-nine have their wines for use in the café. Alameda County has four exhibitors, Napa County eight, Sonoma County three, Santa Clara County five, Fresno County three, San Joaquin County one, Los Angeles County three, and Santa Cruz County two. Of the wine merchants who do business in San Francisco, eight of them have their exhibits in the hall.

The business of the café, although falling off for a few months, has kept up well, and the sales for November were the largest of the year. If all the exhibitors would take more interest in the success of the café, the place could be made one of the best distributing mediums in the State. Every facility is given exhibitors to show their samples and make sales, and those who have given the most attention and helped to keep up the success of the café have reaped the most benefit. A great many cases of different samples of wines and brandies on exhibit have been ordered sent to people in the East. One lot of seventeen cases was sent to a party in Washington, D. C., and he has written back that he is now better pleased with California wines than he ever was before. The following table will show the monthly sales made through the café during the eleven months of the year:

MONTH.	No. of Bottles Sold.	Amount Received.
January	503	$240 40
February	514	257 50
March	537	263 30
April	547	300 70
May	411	218 00
June	317	162 95
July	328	173 95
August	331	170 90
September	298	161 50
October	614	281 15
November	617	282 90
Total for eleven months	5,017	$2,513 25

The money was distributed as follows:

Corkage	$505 70
Reserve Fund	204 75
Twenty per cent of case prices given to café	216 70
Paid to exhibitors	1,310 70
Freight and express charges	44 50
Balance due exhibitors	230 90
	$2,513 25

From the Reserve Fund, $84 75 was paid for printing the wine lists and $4 90 for ice, leaving a balance of $115 10. From three to five hundred wine lists are printed monthly and distributed to the people visiting the hall. I would suggest that a portion of the Reserve Fund be used in advertising the exhibit, so that strangers coming to San Francisco may be posted on what we are doing.

Plans for carrying on the Exchange Department have not yet been perfected. Quite a number of the lock boxes are used by producers to store their samples in, and a few sales have been made. In this department during the year I have tested fifty-five samples of wine for alcohol, which have been brought or sent to me from different portions of the State. Tests were made free of charge.

The wines in the Experimental Cellar have been cared for, and some of them bottled. During the past vintage I fermented two hundred and fifty pounds of Palomino grapes, and three hundred pounds of Pedro Ximines grapes, which were sent to me by E. W. Maslin, of Placer County. The wine made from the grapes I have kept separate, and will convert it into sherry. I also fermented two hundred pounds of Semillon, Sauvignon Blanc, and Muscadelle du Bordelaise grapes, from J. A. Hudson, of Elmira, Solano County. The wine is now in good condition, and promises well.

I will state that the only gold medal awarded at the Paris Exposition for California brandy was awarded to this Commission for the samples sent from our cellar.

The shortage on this year's wine crop has developed a better feeling in the industry, and I hope that the new work begun by this Commission will show even better results next year.

Respectfully submitted.

CLARENCE J. WETMORE,
Manager.

THIRD REPORT.

Read at the annual meeting, held June 9, 1890.

SAN FRANCISCO, June 9, 1890.

To the Board of State Viticultural Commissioners:

GENTLEMEN: As Manager of the Hall and Experimental Cellar, I respectfully submit the following annual report, showing the work that has been done during the past year: The plan of work outlined in my last yearly report has been carried out during the past year, and I am glad to announce that the work has been attended with more success than was at first anticipated. Since making my last annual report nine more exhibitors have placed their wines in the hall, and only one has withdrawn. Of the new exhibitors two are from Alameda County, four from Santa Clara County, and three from Fresno County. Altogether there are now forty-three exhibitors, and forty-two of them have their wines for use in the café.

Last December the Placer County people asked permission to make a display in this hall of the products of their county. The request was granted, and all the space possible was given them. The exhibit lasted for two weeks, and during that time from thirty to forty thousand people visited the hall.

Permission was also granted the Fruit Union to hold their annual meeting in the hall. Accommodations have also been provided for the monthly meetings of the Grape Growers and Wine Makers' Association. Several applications have been received to rent the hall for other purposes, such as auction sales, lectures, etc., but the requests were not granted. If the Commissioners think it advisable to rent the hall for such purposes, the rent can be reduced considerably in that way.

The business of the café has kept up reasonably well, considering the support given to it by both producers and merchants. A number of the exhibitors have not entered the café during the year, and the work of keeping it up has been left entirely to a few exhibitors and the officers of the Commission. The result of their work is given below. United action on the part of the exhibitors would do much to increase the popularity of the place, and by so doing every exhibitor who has his wines for sale would be benefited. The following tables show the business done in the café during the year:

MONTH.	Number Bottles Sold.	Amount Received.
June	317	$125 10
July	328	136 40
August	321	131 15
September	298	126 35
October	614	247 95
November	617	258 30
December	715	316 50
January	437	182 05
February	491	197 25
March	350	177 25
April	515	205 70
May	458	128 75
	5,471	$2,232 75

The disbursements were as follows:

Paid to exhibitors	$1,509 05
Twenty per cent premium to café	349 25
Reserve Fund	246 35
Balance due exhibitors	128 10
	$2,232 75

The corkage on the wines sold in the café, allowed the proprietor, amounted to $427 05, and this added to the 20 per cent on cased prices, or $349 25, gives $776 30 as the total amount the café received for the sale of wines.

The amount credited to the Reserve Fund from sales in the café since the opening amounts to $344 50. From the sale of bottles, cases, and tules, $68 50 has been realized and the amount placed in the Reserve Fund, making a total of $413. The disbursements out of this fund were as follows:

Printing wine lists	$84 75
Ice	4 90
Advertising	125 00
Special article in wine edition of "Examiner"	150 00
Checkbook	75
	$365 40

Carrying a balance of $47 60.

Through instructions from the Executive Committee I had our wine list printed in the special wine edition of the "Examiner," agreeing to pay for the same $150 out of the Reserve Fund, and to collect $5 from as many of the exhibitors as were willing to pay, and to turn the amount collected over to the "Examiner," the whole amount to be paid for the article not to exceed $300. So far I have collected $70 from the exhibitors. Three thousand copies of the paper were given us, and they have been mailed to all our correspondents. Already I have received a number of letters from parties wanting samples of wines, and asking how they can be sent to them.

The number of empty bottles on hand in the store-room is as follows:

Claret, quarts	36
Claret, pints	2,100
Hock, pints	365
Hock, quarts	66
Champagne, pints	149
Champagne, quarts	66
Brandy (white)	50
Brandy (black)	43
Sauterne, quarts	43
Sauterne, pints	33
Total	2,952

The amount received for these bottles, when sold, will be placed in the Reserve Fund.

During the year I have tested seventy-one different samples of wines for alcohol, and four samples for acid. The alcoholic test was made by means of the ebullioscope, and the acid tests by Twitchel's acidimeter. The above tests were made free of charge.

The wines in the Experimental Cellar have been cared for, but have not been bottled. Some of them need bottling, and I would suggest that the committee in charge of the Experimental Cellar examine the wine, and instruct me which samples to bottle. I would also suggest that a small room be fitted up in the cellar to be used as a sherry-room. The expense of fitting up such a room would be small, and the room can be heated by means of a gas stove. There are a number of wines in the cellar that I am endeavoring to make sherry of, but the development is slow, owing to the coolness of the cellar.

Several improvements are needed in the hall, but lack of funds has prevented the making of them. I would suggest the fitting up of the entrance in a more attractive way, and that more lights be put in the roof.

Respectfully,

CLARENCE J. WETMORE,
Manager.

REPORT OF ISAAC DeTURK,

Commissioner for the Sonoma District.

SANTA ROSA, CAL., September 18, 1890.

To the Board of State Viticultural Commissioners:

GENTLEMEN: I beg leave to submit the following viticultural report for the Sonoma District, as required by the blanks furnished by the State Board (for the new directory now being compiled), together with other matters coming under my personal observation, that may be of interest to the Board.

The work has been laborious, and has taken considerable time, as every section has been visited, and nearly every vineyard has also been visited.

Fully three fourths of the vineyards of the district are located on the hills and mountain sides, which made the labor of gathering statistics more arduous and difficult.

I have found in the district nine hundred and twenty-five vine growers who cultivate five acres and upwards. Of these, eight hundred and forty-two are located in Sonoma County.

The following statement shows the number of owners, acres in vines, and product of each county:

SONOMA COUNTY.

Vine growers having five or more acres	842
Total acreage in vines	22,683
Total acreage in bearing vines	21,053
Total amount of grapes, in tons, for year 1889	41,013

LAKE COUNTY.

Number of vine growers, five acres or more	48
Acreage in vines	1,061
Acreage in bearing vines	1,008
Tons of grapes, product of 1889	2,148

MENDOCINO COUNTY.

Number of vine growers, five acres or more	20
Acreage in vines	204
Acreage in bearing vines	183
Tons of grapes, product of 1889	343

MARIN COUNTY.

Number of vine growers, five acres and upwards	15
Acreage in vines	502
Acreage in bearing vines	441
Tons of grapes, product of 1889	637

RECAPITULATION.

Total number of vine growers in the district	925
Total number of acres in vines in the district	24,450
Total number of acres in bearing vines in the district	22,685
Total number of tons, product of 1889	44,141

To the total acreage in vines for the district might be added at least five hundred acres of small vineyards of less than five acres, planted merely for family use. This will increase the total acreage of the district to at least twenty-five thousand acres in round numbers.

The total number of acres planted to table grapes exclusively is four hundred and eighty-five, the varieties being Muscat and Tokay.

From personal observation and from conversation with the vineyardists and wine men of the district, I have obtained the following information on subjects pertaining to the grape and wine interests:

The great body of vines in the district are planted on rolling hills, or on the mountain sides, exposure to the sun being observed in the location of the vineyard. The soil upon which vines appear to produce the best quality of grapes—especially for wine purposes—is either a red gravel, or clay, or white volcanic ash, in which there are more or less properties of iron. This character of soil is confined almost exclusively to the hill and mountain lands, and hence the greater number of vineyards are located on higher lands.

The valley lands produce a greater growth of vine, and a larger yield of berry, but at the expense of quality.

The product of the year 1889 has been somewhat difficult to arrive at, as many vineyardists lost a great part of their crop by the early rains; yet by a careful approximation the result of the report has been arrived at.

The vineyards all over the district are looking exceedingly well, and I find no failure, except in the Sonoma Valley. Here the ravages of the phylloxera have decimated many vineyards, the pest slowly but surely creeping along the whole extent of the valley. So far no remedy against this insidious enemy of the vine has been discovered. The only recourse the vineyardist has, is to replant with resistant vines. This is being generally done, although many vineyardists have become discouraged, dug up their vines, and planted their ground to other crops.

But little additional acreage has been set to vines in the past two years. Those planted will about equal the number torn out and killed by phylloxera.

In a few localities the effect of the low prices obtained for grapes last year is apparent, the vineyards having been neglected and not properly cultivated. The result is that a poor crop will be gathered on these lands.

The great body of vine lands and vineyards are to be found in Sonoma County. The counties of Marin and Mendocino, with a long fog belt extending inland fifteen or twenty miles, have but little land favorably situated for vine growing. Late frosts prevent the realization of a crop in the valleys of northern Lake and Mendocino Counties.

The southern portion of Lake County is admirably situated for vine growing, the climate and soil being all that could be required; yet the great distance to market and absence of transportation facilities have made vine growing unprofitable, so far, in this section.

Many vineyardists contemplate setting out more of their lands, or resetting dead vines with the table varieties—Muscats, Tokays, etc.—as they appear to be longer lived, and resist the ravages of the phylloxera better than other vines. At the same time they command a better price in the markets.

But little loss has been sustained from mildew or sunburn the present season. What loss has been incurred from these causes is due to carelessness and injudicious pruning.

The grape crop of 1890 will average about the same as that of 1889.

There are many thousand acres of good vineyard lands, as yet unimproved, not only in Sonoma, but in Lake and Mendocino Counties. In the last two counties named, the hill lands—where thermal qualifications are favorable—appear to be especially adapted to growing a good quality of the grape, the soil being almost wholly the red gravelly clay, or volcanic ash, considered best for the grape. At the same time, these lands are as yet comparatively cheap. The low prices obtained for grapes the past few years, as well as the stagnation ruling in the wine market, added to absence of transportation facilities, have kept these valuable vine lands from being improved. With a better market, and more favorable conditions, these sections will become heavy vine-growing districts.

By far the largest variety of grape grown in the district is the Zinfandel (this being peculiarly the wine grape). The Golden Chasselas, Burger, and Black Malvoisie come next, while some vineyardists affect a mixture of all the foreign varieties.

At present, most of the wine cellars of the district are empty, or nearly so, the vintage having been shipped to the market or stored.

A large proportion of the present season's grape crop in the northern part of Sonoma and the southern part of Lake County has been contracted to parties for drying purposes.

It has been impossible to obtain an estimate of the wine manufactured in the district during the past year, as the cellarmen have been inclined to be reticent on that point for fear the information might have an unfavorable effect on the wine market.

A considerable quantity of the wine product has been, and is being, manufactured into brandy.

In conclusion, I will say that I have used every endeavor to obtain a complete and exact report as required by the State Board, and nothing has been omitted that careful attention could accomplish.

All of which is respectfully submitted.

ISAAC DeTURK,
Commissioner for the Sonoma District.

METEOROLOGICAL RECORD

Of Observations Taken by Station Agent George R. Stone of the Southern Pacific Company, at Santa Rosa Station, from August 1, 1888, to August 31, 1890, a Period of Two Years.

Months.	Temperature.			Rainfall—Inches.	Weather.		
	Max.	Min.	Mean.		Number of Days Clear.	Number of Days Cloudy.	Number of Days Partly Cloudy.
1888—August	98	50	71	....	20	1	10
September	95	53	64	1.62	20	3	7
October	85	35	63	....	18	1	12
November	81	32	53	3.48	15	11	4
December	69	40	51	5.37	5	23	3
1889—January	69	28	47	1.77	23	7	1
February	72	25	44	.35	22	5	1
March	79	35	53	7.92	15	14	2
April	81	43	58	1.09	14	12	4
May	83	42	59	2.93	15	13	3
June	88	52	65	.25	24	3	3
July	90	46	67	....	25	1	5
August	86	45	66	....	24	....	7
September	90	42	65	....	24	3	3
October	82	44	62	8.78	14	17	....
November	76	34	55	4.39	17	13	....
December	66	32	49	9.47	9	22	....
1890—January	60	27	42	12.84	6	25	....
February	66	28	43	4.74	10	17	2
March	68	34	53	6.13	11	19	1
April	78	40	53	1.82	14	11	5
May	95	43	62	1.40	18	8	5
June	86	42	64	....	23	2	5
July	100	51	67	....	25	....	6
August	88	48	65	....	20	1	10
Totals	....	....	....	82.33	431	232	99
Average	84	35	57	41.16	18	9	4

REPORT OF E. C. PRIBER,

Viticultural Commissioner for the Napa District.

NAPA, August 20, 1890.

To the Board of State Viticultural Commissioners:

GENTLEMEN: It is not very gratifying for the undersigned Commissioner for the Napa District to make his annual report at a time when the conditions of the wine industry are so deplorable as they are at present; but it is with special pride that we can claim for this district, that with all the hard times, the low prices for wines, and the terrible destruction by phylloxera, it shows wonderful improvements, and has gained, during the past few years, a high reputation for the qualities of both its wines and brandies.

The difficulty found in disposing of the young wines at a remunerative figure has forced many growers to hold their products, to buy the best oak cooperage, and to build new cellars. This, as it might be called, "forced retention of aged wines," has enabled them to seek and to find a profitable market with the consumers here and outside of the State.

NAPA COUNTY

Has improved immensely in its cellar facilities. Of nearly five hundred growers, more than one hundred make their own wines. About fifty of them have stone cellars, partly underground or tunnels. The total cooperage in the valley reaches ten million gallons.

While it is true that very little wine of Napa Valley is offered on the San Francisco wholesale market at present, large quantities of the last three vintages are still held by the growers, who can give their product proper care and time to develop those qualities which command a remunerative figure.

These terribly hard times have taught this valuable lesson: that not all wines made are excellent, and not all can be judiciously aged; and thus learning to discriminate, the grower prefers to send all doubtful wine to the distillery to putting it on the market, or to aging it, and by doing so injuring both his reputation and that of his district.

We have thirty-five registered distilleries in Napa County, which have reported to the Internal Revenue Department two hundred and forty-two thousand one hundred and eighty gallons of brandy, from October 1, 1889, to August first, of this year. Quantities of this brandy have been shipped to Europe, where our Napa brandies have gained an excellent reputation.

The ravages of the phylloxera have been more noticeable than ever before. Only about 10 per cent of the fifteen thousand acres are planted in resistant vines. The experience with resistant vines in France, where the production is now rapidly increasing, in consequence of the replanting of those vineyards which were destroyed by the phylloxera, should teach us a lesson. It cannot be impressed too strongly upon our growers

that the replacing of their diseased vines by *Riparias* is the only true salvation for their vineyards, and it might be advisable for our Board to consider if our funds, and the law which appropriates them, would not permit the furnishing of *Riparia* roots to the wine growers. We would also recommend to use all efforts in inducing the growers to pull out and burn up all diseased vines, the present condition of affected vineyards in this State containing these diseased vines making them hotbeds for the propagation of this plague. Experience has shown that where diseased vines have been pulled out and destroyed, the progress of the phylloxera has been comparatively slow.

This year's crop in Napa County will be smaller than those of 1888 or 1889. The shortage is caused mostly by the ravages of the phylloxera, and somewhat by coulure and sunburn. The Zinfandel, which is by far the most predominating grape, did not set as fully as usual, and will yield a light crop. The white grapes are looking very healthy, and give promise of a beautiful crop.

SOLANO COUNTY

Is one of the few counties where table, raisin, and wine grapes (suitable either for drying purposes or the manufacture of sweet or dry wines) are cultivated to perfection. This county has about three thousand acres in bearing, of which about one thousand acres are used for table grapes. The product of five hundred acres is made into raisins, and one thousand five hundred acres are in wine grapes.

In the northern part, around Dixon, we have about five hundred acres in grapes, nearly one half of which are cultivated for raisins alone. The balance of the grapes will be dried this year—in fact, most of them are already contracted for. In former years, a couple of hundred tons of grapes were sent from this neighborhood to the wineries at Cordelia, Napa City, and San Francisco. No wines will be made in this locality the present year.

In the Vacaville section, including Pleasant Valley, most of the grapes are sold for table use. The few vineyardists having wine grapes will dry the present crop. In Pleasant Valley a great many vineyards are partially destroyed by phylloxera. Vineyards near Vacaville look healthy, are well taken care of, and do not show much signs of phylloxera. They prove to be an excellent investment this year. Only a few small wineries exist here, the production of which does not figure largely in the great market.

The vineyards around Cordelia, including Suisun, Fairfield, Benicia, and Green Valley, are planted solely to wine grapes. The climatic conditions do not favor raisin culture and scarcely permit the drying of their product. We have many wineries in this vicinity, which, as the phylloxera has made considerable progress, and has destroyed already hundreds of acres here, are fully able to handle the present crop, which looks very promising. Some grapes near Fairfield make very good sweet wines, but the larger part of the product of the wineries is light, dry wines from grapes grown on the hills surrounding Green Valley and the slopes near Benicia. Solano County may now have two hundred thousand gallons of wine in its different wineries and cellars, and will produce not more than five hundred thousand gallons this year.

CONTRA COSTA COUNTY,

Which produces largely table grapes, lost a considerable portion of last year's crop by early rains. This year's crop is very promising. The wine production in the county may reach four hundred thousand gallons during the coming vintage.

Respectfully submitted.

E. C. PRIBER,
Viticultural Commissioner for the Napa District.

REPORT OF CHARLES BUNDSCHU,

Commissioner for the San Francisco District.

SAN FRANCISCO, October 25, 1890.

To the Board of State Viticultural Commissioners:

GENTLEMEN: I am gratified in reporting to you that the state of viticultural matters pertaining to the Third, or San Francisco District, may be considered in a fair condition of prosperity.

The depressing and unfavorable circumstances that impaired the healthy advancement of the industry for some time past, appear to be supplanted by a feeling of renewed confidence and hopeful expectation.

I find that in all the different sections comprising this extensive district the stock of old wines held in first hands is limited, and that the new vintage could be taken care of without difficulty. Although special inducements have been offered this year for the preparation of dried grapes on a larger scale, sufficient wine grapes have been reserved for wine-making purposes to make our vintage a very abundant one, and sufficiently large to replenish the stock for the regular trade requirements.

SANTA CLARA COUNTY.

Santa Clara County has developed into one of the great centers for the production of red wine varieties, and the general characteristics of the wines—good color and body—make them a desirable product for the great bulk of our export clarets. The Charbono variety, extensively cultivated in the past, has been largely eliminated and replaced by grafts of the Burgundy and Bordeaux types, greatly increasing, thereby, the value of the product. Some of the finest claret types are grown in this wonderful section, especially in the mountain regions, and after undergoing proper treatment and cellar handling, their merits must and will command general approbation and appreciation. They have compelled recognition heretofore, and will continue to grow in public estimation hereafter.

SAN MATEO COUNTY.

San Mateo County is also making strenuous efforts to increase its acreage of vineyards. Its vineyardists are planting out the choicest varieties in the mountain regions, evidently well adapted for the cultivation of the vine. These new vineyards will soon come into full bearing, and will undoubtedly produce satisfactory results.

SANTA CRUZ COUNTY.

The Santa Cruz Mountains District has had good opportunity to show its superiority in many respects. The wines are not very heavy in alcohol, but develop a most delicate flavor and highly distinctive aroma, which may be attributable to the proximity of the ocean. The yield of the vines is generally light, and cultivation is more difficult and expensive than that of the valley lands, but the result shows immense possibilities, limited only by the degree of skill and knowledge of the vineyardist to assist Nature's efforts and to overcome difficulties of fermentation and development.

ALAMEDA COUNTY.

Alameda County, and especially Livermore Valley, appears to have made the most formidable progress in the general rivalry for the production of the higher types of fine table wines. The distinction of the highest awards of merit that were accorded to the products of this now famous district by the Paris Exposition of 1889, must be considered evidence of superiority of climatic conditions and adaptability of soils, especially to Sauterne and Bordeaux varieties, as well as the wine makers' skill and careful methods of making, treating, and ripening their products.

So far as general statements may be relied upon, the Third District is free from the attacks of the phylloxera, and although no serious apprehensions are felt on the part of the wine growers, abundant provision is made for the introduction and propagation of resistant vines. In fact, some newer vineyards of the district have been entirely planted with resistant stocks and grafted with the most approved varieties.

CONDITIONS OF TRADE.

The conditions of trade have not been very favorable for our California growers for some time past. Although the shipments from this port and interior points show a healthy increase in volume, prices have declined to a remarkably low and unprofitable standard. One of the principal reasons for this unfavorable condition of affairs in the past is undoubtedly an over production of inferior wines, which, under the ordinary pressure of commercial competition, have found their way into the channels of trade, and under competitive prices have degraded the prestige, and dragged down the prices of our superior products. The general opinion that all our wines should have a certain age before they could advantageously be placed on the market has induced many to hold their products for future prospects. It should be remembered by all parties interested:

First—That only a limited portion of our wines can be safely placed aside for storing and aging, and that quality alone can form the criterion for judicious selection.

Second—That the conditions essential for preservation, for the improvement, and for the maturing of wines into a really fine product, must be thoroughly understood.

Third—That when the fundamental conditions of original soundness, excellence of quality, and the means of preservation, coupled with the knowledge of methods, are wanting, all attempts at aging wines will most assuredly result in failure, sacrifice, and disappointment.

When only eight or ten years ago it was firmly asserted by representative authority, and published all over the State, that California could never produce too much wine, and that the then prospective vintage (variously estimated at forty to fifty million gallons) would be readily disposed of; when it was stated that the happy owner of an hundred

acres of bearing vineyard would be the enviable possessor of an estate equal to an independent fortune—then nobody anticipated that even the largely reduced yearly quantity of about eighteen million gallons could bring about a disastrous flooding of the wine market. That the prophetic glorification of the future of our industry was not to be realized up to the present time, is due in great measure to the fact that our American population are very slow in adopting the habit of drinking wine in moderation—a habit almost as old as the world, and to-day indulged in by the most enlightened and cultured nations of Europe.

The planting and growing of a vineyard is only the beginning of the problem of "making wine," the solution whereof is its profitable marketing. The production of ordinary wines may be comparatively an easy task, but the selection, nursing, and aging of wines of superior quality is an accomplishment acquired only after untiring application and experiments, coupled with natural ability and skill.

I am most happy to note quite an advance among the growers of this district in all the qualifications of successful wine men, and in proof of my assertion I point to the improvement, especially in the quality of wines made these last two years. I doubt not but that the future will show still better results and bear witness to the correctness of my judgment.

I look upon our past and present struggles as an unavoidable reaction from over-sanguine expectations, which must naturally adjust itself, and then the wine industry will once more be established on a basis remunerative to all.

Respectfully submitted.

CHARLES BUNDSCHU,
Commissioner for the San Francisco District.

REPORT OF GEORGE G. BLANCHARD,

Viticultural Commissioner for the El Dorado District.

PLACERVILLE, CAL., August 18, 1890.

To the Board of State Viticultural Commissioners:

I am pleased that in making this report of the general condition of viticulture in the El Dorado District, I am able to give the Board a more reliable account of the progress and extent of vine growing than I have been able to do in any former report.

For the purpose of better acquainting myself with the absolute condition of this branch of industry, I have quite recently made extensive visits into the counties of Yuba, Sutter, Nevada, Placer, Amador, Calaveras, and Tuolumne; and have received reliable information in relation to the subject of viniculture in the counties of Mono, Inyo, and Mariposa.

I am informed by the several Assessors of the counties of Alpine, Plumas, Sierra, and Mono, that there are no grapes of any kind raised in those counties, except it may be a few experimental vines, planted more for experiment and curiosity than from any idea of profit.

Grape raising, either for wine, table, or raisins, in my district is principally confined to the counties of Placer, Amador, El Dorado, and Calaveras. However, I have found some very fine specimens of raisins and fine qualities of wines produced in the counties of Nevada, Yuba, and Tuolumne.

The raisins of Placer and El Dorado Counties have long been known to the raisin market as superior in quality, those of Placer County having taken the first premium at the Citrus Fair held in Sacramento in 1887.

El Dorado County, having been the site of the discovery of gold in California, necessarily had attracted to it the earlier immigrations to California; and to the gold mining was added, at an early day in its history, that of viticultural pursuits. The early vineyards were planted to what is known as the Mission grape. Probably some of the oldest vineyards in the State, outside of the Missions, are to be found in El Dorado County, planted when no other grape was known in the State except the Mission variety. As the foreign vines became introduced into the State, they necessarilly found their way into this county, so that to-day we have vineyards of the finest foreign varieties. The soil and climate, to an altitude of two thousand eight hundred feet above the sea level, is found to be conducive to their growth to perfection. This adaptation of soil and climate is not confined to the growth to perfection of any particular kind of grape, but extends to the whole family and species.

Except in the county of Placer, and there only to a limited extent, have vine pests of any kind affected the vineyards.

The vines, from an altitude of six hundred feet to that of two thousand eight hundred feet above the sea level, have a uniformity of growth,

healthfulness, and producing qualities. Those of the higher altitudes contain much more of saccharine matter than those of the lower altitudes.

Those grapes cultivated for table use, such as the Tokay, Emperor, Rose of Peru, and Muscat of Alexandria, obtain, in the higher altitudes, a greater degree of perfection in color, richness, and consistency than those grown in lower altitudes. The Flaming Tokay, at an altitude of two thousand feet, arrives at that peculiar color from which originated its sobriquet of "Flaming," and has that degree of brightness not to be found in those grown in the lower altitudes. The Muscat of Alexandria is relieved of that green appearance which it has in the valley counties, and possesses in the foothills a rich golden appearance; and it also has a more pronounced richness of the Muscat flavor.

In the counties of Yuba, Nevada, Placer, El Dorado, Amador, and Tuolumne, there is more or less wine made of a very superior quality. In Yuba, there is a winery whose annual product runs into the hundreds of thousands of gallons, owned and operated by Mr. G. Sieber. At Nevada City, there is also a winery, owned and operated by the Nevada County Wine Company, producing some ten thousand or fifteen thousand gallons of wine annually. In El Dorado County, there are several wineries, all producing a first class quality of white wine, and some of their red wines command the highest price in the market.

The wines of Mr. George Sieber, both red and white, dry and sweet, will compare favorably with those of any other section of the State, and are the product, I was informed, of the grapes raised in the foothills back of Marysville. All the grapes converted into wine at the Nevada Winery are raised in the higher altitudes of the grape-producing regions of Nevada and Placer Counties, none of the grapes being raised at a less altitude than from two to three thousand feet.

The grape-producing regions of my district will cover, from Yuba to Inyo Counties, an area of from twenty to thirty miles in width, by from two hundred and fifty to three hundred miles in length; and of all this vast region, there is not a thousand acres but what is susceptible of producing the finest qualities of grapes of any variety, either for wine, raisin, or table use.

Profit being the great desideratum of all industries, and especially those that require so much labor and expense as that of grape culture, wine, and raisin making, as to this vast area, the great distance to market, and almost total want of facilities for transportation, have caused this industry to be neglected; for no matter how complete an adaptability there may be, both in soil and climatic condition in this region, unless the industry can be made profitable, it will find but very few who will embark in it.

It is strange to observe, and yet true, that very little sulphur or other curative articles are used in any of the vineyards in these localities, there being no apparent need of their use, especially in the higher altitudes of the grape-growing regions.

On account of this distance from market and want of transportation facilities, very few new vineyards have been planted in the last year or two. In Placer County, there has been a marked increase of acreage in the planting of vines in the last year, which, on account of the facilities for transportation to market, have been mostly table and raisin varieties.

Since the establishment of this Commission it is observable in all of the vine-growing localities of my district that there has been a constant increase in the cultivation of those superior varieties of foreign vines, both for wine and table use; and also through the advice and information in wine making, given to our wine makers and viticulturists through our Chief Executive Viticultural and Health Officer, there has been a most remarkable advancement in the art of wine making and grape culture generally.

At no distant date, when railroads shall have been extended so as to reach these grape-producing lands to such an extent as to afford facilities for cheap transportation, this whole region to which I have alluded will be one vast vineyard, giving employment to thousands of laborers and adding vastly to the wealth of California.

Inasmuch as the Board of State Viticultural Commissioners are engaged in the compilation of a new directory of the grape growers, wine and raisin makers, I shall omit in this report any extended history of the development this industry has attained in my district, and ask those interested in and desirous of the information to consult this new directory for the same.

GEORGE G. BLANCHARD,
Commissioner for the El Dorado Viticultural District.

REPORT OF ETHELBERT DOWLEN,

Special Agent to Investigate the Anaheim Vine Disease.

Being one of a series of forty-three reports now on file at the office of the State Viticultural Commissioners, and read at the annual meeting, held June 9, 1890.

To the Board of State Viticultural Commissioners:

In September, 1888, the Board of State Viticultural Commissioners decided upon making an investigation into the causes of the destruction of the vineyards of the Los Angeles District. The disease which was the cause of the trouble had then been at work for at least four years, and is still working, though with lessened virulence, and it has proved to be, probably, the most destructive disease that has ever attacked the vines of this country, quite equaling in its power for evil either black rot or phylloxera.

At the beginning of the investigation, which was placed in the special charge of Hon. J. DeBarth Shorb, a series of questions as to date of attack, soil, varieties grown, and their resisting power, practice in cultivation, etc., were sent out to the principal vine growers of the affected district. Five hundred circulars were sent out. One hundred and one replies were received. Nine replies were from parties who had given up viticulture; there were, therefore, ninety-two replies from persons actually engaged in vine growing. The information given in these replies has been tabulated and sent in. (Reports 15, 27, 28.) A special set of circulars was also sent to those vineyardists who were in the habit of regularly sulphuring their vines; the information on this point is tabulated in report 15.

The answers to circulars gave particulars as to thirty-six localities and forty-six varieties of vines. So far as the information given in these replies goes, it seems that the disease (variously known as "Los Angeles disease," "Los Angeles rot," "new disease," and "mysterious disease," but named by the Commission the "Anaheim disease") which has been the cause of all the trouble had been working in the vines for at least four years previous to 1888.

The earliest date of attack reported is 1884, when it was first noticed in North Pomona and Anaheim, the former locality being at least twenty miles northeast of Anaheim, a range of hills running between the two places.

The disease then spread from Anaheim, apparently remaining almost, if not quite, stationary at North Pomona.

The dates of first attack at various points are given below:

Anaheim and North Pomona in 1884.
Santa Ana in 1885.
Orange, Tustin, Fullerton, McPherson, Los Angeles, San Gabriel, Alhambra, and Burbank in 1886.
Lamanda Park, Florence, Tropico, and Vernon in 1887.
Verdugo and Maynard in 1888.
Riverside, El Cajon, and Sweetwater Valley were not reported until 1889.

The above dates give the period when attention was first drawn to the altered condition of the vines in the various localities; in all probability the disease had been present for some time previously. One thing is evident, the vines were first attacked seriously in and around Anaheim and Santa Ana, sweeping all through the Santa Ana Valley, spreading thence northwesterly to Los Angeles, thence eastward along the San Gabriel Valley to Azusa, through Lamanda Park and Sierra Madre, where, however, it has not done much damage. Northward from Los Angeles the disease went along the San Fernando Valley, through Tropico and Burbank, even jumping the Soledad Mountain, and reaching Maynard, in Antelope Valley, at over two thousand feet above sea level.

In 1889 the disease made a jump over into San Diego County, appearing first in El Cajon Valley, and afterwards in the Sweetwater Valley. The districts around Los Angeles seem to have suffered about alike, but not to the same extent as the Santa Ana Valley.

The same disease was noticed by Prof. F. L. Scribner and Prof. Pierre Viala, in Napa Valley, in 1887, where it was again seen in 1889; but in this district it has never done any harm.

With respect to the resisting power of the vines, the Mission and Muscat varieties were first affected, and have suffered most; the Burger, Mataro, and Trousseau come next; the Carignan and Grenache have suffered slightly; the Blaue Elba scarcely at all; the Lenoir and Gamay Teinturier have escaped altogether. The wild vines have also been attacked.

It does not seem that irrigation or non-irrigation, soil, time and manner of pruning, or climatic conditions, can be claimed as being the prime cause of the disease, though each of these may have some bearing upon the case. Altered climatic conditions were at one time somewhat strongly urged as the cause of all the trouble, the wet season of 1884 having been followed by the first noticeable attack being advanced as proof. If there is anything in this view, the exceptional rainfall of the past winter should be followed by increased severity of disease; instead of this, the reverse is the case, as there is at the present time (June) much less disease amongst the vines than at the corresponding period of last year.

Respecting the manner in which the disease manifests itself, the following are the chief points: The earliest symptoms of attack are shown by a few of the leaves exhibiting peculiar yellow spots and patches. These leaves may be found on one or two canes only, or they may be scattered over the entire vine. These spots, at first small, often spread until almost the whole of the leaf blade is involved; sometimes only one side of the leaf is affected. The spots may remain as irregular patches, or may occupy all the space between the principal veins of the leaf, in which case the cellular tissue is discolored, whilst the fibro-vascular ribs remain green, forming a very definite pattern. In black varieties the yellow patches turn red, and eventually become brown and dead. In white varieties the yellow spots retain their color until they become brown and dead. The edges of the leaves become dead, and curl up over the upper surface of the lamina of the leaf; eventually the leaf dies, and often the lamina drops off, leaving the petiole attached to the cane. In the second year, soon after the vines have started, many of the young leaves, when about an inch in diameter, have their edges blackened and

curled up as though scorched or badly frosted; the leaves which are afterwards produced will show the same markings as those first described. At the same time as these changes take place in the leaves, the fruit may be attacked; some of the berries, or perhaps all, in a bunch will shrivel, and, in the end, dry up, in which case they will remain hanging on the vine; or the development may be arrested, in which case the fruit, if it ripen, will be hard and sour. The fruit may be attacked at any time from the opening of the blossom, or occasionally a little before then, until the first coloring of the berries.

In the second year of disease, the canes are, many of them, dwarfed and much crowded on the main stock; if they are of larger growth, they are often flattened and have their internodes shortened.

In the third year, the growth is very much reduced, the canes are often only a few inches in length, and the vine usually dies before the end of summer, though sometimes it will live on for another year. It not unfrequently happens that in each year diseased vines will put out suckers which, at first sight, appear very strong and healthy, but these, too, in the end, die in the same way as the rest of the vine.

Usually, the vines will live on for three years from the first attack, though sometimes they will struggle on for five years, or, as in the case of some Mataro vines, they will die in a short time from being first attacked. The Mataro vines referred to were attacked suddenly in August, 1888, the leaves dropped, and the fruit dried upon the vines, and before winter many of the vines were dead. Those that were left, came out somewhat weakly in 1889, and again went under shortly after the hot weather set in, and practically the whole plot was dead before the winter of 1889.

The canes of diseased vines show the following features, in addition to those noted above: Many canes do not ripen at all, even though they may have made a fair growth; others are ripened only on one side; others have patches of unripened wood and bark; these unripened patches and stripes often turn greenish brown and black on the outside. Internally, the characters are as follows:

In the earlier stages of disease, the wood, though still green, is drier and lighter colored than in healthy canes. Soon yellowish and brown spots and streaks appear in the woody bundles. Eventually the whole of the wood becomes dark brown and moist, the pith also becomes darkened, and the inner bark becomes blackened, so as to show in a transverse section, as a black ring around the fibro-vascular bundles. The medullary rays sometimes show darker than the rest of the woody tissues. The bark is also easily detached from the wood. Similar characters are also found in the spurs and stock, and later on, in the roots as well.

The sap ceases to flow as a watery fluid, but oozes out from the cut surfaces of canes or stem in transparent, colorless, gummy masses.

The disease always travels downwards. The tips of canes die first, and it is quite easy to find canes, which apparently are quite green and healthy at their junction with the stem, but which are quite dead for at least half the distance from the tip. On cutting such canes longitudinally, the transition from fresh green wood to that which is dead and brown is plainly seen.

The same course is taken by the disease in cuttings. Amongst the cuttings taken at the time of pruning in 1888–89, many were found to have developed disease after being put in the nursery, and it was found to be always the case that the disease started at the upper end. Some cuttings were purposely planted in an inverted position, still the result was the same—the disease always started at the end which was naturally the farthest from the main stem, whether that end was placed in the air or in the soil. Cuttings taken from presumably healthy vines, and brought from a distance, have not always proved to be exempt from disease, but have shown the first signs in the first year of planting.

There is also often a rapid increase of disease in a vine immediately after pruning. This was noticed in the pruning season of 1888–89, and again during the last pruning season. In one instance spurs were observed to die back five inches within seven days after pruning.

Under the microscope, the tissue of diseased canes always show the same characters, which are as follows:

In those canes which remain unripened, and in those which appear to be drier than is normal, it will be found that starch is either altogether absent or is present only in scattered grains, few in number and small in size, which often appear to be eroded. These scattered grains are often discolored, and sometimes do not readily turn blue on the application of iodine. In those canes which have one side ripe and the other side unripe, the tissues of the ripened portion are almost always well supplied with starch—some starch will always be found—whilst in the unripened portions the tissues will be altogether devoid of starch. In the discolored areas of the woody bundles, the components of the tissues are seen either to have their walls simply stained brown or else the cell cavity is partially or wholly filled up with a dark brown deposit; this is especially the case with the blackened inner bark above mentioned. The larger ducts and vessels are often seen to be more or less filled up with thylles, which are developed sometimes to a great extent. Threads of mycelium are also found in more or less abundance running through the various tissues. Bacteria are found more or less plentifully, and various forms of fungi are abundant upon the canes of diseased vines.

No insects have been met with which could have anything to do with causing the disease—in fact, the vines of this district are seldom affected by insects of any kind, a very rare invasion of army worms, or an occasional attack of cut worms, being all that has to be contended with, there being no phylloxera in this district.

The above are the chief features presented by vines affected with the Anaheim disease. What this disease is, cannot positively be stated at present. It may be that more than one disease is concerned in the death of the vines. None of the ordinary diseases of vines, such as anthracnose, black rot, downy or powdery mildews, the various root fungi, or phylloxera, are concerned in the case.

At present the Anaheim disease stands side by side with certain European vine diseases, which have not yet been worked out, though they have been known and studied for a long time.

The malady to which the Anaheim disease bears the greatest likeness is mal-nero, which has been known in Sicily and Italy for many years past, and where it has been studied for the last twenty years, having been first recognized, according to M. Cugini, in Sicily, in 1863.

The general characters of mal-nero are as follows: The internodes of the canes are shortened and flattened instead of remaining cylindrical.

According to M. Gregori, the leaves are spotted with yellow and red, and present on these spots small drops of resinous substance. The fruit bunches dry up. A transverse section of the stem shows the wood to be spotted brown or black. The bark is only slightly adherent and is brown. The entire wood becomes altered, and the roots still appear healthy when the stem and branches are much changed.

Under the microscope it is seen that, in the altered cells, the starch, which is normally present, has disappeared, or looks as if gnawed, and is brown. It changes color with difficulty on application of iodine. The members of the cellular tissues are brown; in the interior of the vessels there is a great increase in the number of thylles, and there is an abundant deposit of thick brown matter. Bacteria are also abundant.

Vigorous shoots are often put forth from the stem near the ground, or even from the roots. The disease always travels down from the main stem to the roots, and the vine finally dies in from three to five years.

From the above it will be seen that there are many points of resemblance between mal-nero and the Anaheim disease. Still there are some points of difference; *e. g.*, the case of the Mataro vines which were suddenly struck down; other instances of a sudden attack after a spell of hot weather have also been reported. To a certain extent these cases of sudden attack resemble folletage rather than mal-nero, as folletage most frequently happens after heavy rains, and during great heats. Under an attack of folletage, vines will suddenly lose their leaves, even the canes will sometimes dry up, and the vines die soon after. But whilst with folletage vines are only killed here and there, and the trouble does not spread, in the case of the Mataro vines above referred to almost entire blocks were killed, and the trouble continued into the following year. Moreover, the attack did not succeed heavy rains.

As with the Anaheim disease, so with the mal-nero, nothing is positively known as to the cause of the malady. Opinion is still divided amongst Italian scientists as to whether mal-nero is due to the action of parasitic fungi or not, most of the Italian authorities being of opinion that these fungi are not the cause of the disease. In the Anaheim disease, fungi are abundant upon and in the diseased vines, but whether as cause or effect is not yet known. In this connection it may be remembered that the habits of some parasitic fungi, at any rate, are liable to change.

The fungus of white rot (*Coniothyrium diptodiella*) was at one time classed as a saprophyte only; it is now certainly known to be parasitic, and the fungus of black rot (*Læstadia Bidwellii*) has been found in parts of New York State, northern Ohio, and the islands of Lake Erie, to be rather saprophytic than parasitic in its nature.

The Anaheim disease has probably existed in this State for many years past. It was noticed in Napa County in 1887, and again in Napa Valley and Livermore Valley in 1889, but in each district vineyardists stated that it could not be the new disease, for it had been known to them for years, and had never done any harm beyond killing a few vines now and then, and that it would come and go. The same was found to be the case at Riverside, where, also, vineyardists stated that they had known that affection of the vines for years, and that sometimes a vine would die, and sometimes it would recover.

It will be seen from the above, that either there are considerable variations of the same disease, or else that more than one disease is at work; The different modes of attack, the different results in different parts of the State, and the different appearances of the leaves of the diseased vines, are points not yet reconciled to each other. Professor Henri Grosjean, of the French Ministry of Agriculture, writing to Hon. J. DeBarth Shorb on the Anaheim disease, February 26, 1890, says: "We have not yet heard of a disease presenting the different characters described in Mr. Dowlen's letter, and we would not be surprised to be in presence of several diseases." Professor L. Paparelli, of the University of California, a pupil of Professor Targioni Toretti, writing May 19, 1890, says: "For my part, judging by the samples and description of the Anaheim vine disease, I should think that not the mal-nero alone is in question, but two or three maladies together, perhaps all of a non-parasitic nature." This question has also been referred to in Report No. 34.

With respect to remedies, partial success has been reached. In December, 1888, a small hothouse was erected by the Viticultural Commission, in which rooted vines, both healthy and diseased, of different varieties, were set out for observation and experiment. Unfortunately, soon after the vines had been set out, one end of the house was accidentally burned out, and almost all the vines were killed. Whilst the damage was being repaired, a second house was built onto the first, the cost being defrayed by the Los Angeles County authorities. By the middle of February, 1889, both houses were started with a fresh supply of cuttings and rooted vines of the varieties mostly grown in the district. Many of these were known to be diseased. Of the cuttings thirty-six were of the Mission variety. The rooted vines were several times treated with a mixture known afterwards as "Ongerth's powder." Part of the cuttings were also treated with this powder, and with modifications of it, both in solution and as powder. The cuttings were set out in rows of four each, two in each row being dressed, and two being left untreated to serve as checks. All the rooted vines grew well, and nearly all the cuttings started. By the end of April both houses were full of vines, and by the end of June the growth had so increased that quite a third of the rooted vines had to be taken out. Through the summer of 1889 the vines were left to themselves, except that occasionally they were supplied with a little water. In October, 1889, most of the vines were cleared out to make room for a fresh supply, when it was found that of the Mission cuttings nearly all the untreated plants were dead, whilst of the treated cuttings only two had died. All the rest had made large growth (completely hiding their dead companions), which was quite healthy. Three of these healthy plants were reserved. Of the rooted vines three Missions, diseased when put in, were quite healthy, and three Muscats and one Burger, also diseased when put in, were only very slightly diseased. These vines were all reserved, and, up to the present time, except for a little damage by sunburn to one of the cuttings and damage from gophers to one of the Muscats, these vines are all in good health. The treatment has been continued this year. Fresh vines, much diseased, were brought in during last December and January. Some of these were treated with various substances; others were untreated. At the present time, all the treated vines are in much better condition than those left untreated.

In the vineyards not so much success has been reached. Last year the above mentioned powder was applied experimentally on three vineyards, having a total of about one thousand acres. Three applications were made, one just before the vines started, one just after starting, and

a third in June. The disease had shown itself rather early, and after each application the disease was undoubtedly checked, and a new and healthy looking growth was induced, but by the end of the season the disease had apparently reasserted itself. The powder has been tried by different vineyardists, some of whom speak favorably, and others unfavorably of it.

Other substances have been tried—iron sulphates as a dressing to the ground, Bordeaux mixture, benzine introduced into the sap circulation, superphosphate of lime as a ground dressing. Some of these seem to have been of benefit for a time, others have had no appreciable influence.

The present outlook is encouraging. The vines were rather late in starting, but in all cases they have made excellent growth, with promise of a large crop of fruit; this is the case with all varieties, Mission included. Even where the vines were left unpruned, and the ground uncultivated, the vines having been condemned on account of their badly diseased condition, a strong, healthy looking growth has been made. The signs of disease in the early part of the year were very few, and there has been but little increase, and it is possible that the disease may pass away. But too much confidence must not be placed in this state of things, as the hot weather of the next three months may bring about a change for the worse, as the vines must of necessity be still in a very weak condition.

ETHELBERT DOWLEN.

June 1, 1890.

The suggestion at the close of the above report, that "it would be well not to place too much confidence in the then condition of the vines," has unfortunately turned out to be only too well founded. Since the above report was written, the hot spells of June, July, and August have, in places, done considerable damage to the vines, though the total mischief should not be credited to the Anaheim disease, as drought and sun heat have each played a considerable part in the damage done.

ETHELBERT DOWLEN.

August 1, 1890.

REPORT OF J. B. J. PORTAL,

Special Agent to Investigate the Market for Dried Wine Grapes in Europe.

In 1888 the State Viticultural Commissioners resolved, in view of the depression then existing in the wine market, and the prospect of finding a market for California dried wine grapes in France, to give the whole subject a thorough investigation. Accordingly, Mr. J. B. J. Portal, a prominent vineyardist of San José, who was then going to Europe on business, was intrusted with a special mission to investigate this subject and submit a report. His reports came in from time to time, but in view of the recent and almost prohibitive tariff placed by France on products of this description, it is believed that the present chances of opening up a market in France are very slim indeed. The reports of Mr. Portal, and the letter of instructions given to him, are as follows:

LETTER OF INSTRUCTIONS.

SAN FRANCISCO, CAL., April 29, 1889.

J. B. J. PORTAL, *Esq.*, *New York:*

DEAR SIR: It having been represented to this Commission that you are now on your way from this country to France on business of a private nature, connected, however, with the development of commerce in California wines; and it being known to our Commission that you are familiar with the present condition of viticulture in California, by a unanimous vote of the Board during a special session held on the twentieth instant, you were specially requested to devote a portion of your time, or so much thereof as you can spare from private business, to the investigation of the following subjects:

First—To what extent is there a market in France for dried wine grapes for wine-making purposes, and to what extent may the same be increased, or rather to what extent may it be possible for the vineyardists of California to obtain a share of this market for their dried wine grapes.

Second—In what portions, or in what cities of France, is there a market for dried wine grapes; what is their relative importance in the trade; what is the present source of supply of dried wine grapes; what distinctions are there made in the various qualities as supplied by the trade, with respect to their relative market values—as, for instance, distinction relating to color, quantity of sugar contained, fine qualities for wine making, etc.; to be even more particular, would there be any distinction in value in dried grapes produced from Zinfandels, Missions, Rieslings, or Burgers.

Third—What are the names and business addresses of the persons engaged in importing, dealing in, and manufacturing for wine purposes, dried grapes in the most important sections and places in France engaged in that industry?

Fourth—Are the dried grapes required for this French market packed in any special manner, and are they required to be with or without stems?

Fifth—At what season of the year could dried wine grapes shipped from this State be utilized in France, or, in other words, would the element of time in transportation, whether by sailing vessel around the Horn, or by steamship via the isthmus of Panama, or by rail across the continent, materially affect the disposition of these products in France.

Sixth—Give us any information as to the value of California dried wine grapes, such as you know would be likely to be dried, in comparison with prices paid for dried grapes of different qualities from other countries.

Seventh—If you can conveniently devote a portion of your time to these questions, and report as early as possible, in time for the vintage of this year, you will render an important service to this State; and in order to aid you in this respect, this Commission respectfully commends you to the kind attention of all who may be able to give you information on these subjects.

Yours respectfully,

CHARLES A. WETMORE,
President.

CLARENCE J. WETMORE, Secretary.

FIRST PARTIAL REPORT.

MARSEILLES, FRANCE, June 11, 1889.

To the Board of State Viticultural Commissioners, San Francisco, Cal.:

GENTLEMEN: It takes a great deal of tact and time to get anything that a Frenchman calls a secret. However, I think by averaging the most contradictory opinions, I can give you the true manner of action at this time, so that you can take the responsibility of advising the vine growers and wine makers of California as to what they should do.

First—It is not profitable, at the present price of dried grapes in the French market, to ship from California. This price is 20 francs per one hundred kilos, delivered at Bordeaux, Marseilles, or Havre.

Second—No merchant will buy any dried grapes until a fair sample of at least one hundred pounds be sent to him for proper experiment. All say that they know nothing of dried California grapes, but are very willing to try them, and report at once.

I cannot give you here a full report of what I have seen and done at Bordeaux, Narbonne, Bezier, Marseillan, Marseilles, Cette, Montpellier, and Paris, but will later. I have the verbal opinions and business addresses of the most important merchants of the above dried grape centers.

My opinion is that the best interest of all concerned is to cultivate the American markets. There are here at Marseilles, merchants shipping dried grapes to New York, Mexico, and South America, and to many other places, that on account of their position should be supplied by California.

It would be advisable to dry a small lot of each kind of grapes and send them to France next winter, so that California, after proper reports, could be ready for the market, if any should develop in the future.

If you desire me to investigate the market in New York, let me know, and I will stop there on my return to California in July.

I regret very much that my report is so discouraging, but these are the facts, and the investigation has been thorough.

I remain, gentlemen, yours respectfully,

J. B. J. PORTAL.

SECOND REPORT.

SAN JOSÉ, CAL., March 4, 1890.

To the Board of State Viticultural Commissioners:

GENTLEMEN: In my letter to your honorable Board from Marseilles, France, I promised some additional facts when the supplies of dried grapes sent by your Commission to me in Paris should have been received and properly analyzed. I will endeavor to answer the questions in the order as per your letter of instructions, dated April 29, 1889.

First—To what extent is there a market in France for dried wine grapes, etc. The market for wine grapes at present is very depreciated, and has been so for over a year. Unless there is material change, it is not possible for California vineyardists to obtain a share of the little market now existing.

Second—The principal cities that now deal in dried grapes are, or have been, Cette, Marseilles, Bordeaux, Marseillan, and Montpellier, and are supplied principally by Greece and Turkey in Asia at from 15 to 20 francs per hundred kilos. No particular variety is demanded, but the price paid is always according to the highest degree of alcohol they contain. They go from 28 to 34 liters of alcohol per one hundred kilogrammes of raisins.

The principal grape that Turkey furnishes ranks between 28 and 30 liters of alcohol per hundred kilogrammes. Their best variety is the *Thyra*, and sells at 15 francs per hundred kilogrammes, net, at Bordeaux, Cette, and Marseilles.

Greece furnishes the *Corinthe* and other varieties of a higher quality than Turkey, and range in alcohol from 32 to 34 per cent, therefore commanding as high as 20 francs per hundred kilogrammes. But at these figures there is neither profit nor demand.

Third—The principal dealers in dried grapes are:

Talbot Freres, 73 and 74 Rue de la Rousselle, and 2, 4, 6, 8, and 10 Rue Reniere, Bordeaux.

Henri Flamisset, druggist, seul vendeur du sucre Zenamai et importeur de raisins secs, Comptoirs a Smyrne (Turkie d'Asie) a Patras (Grece) et 15 Rue des Menuts, Bordeaux.

Alphonse Bousquet, Quai Vaulan, Cette (Herault).

Frich et Dormont, Cette (Herault).

Pascal, Fabre & Co., Marseillan (Herault).

Jean Voisin, Marseillan (Herault).

Leon Barral, Prop'r de Vignes Americaines, 11 cours des Casernes, et 2 Rue Brenys, Montpellier.

Bessede Fils, Marseilles.

M. Dufour, 16 Rue d'Antin, Paris.

Fourth—The packing is simply in substantial sacks. It does not matter if the grapes are stemmed or not. They may bring a little more without the stems.

Fifth—The fast transportation of dried grapes from California to France will only add to the cost of the product, as the market is about even all the year round, and the European crop being nearer the market, would always be ahead of the California product. It appears to me that shipping around the Horn by sailing vessel would be the best mode of shipment.

Sixth—California grapes of an average quality, and of the kind shipped by your Commission to me in Paris, in June last—and analyzed at my request by the "Laboratoire de la Societe des Agriculteurs de France," showing that one hundred kilogrammes produced 39.75 liters of absolute alcohol—would naturally bring the highest price in Europe, being higher than any other grape sent there up to this time.

I did not see the grapes myself, as they arrived too late, but I had them analyzed by the best authorities known, as you will see by the return of analysis marked 6,148:

REPORT OF ANALYSIS. (Translated.)

LABORATORY OF THE SOCIETY OF AGRICULTURE OF FRANCE,
336 Rue Saint Honore, Paris.

Specimen of dried grapes submitted by M. Dufour, of 16 Rue d'Antin, Paris, and received the twenty-first of September, 1889. Composition:

Glucose (inverted sugar) .... 68 per cent.

One hundred kilogrammes of these raisins has the equivalent of 39.75 liters of absolute alcohol.

Respectfully submitted.

J. B. J. PORTAL.

FINAL REPORT.

SAN JOSÉ, CAL., August 30, 1890.

To the Board of State Viticultural Commissioners:

GENTLEMEN: I think that at the time of my last report to your honorable body on the dried grape question, with which I have been charged, the conditions of the market were less favorable in tone than they are already this season. France, Germany, and England are inquiring at what figures California dried wine grapes—red or white—can be obtained, while our home market seems to increase rapidly, and orders have been already received for the 1890 crop. There are now several establishments in London and in Germany organizing to utilize large quantities of dried grapes, and as the analysis made at my request by the Agricultural Analyst of the French Government has proved the California grapes to be higher in alcoholic product than any others introduced into the French market, it is reasonable to expect that in the years 1890 and 1891 large contracts will be made in California at remunerative figures for all the dried wine grapes that can be produced in the State.

Respectfully submitted.

J. B. J. PORTAL.

RAISINS.

An address delivered by B. N. ROWLEY, Esq., at the Seventh Annual Viticultural Convention, August 14, 1889.

There is some talk at present of overproduction of raisins in California, and that the planting of grapes for raisin purposes should at once cease. Let us glance over the situation, reviewing the raisin-producing districts of California, sections where the raisin grape grows to perfection, and where the climatic conditions are such that raisin making can be carried on successfully in all its branches.

Aside from the districts already occupied, there are some remote outlying districts or sections in the State that will some time in the future be brought within the scope of what might be properly termed "raisin-producing districts." The further extension of our transportation facilities will bring this about. At present the producing and curing districts of California are limited to Fresno, Tulare, Woodland, Yolo, Riverside, and portions of San Bernardino County, the El Cajon Valley of San Diego County, and the Santa Ana, Tustin, Orange, and McPherson Districts of Los Angeles. The latter is practically out of the field for some years to come at least, the vines having been destroyed by disease. Four years ago this section had an acreage equal to the production in 1888 of four hundred thousand boxes of raisins. Unfortunately the vine disease reduced this possible yield to the small quantity of forty thousand boxes, with the prospects of a smaller yield in 1889.

It is not possible to produce raisins in every section of the State where the Muscat and other varieties of raisin grapes grow to perfection. A section of the country in which the industry of raisin growing and curing can be successfully carried on, should be possessed of an even temperature and a dry climate during the ripening and curing season; should be devoid of cold and cloudy days, foggy nights, or showers and wind storms during the months of June, July, August, September, and October. These are combinations of climate, to say nothing of soil qualifications, that are not found at every cross road, even in California, so that we find the sections especially adapted to the cultivation of grapes for raisin purposes are limited even in our wonderful State.

A section of country selected for raisin making should be known as an early one; the bulk of the purchases of raisins are made from what is known as the "first crop," which should be cured and shipped for what is known as "early delivery." The first deliveries of the season, as a rule, prove the most profitable.

While the sections of country adapted to raisin making are limited in number, they are subject to considerable expansion beyond the present point of production. The planting of raisin grapes has been engaged in very extensively during the season just passed, and the large acreage devoted to raisins in 1887 and 1888 has been very largely increased during 1888 and 1889. Without any doubt, the present acreage five years hence (1894 or 1895) will all be in full bearing, and will

represent a possible production of upwards of two million five hundred thousand boxes of raisins, including all kinds and grades. While there is at present and always will be a very full supply of common and poor grade raisins, the supply of choice "London Layers" and fancy grades will not be fully up to the demand for years to come. Out of the possible two million five hundred thousand boxes of raisins there will be but a possible eight hundred thousand boxes of "London Layers," or choice stock. Our population is increasing largely year by year, and hence the natural increase in the consumption of raisins will be large. Naturally, when "Old Spain" produces very large crops, and they are permitted to be thrown upon the American market, prices will rule low. There is a remedy for this through the proper adjustment of our tariff laws.

The question is frequently asked, "Will it pay to plant raisin grapes, and further increase our already large acreage?" To answer that question intelligently, you should be posted as to the quantity of foreign raisins that are imported into the United States annually, as well as the amount of raisins produced in the State of California, in order to arrive at a close approximation of the consumptive demand. In answer to the above, we would say that the growing of raisin grapes will always be found a profitable venture in California if properly attended to.

In planting a raisin vineyard, you must, in the first place, know where to plant; second, how to plant; and third, but not least, how to care for and cure the crop.

The quantity of raisins (foreign) imported into the United States for the seasons of 1887 and 1888 was forty million five hundred thousand pounds, equal to two million and twenty-five thousand boxes of twenty pounds each. The consumption of raisins in the United States for any one year is practically represented by the quantity packed in this State and the quantity imported from foreign countries during any one season. Figuring upon that basis, we place the consumptive demand at three million two hundred and seventy-five thousand twenty-pound boxes for the seasons of 1887 and 1888. The pack of raisins in the State of California for the year 1888 we place at one million two hundred and fifty thousand boxes.

A number of growers and packers have, by their close and careful application to the business, earned a lasting reputation for their California raisins, for which there will always be a good demand and ready market at paying prices. The grower who thoroughly understands the business in all its branches, grows, cures, and packs his own crop, will realize the largest returns. With the small grower this is impossible, for he cannot successfully pack and market his own crop.

The raisin business is divided into three classes:

First—The large grower who packs and markets his crop under his own brands.

Second—The grower who sells his crop on the vines, or cures it and sells it in the sweat boxes.

Third—The professional packer who is not a grower, but has grading and packing houses established in the various raisin districts throughout the State.

Few, if any, of the raisins imported from Spain reach this country as packed by the producers or growers in that country. The raisins are cured in the producing districts, packed and shipped to the exporters, who maintain large warehouses or repacking establishments, where the goods intended for the export trade are regraded and repacked under the immediate supervision of the exporting merchants, who thoroughly understand the wants and requirements of the various markets and countries to which they ship.

As to the acreage at present devoted to raisin grapes in California, after spending considerable time and carrying on an extremely extensive correspondence, we place it at twenty-one thousand acres. This represents the vines of all the raisin districts of the State ranging from one to sixteen years of age, many of which will be in bearing this season. A considerable increase in the yield may be expected in the near future from the new vineyards that have been planted this season, and from the grafting of a large number of vines, heretofore devoted to wine purposes, with the raisin grape.

A healthy, well cared for raisin vineyard will produce, when in full bearing, an average of from five to six tons of grapes to the acre. There are several large vineyards in the State that average, year in and year out, better returns than this, while there are many vineyards the average of which does not exceed three to four tons to the acre. In a good year, under favorable conditions, it is safe to calculate four tons of raisin grapes to the acre. Figuring on a basis of twenty-one thousand acres of vines in bearing in this State, the annual yield would be one hundred and sixty-eight million pounds of grapes, out of which it is possible to make fifty-one million five hundred thousand pounds of raisins of all grades, which, if boxed, would fill two million five hundred and seventy-five thousand twenty-pound boxes. You will notice that we say "possible to produce." While it may be "possible," it is not probable that any such quantity of raisins will be produced, as there are very many reasons why such a production from the present acreage will not be realized for many years to come, if ever.

Now, let us consider the situation of our competitors at Malaga, Spain. This district produces a large, thin-skinned, finely flavored raisin, which has become famous the world over for these qualities, and virtually offers the only competition from which California growers need have any fear. The importation of raisins from Malaga into the United States has fallen off materially during the past seven or eight years. The reason for this is attributed by some to the fact that California raisins have so improved in quality and quantity that they have virtually driven the Malaga raisin out of the market. While it is a fact that California raisins have come in direct competition with the imported Malaga, and have exerted a powerful influence in the direction of reducing importations, yet it is not true that the noticeable decline in the receipts of raisins from that section is entirely due to the competition from California. The receipts of Malaga raisins into the United States commenced to decline about seven years ago—1882—at which time we were importing over one million boxes. The falling off in the importations has continued ever since, and in 1888, we find the quantity imported reduced to the small amount of about one hundred thousand boxes of twenty-two pounds each. The causes for this rapid decline are the ravages of insect pests, vine diseases, crop failures, and loss of money by producers.

The total crop of the Malaga District for the year 1878 was two million one hundred and eighty thousand boxes, and of this quantity the United States received one million one hundred and eighty-three thousand boxes. In 1879 the crop amounted to two million one hundred

and twenty-five thousand boxes. The United States received one million one hundred and forty-six thousand boxes. In 1880, the crop was two million and fifteen thousand boxes, and the United States received one million one hundred and fifteen thousand boxes. At this point the very noticeable falling off in the crop of Malaga raisins commenced. In the year 1881, there were produced one million eight hundred thousand boxes, and the shipments to the United States were one million boxes. In 1882, the crop was one million eight hundred and sixty-eight thousand boxes, of which the United States received nine hundred and sixty-eight thousand boxes. These statistics show the total crop of the Malaga District for the five years above mentioned to be nine million nine hundred and eighty-eight thousand boxes, while the receipts into the United States during that period were five million four hundred and fifty thousand boxes. This proves that we have been receiving and consuming more than one half of the total crop from Malaga, while England takes the credit of being the principal market, and only received during the same period nine hundred and twenty-five thousand boxes.

There is a prevailing impression that the cost of production at Malaga, owing to the low price of labor, is very much less than the cost of production in California. This is a mistake. While it is true that the Spanish crop is grown, cared for, and harvested by what is known as "European cheap labor," on the other hand, their methods of cultivation, manner of handling, curing, and packing their crop are such as to swell the cost of production to such a point that farmers barely make expenses, particularly at the present time, in the face of the active competition from California, where raisins are produced at a very reasonable cost, owing to our improved methods and labor-saving machinery.

The producers have been losing money on their shipments for several years past, and the fight they have had to make against vine diseases, insect pests, etc., has thoroughly discouraged them, and they have allowed the quantity and quality of the Malaga crop to materially decline. At this point we will quote from a private letter from Messrs. W. Bevan & Co., of Malaga, Spain:

"Within the next two or three years there will again be a large production of Malaga raisins; the improved and more economical methods of working the vineyards, harvesting, and shipping the crops will enable our farmers to produce a box of raisins, it is believed, cheaper than it can possibly be done in California."

Mr. Bevan, the gentleman we have just quoted, has just returned to his home in Spain, after an extended visit throughout the Eastern States and the State of California. While in this city, after having carefully inspected our raisin vineyards, he expressed himself as not only being well pleased, but agreeably surprised with what he saw, and stated that if it were possible for him to dispose of his holdings in Malaga that he would consider very seriously the matter of coming to California and engaging in the raisin business. "No place in the world," said Mr. Bevan, "holds out such promises for the future of raisin growing as does the State of California."

People in Malaga are alive to the California competition, and, we are informed, have induced English capital to come to their assistance. From a private letter we quote:

"While last season's crop, 1888, was a very small one, and this season's will be but little better, preparations are being made with the expectations of a heavy business in Malaga raisins in the near future."

That other causes have been at work reducing importations of Malaga raisins other than California competition, is shown by the fact that in the year 1882, while there was a marked decline in the importations from Malaga, the production in California was less than one hundred and twenty thousand boxes of all grades. The year 1883 shows a still greater falling off, and the California crop amounted to but one hundred and forty-two thousand boxes. In 1884, when our total imports from Malaga amounted to but seven hundred and forty thousand boxes—a falling off of three hundred thousand boxes—the California crop amounted to only one hundred and seventy-five thousand boxes of all grades. Out of this production in California during the year 1884 there were but a possible fifty or sixty thousand boxes of "London Layers," or a grade that would come into competition with the product from Malaga.

As soon as the Malaga District recovers from the effects of insect pests and vine diseases, and again becomes productive, California growers will find Malaga a very formidable competitor. In 1887, California produced eight hundred thousand boxes of raisins, and of this amount about two hundred and fifty thousand boxes would represent the quantity of "London Layers" produced that would come into competition with those from Malaga. By this it will be seen that the total quantity of "London Layers" and fancy grapes produced in California, and the total quantity imported from Malaga during that year, were five hundred and thirty-six thousand boxes, or about one half the quantity usually imported during any one year from Malaga prior to 1882, when the failure of the Malaga crop commenced. During the year 1888, California produced one million two hundred and fifty thousand boxes of raisins, of which amount five hundred thousand boxes represent "London Layers" and other choice grades. Our total importations from Malaga during the year 1888 amounted to one hundred thousand boxes from a crop of five hundred and forty thousand boxes. Again, we find that the total production of choice grades of California raisins, and the total importations from Malaga, amount to but five hundred thousand boxes, or considerably less than one half our former importations from Malaga alone. The lesson to be learned from this is that California has not driven Malaga raisins out of this market, but that the production of Malaga raisins has materially fallen off in quality and quantity, and that other markets are taking more than heretofore.

In regard to raisins from the Valencia District, which is one of the largest producing districts in Spain, and from which the United States receives annually very large quantities of raisins, it must be said that they are of a low grade, and used principally for cooking purposes; and while we do not fear Valencia as an active competitor, it may be well to inquire into the production and situation at that point.

During the season of 1888, the crop at Valencia fell short of expectations, being considerably damaged by rain; but nevertheless the crop amounted to sixty-five million pounds. Of this amount the United States received thirty-one million pounds. In 1887 the crop was seventy-nine million pounds, and the United States received thirty-two million pounds. The largest crop produced at Valencia for many years was during the season of 1882, about the commencement of the decline at Malaga, when the Valencia crop amounted to eighty-three million pounds,

of which the United States received forty-three million pounds. From these figures it will be readily seen that Valencia would prove no small competitor, provided California raisins came into competition with those from Valencia. The quality of the Valencia raisin is such—owing to the small percentage of saccharine or grape sugar they contain, and their poor keeping qualities—that they will never rank as a competitor of the California raisins, which are notably rich in grape sugar.

In summing up, we find that we have not reached the point where California can be relied upon to supply the entire consumptive demand of raisins in the United States. This demand will naturally be on the increase. Vine diseases, insect pests, crop failures, and climatic causes generally, will reduce the output of our raisin crop somewhat. California growers can maintain the present high standard and reputation for California raisins, and we need not stand in any great fear of foreign competition; but before planting the entire remainder of the raisin-producing sections of this State with raisin grapes, it would be well to give due consideration to the facts and statistics which I have furnished you to-day for your consideration.

SUCCESS OF RESISTANT VINES.

Written especially for this Report by JULIUS DRESEL.

We are now in the midst of our vintage, and every one may judge for himself how dreary an aspect the vineyards present around Sonoma, a place famous all over the United States for the best wines in California. I therefore think it opportune to make some remarks about that strange sight of an intelligent community listlessly standing by, waiting for something to turn up, while the vineyards, once the pride of our eyes, fall dead, acre after acre, from the extended flats at the mouth of our lovely valley clear up to the tops of our lofty hills. It is strange, indeed.

Finally, something happy really turns up. The prices for grapes actually rise from 30 to 50 per cent. Zinfandel bring $15 to $17 and Gutedel and Rieslings, $18 to $20. Cabernet Sauvignon is in demand for even $27, but not to be had. Besides, there is good reason that similar prices will prevail for the next few years and better wine prices may follow in consequence.

With $15 and $20 per ton the wine grower can make his occupation a profitable one, and with this the main objection against replanting is void. The phylloxera has certainly lost some of its terrors since the resisting American stock has been planted and grafted with entire success on a stretch of over four hundred acres between Haubert's and Rufus' vineyards.

Twelve years ago Dresel & Co. began to introduce Lenoir from Texas, and Riparia, Herbemont, Elvira, and other resisting stock from Missouri, all of which were dropped in favor of Riparia, on account of its good growing qualities and remarkable adaptability to all kinds of soil. Riparia did equally as well on the hillsides and flats, in sandy or clayish as well as in loamy soils.

In grafting, its junction with the scion presented no difficulty. Stem and graft developed about evenly, and bear abundantly to the present day red or white grapes of French or German origin, of high flavor or of neutral character. At present, dead vineyards are more worthless than naked land. By renewing them with resisting stock, the value of the land may be raised to $300 and more per acre. Therefore, I advise replanting. Cuttings are cheap. Lenoir and Riparia may be had in Sonoma and Napa. They should be planted in the nursery for one year, remain two years in the vineyard, then grafted in the third year during March, April, and May, and in the fifth year they will bring a fair crop. Cleft grafting is quickly done; anybody can learn it easily enough. An experienced hand can finish from one hundred and fifty to two hundred in a day.

The most important thing to observe in grafting is: Cut the stock even with the soil, or better half an inch above it, and then heap the soil in a mound around the graft to protect it against wind and sun.

After the graft has taken, say in September, remove the mound and any roots that may have grown from the scion. Now the vine is perfect. If the grafting has been done below the surface of the soil, it will be necessary every year to dig around the plant and remove all roots that will form on the scion, or else these roots will draw the nourishment from the leaves to the detriment of the resistant roots below. Phylloxera will then appear, kill the upper roots, and the vine becomes sickly or dies.

I expressly state that we met, apart from the cost, no serious drawback in this replanting experiment of our one hundred and fifty acres, and assert that it would be a tedious search to find a single vine that has died. On the other hand, we will be pleasantly remunerated this year by the sale of fifty thousand gallons of wine raised exclusively on American stock.

In plain view of these facts, how is it possible that so many of my fellow wine growers in Sonoma Valley persistently decry my happy success in replanting, spreading the ridiculous report that the resistant stock in our vineyard was dying out as fast as the remnants of the old plantation? Is it not a curious freak of human nature to belittle a promising result, instead of sympathizing with an experiment that might redound by imitation to the general benefit of our devastated valley?

Colonel Gardner, of the Census Bureau, when taken through our vineyard, was astonished at what he called a wonderful crop of grapes in so young a vineyard, and he made a corresponding report to Washington about the success of resisting stock at Sonoma.

But those who still doubt the correctness of my statements, I refer to the testimony of so experienced viticulturists as Messrs. D. D. Davisson, O. W. Craig, Chas. Kohler, and John O'Brien, of Sonoma, and I. DeTurk and L. Burris, of Santa Rosa, who have visited our vineyard for investigation, and left convinced, as I am myself, that our fellow wine growers could do no better than replant dead vineyards with American resistant stock at their earliest convenience.

JULIUS DRESEL.

SONOMA, October 7, 1890.

TARIFF AND SWEET WINE BILLS.

Appended will be found the full text of the McKinley Tariff bill in regard to all alcoholic liquors, and of the "Sweet Wine bill," which was included in the tariff measure:

TARIFF BILL.

SECTION 329. Brandy and other spirits manufactured or distilled from grain or other materials, and not specially provided for in this Act, two dollars and fifty cents per proof gallon.

SEC. 330. Each and every gauge or wine gallon of measurement shall be counted as at least one proof gallon, and the standard for determining the proof of brandy and other spirits or liquors of any kind imported shall be the same as that which is defined in the laws relating to internal revenue; but any brandy or other spirituous liquors, imported in casks of less capacity than fourteen gallons, shall be forfeited to the United States; *provided*, that it shall be lawful for the Secretary of the Treasury, in his discretion, to authorize the ascertainment of the proof of wines, cordials, or other liquors, by distillation or otherwise, in cases where it is impracticable to ascertain such proof by the means prescribed by existing law or regulations.

SEC. 331. On all compounds or preparations of which distilled spirits are a component part of chief value, not specially provided for in this Act, there shall be levied a duty of not less than that imposed upon distilled spirits.

SEC. 332. Cordials, liquors, arrack, absinthe, kirschwasser, ratafia, and other spirituous beverages or bitters of all kinds containing spirits, and not specially provided for in this Act, two dollars and fifty cents per proof gallon.

SEC. 333. No lower rate or amount of duty shall be levied, collected, and paid on brandy, spirits, and other spirituous beverages, than that fixed by law for the description of first proof; but it shall be increased in proportion for any greater strength than the strength of the first proof; and all imitations of brandy, or spirits, or wines, imported by any names whatever, shall be subject to the highest rate of duty provided for the genuine articles respectively intended to be represented, and in no case less than one dollar and fifty cents per gallon.

SEC. 334. Bay rum or bay water, whether distilled or compounded, of first proof, and in proportion for any greater strength than first proof, one dollar and fifty cents per gallon.

SEC. 335. Champagne and all other sparkling wines in bottles, containing each not more than one quart and more than one pint, eight dollars per dozen; containing not more than one pint each and more than one half pint, four dollars per dozen; containing one half pint or less, two dollars per dozen; in bottles or other vessels containing more than one quart each, in addition to eight dollars per dozen bottles, on the

quantity in excess of one quart, at the rate of two dollars and fifty cents per gallon.

SEC. 336. Still wines, including ginger wine or ginger cordial and vermouth, in casks, fifty cents per gallon; in bottles or jugs, per case of one dozen bottles or jugs containing each not more than one quart and more than one pint, or twenty-four bottles containing each not more than one pint, one dollar and sixty cents per case; and any excess beyond these quantities found in such bottles or jugs shall be subject to a duty of five cents per pint, or fraction thereof, but no separate or additional duty shall be assessed on the bottles or jugs; *provided*, that any wines, ginger cordial, or vermouth, imported, containing more than twenty-four per centum of alcohol, shall be forfeited to the United States; *and provided further*, that there shall be no constructive or other allowance for breakage, leakage, or damage on wines, liquors, cordials, or distilled spirits. Wines, cordials, brandy, or other spirituous liquors, imported in bottles or jugs, shall be packed in packages containing not less than one dozen bottles or jugs in each package; and all such bottles or jugs shall pay an additional duty of three cents for each bottle or jug, unless specially provided for in this Act.

SEC. 337. Ale, porter, and beer, in bottles or jugs, forty cents per gallon, but no separate or additional duty shall be assessed on the bottles or jugs; otherwise than in bottles or jugs, twenty cents per gallon.

SEC. 338. Malt extract, fluid, in casks, twenty cents per gallon; in bottles or jugs, forty cents; solid or condensed, forty per centum ad valorem.

SEC. 339. Cherry juice and prune juice, or prune wine and other fruit juice not specially provided for in this Act, containing not more than eighteen per centum of alcohol, sixty cents per gallon; if containing more than eighteen per centum of alcohol, two dollars and fifty cents per proof gallon.

SEC. 340. Ginger ale, ginger beer, lemonade, soda water, and other similar waters in plain green or colored molded or pressed glass bottles, containing each not more than three fourths of a pint, thirteen cents per dozen; containing more than three fourths of a pint each, and not more than one and one half pints, twenty-six cents per dozen; but no separate or additional duty shall be assessed on the bottles. If imported otherwise than in plain green or colored molded or pressed glass bottles, or in such bottles containing more than one and one half pints each, fifty cents per gallon, and in addition thereto, duties shall be collected on the bottles or coverings, at the rate which would be chargeable thereon if imported empty.

SEC. 341. All mineral waters, and all imitations of natural mineral waters, and all artificial mineral waters not specially provided for in this Act, in plain green or colored glass bottles, containing not more than one pint, sixteen cents per dozen bottles; if containing more than one pint, and not more than one quart, twenty-five cents per dozen bottles; but no separate duty shall be assessed upon the bottles. If imported otherwise than in plain green or colored glass bottles, or if imported in such bottles containing more than one quart, twenty cents per gallon, and in addition thereto, duty shall be collected upon the bottles or other covering, at the same rates that would be charged if imported empty or separately.

SWEET WINE BILL.

SECTION 42. That any producer of sweet wine, who is also a distiller, authorized to separate from fermented grape juice, under Internal Revenue laws, wine spirits, may use, free of tax, in the preparation of such sweet wines, under such regulations and after the filing of such notices and bonds, together with the keeping of such records and the rendition of such reports as to materials and products, as the Commissioner of Internal Revenue, with the approval of the Secretary of the Treasury, may prescribe, so much of such wine spirits so separated by him as may be necessary for the preservation of the saccharine matter contained therein; *provided*, that the wine spirits so used free of tax shall not be in excess of the amount required to introduce into such sweet wines an alcoholic strength equal to fourteen per centum of the volume of such wines after such use; *provided further*, that such wine containing after such fortification more than twenty-four per centum of alcohol, as defined by section three thousand two hundred and forty-nine of the Revised Statutes, shall be forfeited to the United States; *provided further*, that such use of wine spirits free from tax shall be confined to the months of August, September, October, November, December, January, February, March, and April of each year. The Commissioner of Internal Revenue in determining the liability of any distiller of fermented grape juice to assessment under section three thousand three hundred and nine of the Revised Statutes, is authorized to allow such distiller credit in his computation for the wine spirits used by him in preparing sweet wine under the provisions of this section.

SEC. 43. That the wine spirits mentioned in section forty-two of this Act is the product resulting from the distillation of fermented grape juice, and shall be held to include the product commonly known as grape brandy; and the pure sweet wine which may be fortified free of tax as provided in said section, is fermented grape juice only, and shall contain no other substance of any kind whatever introduced before, at the time of or after fermentation, and such sweet wine shall contain not less than four per centum of saccharine matter, which saccahrine strength may be determined by testing with Balling's saccharometer or must scale such sweet wine after the evaporation of the spirits contained therein, and restoring the sample tested to original volume by addition of water.

SEC. 44. That any person who shall use wine spirits as defined by section forty-three of this Act, or other spirits on which the Internal Revenue tax has not been paid, otherwise than within the limitations set forth in section forty-three of this Act, and in accordance with the regulations made pursuant to this Act, shall be liable to a penalty of double the amount of the tax on the wine spirits or other spirits so unlawfully used. Whenever it is impracticable in any case to ascertain the quantity of wine spirits or other spirits that have been used in violation of this Act in mixtures with any wines, all alcohol contained in such unlawful mixtures of wine with wine spirits or other spirits in excess of ten per centum shall be held to be unlawfully used; *provided, however*, that if water has been added to such unlawful mixtures either before, at the time of, or after such unlawful use of wine spirits or other spirits, all the alcohol contained therein shall be considered to have been unlawfully used. In reference to alcoholic strength of wines and mixtures of wines

with spirits in this Act, the measurement is intended to be according to volume and not according to weight.

SEC. 45. That under such regulations and official supervision and upon the execution of such entries, and the giving of such bonds, bills of lading, and other security as the Commissioner of Internal Revenue, with the approval of the Secretary of the Treasury, shall prescribe, any producer of pure sweet wine, as defined by this Act, may withdraw wine spirits from any special bonded warehouse free of tax, in original packages, in any quantity not less than eighty wine gallons, and may use so much of the same as may be required by him, under such regulations, and after the filing of such notices and bonds, and the keeping of such records, and the rendition of such reports as to the materials and products and the disposition of the same, as the Commissioner of Internal Revenue, with the approval of the Secretary of the Treasury, shall prescribe, in fortifying the sweet wine made by him and for no other purpose, in accordance with the limitations and provisions as to uses, amount to be used, and the period for using the same, set forth in section forty-two of this Act; and the Commissioner of Internal Revenue, with the approval of the Secretary of the Treasury, is authorized, whenever he shall deem it necessary for the prevention of violations of this law, to prescribe that wine spirits withdrawn under this section shall not be used to fortify wines except at a certain distance prescribed by him from any distillery, rectifying house, winery, or other establishment used for producing or storing distilled spirits, or for making or storing wines other than wines which are so fortified, and that in the building in which such fortification of wines is practiced no wines or spirits other than those permitted by his regulation shall be stored. The use of wine spirits free of tax for the fortification of sweet wines under this Act shall be begun and completed at the vineyard of the wine grower where the grapes are crushed and the grape juice is expressed and fermented, such use to be under the immediate supervision of an officer of Internal Revenue, who shall make returns describing the kinds and qualities of wine so fortified, and shall affix such stamps and seals to the packages containing such wines as may be prescribed by the Commissioner of Internal Revenue, with the approval of the Secretary of the Treasury; and the Commissioner of Internal Revenue shall provide by regulations the time within which wines so fortified with the wine spirits so withdrawn may be subject to inspection, and for accounting for the use of such wine spirits, and for re-warehousing, or for payment of the tax on any portion of such wine spirits which remain not used in fortifying pure sweet wines.

SEC. 46. That wine spirits may be withdrawn from special bonded warehouses at the instance of any person desiring to use the same to fortify any wines in accordance with commercial demands of foreign markets, when such wines are intended for exportation, without the payment of tax on the amount of wine spirits used in such fortification, under such regulations, and after making such entries, and executing and filing with the Collector in the district from which the removal is to be made such bonds and bills of lading, and giving such other additional security to prevent the use of such wine spirits free of tax otherwise than in the fortification of wine intended for exportation and for the due exportation of the wines so fortified, as may be prescribed by the Commissioner of Internal Revenue, with the approval of the Secretary of the Treasury; and all of the provisions of law governing the exportation of distilled spirits free of tax, so far as applicable, shall apply to the withdrawal and use of wine spirits and the exportation of the same in accordance with this section; and the Commissioner of Internal Revenue is authorized, subject to the approval of the Secretary of the Treasury, to prescribe that spirits intended for the fortification of wines under this section shall not be introduced into such wines except under the immediate supervision of an officer of Internal Revenue, who shall make returns describing the kinds and quantities of wines so fortified, and shall affix such stamps and seals to the packages containing such wines as may be prescribed by the Commissioner of Internal Revenue, with the approval of the Secretary of the Treasury. Whenever such wine spirits are withdrawn, as provided herein, for the fortification of wines intended for exportation by sea, they shall be introduced into such wines only after removal from storage and arrival alongside of the vessel which is to transport the same; and whenever transportation of such wines is to be effected by land carriage, the Commissioner of Internal Revenue, with the approval of the Secretary of the Treasury, shall prescribe such regulations as to sealing packages and vehicles containing the same, and as to the supervision of transportation from the point of departure, which point shall be determined as the place from which such wine spirits may be introduced into such wines, to the point of destination as may be necessary to insure the due exportation of such fortified wines.

SEC. 47. That all provisions of law relating to the reimportation of any goods of domestic growth or manufacture which were originally liable to an Internal Revenue tax shall be, as far as applicable, enforced against any domestic wines sought to be reimported, and duty shall be levied and collected upon the same when reimported, as an original importation.

SEC. 48. That any person using wine spirits or other spirits which have not been tax paid, in fortifying wine otherwise than as provided for in this Act, shall be guilty of a misdemeanor, and shall, on conviction thereof, be punished for each offense by a fine of not more than two thousand dollars, and for every offense other than the first, also by imprisonment for not more than one year.

SEC. 49. That wine spirits used in fortifying wines may be recovered from such wine only on the premises of a duly authorized grape brandy distiller, and for the purpose of such recovery, wine so fortified may be received as material on the premises of such a distiller, on a special permit of the Collector of Internal Revenue in whose district the distillery is located; and the distiller will be held to pay the tax on a product from such wines as will include both the alcoholic strength therein by the fermentation of the grape juice and that obtained from the added distilled spirits.

REPORT OF CHARLES B. TURRILL, SECRETARY.

Read at the annual meeting, held June 9, 1890.

To the honorable Board of State Viticultural Commissioners:

GENTLEMEN: Custom, more than actual necessity, requires at this time a report from the Secretary of the Board. So established and smooth running has become the routine work of the Secretary's office, and so efficiently has it been managed by my predecessors, that upon assuming its duties a year ago I found but little to require change.

During the last year the correspondence addressed to the Commission has been fully up to that of previous years, as shown by the files of past correspondence, and has come from nearly all sections of California, as well as from different parts of our own country, from Europe, Mexico, Central America, and Australia. In all cases as full attention as possible has been given to all these various applications for information and advice, while foreign correspondents sending information have been properly thanked for the same.

The library of the Commission, which for completeness and the intrinsic merit and rarity of its volumes, is not only the most complete viticultural library in the State, but on this continent as well. During the year a number of additions have been made. Especially noteworthy among these is a set of reports of the Commissioner of Internal Revenue. The lack of funds has prevented the purchase of books, and only a few periodicals have been subscribed for.

The reports of the Commission have been sent to a large number of producers in various parts of the State who have applied for them. Complete sets of these reports have been sent to several libraries, scientific societies, etc., in different parts of the world, with the request that each send to this Commission such reports as they may have of their own publication. This method is already beginning to bear fruit, and has brought us reports of interest from Australia and elsewhere.

During the past year the Seventh Annual Viticultural Convention was held in the hall of the Commission, beginning August 13 and closing August 17, 1889. Much interest was shown in the proceedings in the afternoons and evenings, when papers were read by different viticulturists and freely discussed by those present. Two hundred and six samples of wines and brandies were exhibited at the Convention, and were carefully judged and reported upon by the committees. These reports, together with stenographic reports of the proceedings, are in the hands of your Secretary awaiting publication.

During the month of December, under invitation, there was conducted in a portion of the Viticultural Hall a most meritorious citrus exhibit by the producers of Placer County. Notwithstanding the inclement weather, thousands of visitors were attracted, all of whom also had an opportunity, which they improved, of inspecting the viticultural exhibit of the Commission.

Upon the invitation of the Commission, Major H. Gardner, Special Agent of the Eleventh Census of the United States, appointed to report upon the viticultural industries of the country, has had desk room in my office while in the city. I have rendered him all the assistance in my power in his work.

The Commission has received during the year the regular newspapers from various parts of the State, which have been kept on file. The thanks of the Commission are due to the publishers of these journals for their courtesy.

The series of scrapbooks started several years ago have been efficiently kept up by Mr. W. H. McNeil. These books, arranged by viticultural districts, and special subjects, are of great value, presenting, as they do, a current encyclopædiac account of the development of the State from the regular issues of the press.

I would respectfully urge the advisability of compiling a new directory of grape growers and wine makers. The directory published in 1888 has served a good turn, but it is now becoming somewhat obsolete, owing to many changes and removals among those whose names are therein, and also because there are a large number of new names to be added to the list. The work of getting out such a directory is considerable, and much time will have to be taken to do the work carefully and efficiently, but it seems that the advantages of having such a book brought up to date will well compensate for the labor and expense of its preparation and publication.

This Commission was invited to send delegates to a preliminary meeting called to take action regarding a California exhibit at the Columbian Exposition, to be held in Chicago, Illinois, in 1893. The delegates from this Commission, who could be reached in the limited time given by the notice, attended and took part in the proceedings, the outcome of which has been the call for a State Convention, to be held in San Francisco on September eleventh next. This Commission is one of the bodies invited to send five delegates to that Convention.

In closing, I desire to report that all the work of the Secretary's office is fully in hand, and everything has been attended to in proper season.

Respectfully submitted.

CHARLES B. TURRILL,
Secretary.

MINUTES OF THE VITICULTURAL COMMISSIONERS.

OFFICE OF THE BOARD OF STATE VITICULTURAL COMMISSIONERS,
204 MONTGOMERY STREET, SAN FRANCISCO, March 10, 1888.

A special meeting of the Board was called to order on the above date at 10 o'clock A. M., Arpad Haraszthy presiding. The following Commissioners were present—Haraszthy, Wetmore, West, DeTurk, Krug, and Manlove. The Secretary being necessarily absent, the Chief Executive Officer was requested to take his place. The minutes of the previous meeting were read and approved.

Mr. Haraszthy stated that he had been requested to extend to California vineyardists the invitation of the Australian Government to participate in the World's Exposition to be held at Melbourne during the present year.

Mr. West then presented the following resolution, which was seconded by Mr. Krug, and unanimously carried:

Resolved, That we do hereby appoint Mr. F. Pohndorff as agent of this Commission to proceed to London, Bordeaux, and Spain, to carry with him samples of California viticultural products with a view to determine the opportunities of trade with those places; also to procure samples and make collections of wines, raisins, cuttings, and other products of interest and value for our study, the actual expense of such work to be defrayed by this Commission not to exceed the sum of $1,500; and be it further

Resolved, That we do hereby recommend to the honorable Commissioner of Agriculture for the United States the name of F. Pohndorff as an efficient agent for appointment by the Department of State at Washington as special agent to the International Conference at Madrid, to consider measures of importance concerning adulterations of the wine products of the world.

A special committee, consisting of Commissioners Manlove, Krug, and Wetmore, was appointed to instruct Mr. Pohndorff as to his duties in the respect referred to in the above resolution.

The Secretary was instructed to forward to Commissioner Colman a copy of the resolutions recommending Mr. Pohndorff for appointment to represent our interests at Madrid.

A communication was read from B. F. Clayton, of New York, to our Chief Executive Officer, asking for instructions regarding certain matters pertaining to viticulture, and our interests in New York. Respecting the above communication, Mr. Wetmore offered the following resolution, which was adopted:

Resolved, That this Commission do hereby appoint Mr. B. F. Clayton as local officer and agent of this Commission, to disseminate in the East information concerning our industry, and to carry out, so far as practicable, the policy of this Commission as instructed from time to time; to serve without compensation, and to report to this Board when convenient.

Resolved, That the Secretary be instructed to acknowledge gratefully the services of said B. F. Clayton performed in the past, and to notify him of the above appointment.

The following resolution was offered by Dr. Manlove, and was carried unanimously:

Resolved, That it is the sense of this Commission that so far as practicable and wise, all internal revenue taxes should be reduced or abolished, it being expressly understood, however, that distinct principles, other than the collection of revenue solely, and in the interest of public morals, should govern the taxation of spirits; and,

Resolved, further, That there should be no reduction in the tax on spirits, except so far as grape brandy is needed for the preservation of pure sweet wines, and alcohol used in the arts.

Resolved, further, That it is of great importance that our delegation in Congress should consider also the wisdom of increasing the tax on spirits, and particularly such modifications of existing laws that may be necessary to encourage improvement in the quality of distilled liquors and the restriction of compounded and rectified goods, to this end the principle of indefinite bonding being capable of assisting in a practical reform.

The meeting then adjourned.

CLARENCE J. WETMORE,
Secretary.

BOARD OF STATE VITICULTURAL COMMISSIONERS,
SAN FRANCISCO, April 18, 1888.

A special meeting of this Board was called to order at the above date at 11 o'clock A. M. by President Haraszthy. The following Commissioners were present: Haraszthy, Krug, Shorb, West, and DeTurk; also, Chief Executive Officer Wheeler and Secretary C. J. Wetmore.

The Secretary read the resignation of Arpad Haraszthy as President of the Commission. After careful consideration the resignation was not accepted by a unanimous vote.

A communication was received from Dr. Vanderbeck offering to take charge of an exhibit of wines at the Melbourne Exposition, and stating his terms for doing so. On motion, the offer was not accepted.

A communication was also read from Mr. E. J. Howell, a wine merchant of London, and special correspondent of the London "Globe," offering his services as special agent of the Commission. On motion of Mr. West, Mr. Howell was appointed a special agent of this Commission at London, to serve without compensation.

President Haraszthy then handed in his report to the Governor for the year 1887.

Chief Executive Officer Wheeler reported that the reports of the Commissioners for 1887 would be sent to the State Printer in a few days; also, that the manuscript of the last Convention had already been sent to the State Printer; also, that he was having some translations made of French authorities on wine making, which, when published, would be for free distribution.

The meeting then adjourned.

CLARENCE J. WETMORE,
Secretary.

BOARD OF STATE VITICULTURAL COMMISSIONERS,
SAN FRANCISCO, June 11, 1888.

The regular semi-annual meeting of the State Viticultural Commission was held on the above date, Vice-President Wetmore in the chair.

The following Commissioners were present: Messrs. Wetmore, Krug, West, DeTurk, Shorb, Manlove, and Doyle; also, Chief Executive Officer Wheeler and Secretary C. J. Wetmore.

The minutes of the previous meeting were read and approved.

Vice-President Wetmore, from the Committee on Experimental Wine Cellar, reported that there was in the cellar a fine lot of wines selected from different parts of the State, and also some samples made by the Commission; that some of the wines were ready for bottling, and that they would not improve if left longer in the casks. The committee hoped that all the Commissioners would visit the cellar after the meeting adjourned.

The committee appointed to give instructions to Mr. Pohndorff, special agent of the Commission to attend the conference at Madrid, reported that so far they had not been able to do anything, owing to the fact that no word had been received from Washington, D. C., as to the time of holding the conference.

Chief Executive Officer Wheeler reported that the reports of the last Convention would soon be ready for distribution; also, that the report for 1887 of the Commissioners would soon be ready to be sent to the State Printer; also, that he had translated a treatise on wine making, by Ladrey, and that when published by the State Printer it would be for free distribution.

The Chief Executive Officer was instructed to confer with the Committee on Distillation, and prepare an essay on distillation, and to submit the same to the Board before publication.

The election of officers for the ensuing year then took place, resulting as follows: President, Charles A. Wetmore; Vice-President, I. DeTurk; Treasurer, Charles Krug; Secretary, Clarence J. Wetmore; Chief Executive Officer, J. H. Wheeler.

The following resolution, offered by Mr. Doyle, was adopted:

Resolved, That the Chief Executive Officer ascertain, and report to the Board, under what section of the Revised Statutes and department rulings cherry juice is admitted by the customs officers at a less rate of duty than distilled spirits, which form a component part of it of chief value.

Recess taken until 2 P. M.

On resuming business, Mr. Krug moved that the President appoint a standing Committee on Statistics, whose duty will be to supervise and direct the gathering of statistics in conjunction with the officers of the Commission.

The motion was carried, and the President appointed the following committee: Messrs. Krug, West, and Shorb.

President Wetmore then brought up the subject of a State Wine Exchange and Permanent Exhibit, and stated that he had given the matter considerable thought, and had sent out a prospectus to the members of the Commission after consulting with several members of the Board, and other wine growers. After explaining his ideas of such an exchange, and the manner in which he thought it should be run, Mr. Doyle offered the following resolution, which was unanimously adopted:

Resolved, That we approve of the suggestion of a Wine Exchange, to bring producers and buyers of viticultural products together and maintain a permanent exhibit of such products, and that a committee of three, of which the President shall be Chairman, be appointed to frame a detailed plan therefor, and report the same at the earliest opportunity.

The following is the committee appointed: President Wetmore, Shorb, and DeTurk.

The meeting then adjourned, to meet on the following day at 11 o'clock A. M.

CLARENCE J. WETMORE,
Secretary.

BOARD OF STATE VITICULTURAL COMMISSIONERS,
SAN FRANCISCO, June 12, 1888.

The adjourned meeting of yesterday was called to order on the above date at 11 o'clock A. M. The following Commissioners were present: Messrs. Wetmore, West, DeTurk, Doyle, Shorb, and Manlove.

President Wetmore, Chairman of the Committee on Permanent Exhibit and Viticultural Exchange, reported that the members of the committee had consulted together and had agreed upon the following:

First—A commodious store should be rented on the ground floor, and with a good cellar, in a favorable locality.

Second—Transfer of all the present offices of the Commission to such store after fitting up suitable rooms by proper partitions, etc., reserving the larger portion of such store for

(*a*) Permanent exhibit of wines, brandies, raisins, and other viticultural products of California, together with maps, photographs, and other illustrated attractions for the general public.

(*b*) Sampling department, where an opportunity will be given to purchase and sample any of the products offered by producers, and admitted in accordance with rules governing the same; exhibitors in this department will be credited with proceeds of products sold at their regular trade prices, and profits of retailing same to defray expenses as far as practicable, and all surplus profits to be paid into the State Treasury. Visitors in the department to be guided only by their own taste or desires, aided by the catalogue; all interference on the part of the management and service in guiding taste or selection to be strictly prohibited; the management not to be responsible for unsold samples, except reasonable care of same, which shall be subject at any time to withdrawal by exhibitor after paying any necessary expense incurred specially with respect to them; such exhibits shall be subject also to be returned to the exhibitors at any time in accordance with the rules of this department. Sampling is also provided for in this department of such experimental stock as is the property of the State from the experimental cellar, as may from time to time be determined. Prices for retailing samples to be as fair as practicable, but so fixed as not to come into unfair competition with the ordinary retail trade. All attempts to use this department for the purpose of undercutting fair trade prices to be discouraged by strict rules, but every encouragement in favor of good prices for superior goods to be afforded in order to stimulate the production and care of fine products.

(*c*) Viticultural Trade Exchange, wherein facilities for producers, brokers, tradesmen, and wholesale merchants, to meet and examine products by sample, will be afforded, subject to special rule.

(*d*) Cellar for storage and experimental work.

Third—Management. The Permanent Exhibit and sampling to be under the general direction of a special committee, and managed by an officer of the Board, with such assistance as may be found necessary. In case this work is added to the duties of the Secretary, an additional compensation to be allowed for the same.

Fourth—The Exchange Department. To be organized by the Executive Committee of this Board, with power to associate with them an Advisory Board of Control from outside the Commission, whose rules shall first be reported to the Commission for approval.

After considerable discussion on the above plan, the following resolution, offered by Mr. Doyle, was unanimously adopted:

Resolved, That a permanent exhibition of viticultural products of the State be established in connection with the offices of the Commission in San Francisco; that the plan, outlined by the special committee just reported, be approved, and that it be referred to the Executive Committee, to prepare and adapt the details of such plan, and to carry out the same; that the premises under the Mechanics' Institute building, on Post Street, are deemed suitable for the purpose, and the committee are authorized to rent the same (unless more suitable ones be found), and fit the same up for the offices of the Commission, the permanent exhibition of products aforesaid, and with the view to the establishment of a Viticultural Trade Exchange on the same premises.

The President then appointed the following standing committees:

Executive Committee.—DeTurk, West, and Manlove.
Auditing Committee.—Manlove.
Finance Committee.—Doyle, Rose, and Shorb.
Vine Pests and Diseases of the Vine.—DeTurk, West, and Manlove.
To Confer with the Board of Regents.—Doyle, West, and Krug.
Distillation, Counterfeits, and Adulteration.—Shorb, West, and Krug.
Evils Resulting from the Introduction of Foreign Fruit Juices, as at Present Allowed.—Doyle, West, and DeTurk.
Raisins and Table Grapes.—West, Rose, and Manlove.
Experimental Wine Cellar.—Wetmore, DeTurk, and Krug.

Mr. Shorb then moved that a committee of three, of which the President should be the Chairman, should be appointed to wait upon Miss Kate Field and see if she would accept the office of lecturer for the Eastern States on the subjects pertaining to the wine industry, and if she would accept, to make satisfactory arrangements with her.

The motion was carried, and the following committee was appointed: Wetmore, Shorb, and Doyle.

On motion of Mr. Shorb, the Executive Committee was instructed to draft a set of resolutions showing the appreciation of this Commission for the work done in the past for the viticultural industry of the State by Arpad Haraszthy, late President of the Commission.

The meeting then adjourned.

CLARENCE J. WETMORE,
Secretary.

BOARD OF STATE VITICULTURAL COMMISSIONERS,
SAN FRANCISCO, October 26, 1888.

A special meeting of the Board was held on the above date, and called to order at 11 o'clock A. M. by President Wetmore. The following Commissioners were present: Messrs. Wetmore, Krug, and Manlove.

A. S. Hallidie, Commissioner to represent the State at the Paris Exposition, was present, and conferred with the members with reference to an exhibit of wines to be made at the Exposition. After discussing the subject, the Commissioners agreed to make a collection of wines and brandies, and forward them through Mr. Hallidie.

President Wetmore reported that at the last meeting of the Board the Executive Committee was instructed to take possession of the premises in the Mechanics' Institute building on Post Street, and fit the same up for a Permanent Exhibit and Viticultural Exchange. Since that meeting the Trustees of the Mechanics' Institute refused to rent the store for the purposes we wished it. He further reported that he had looked around for another place, and had secured Platt's Hall at a rental of $350 per month, and that the hall would be turned over to us about December 1, 1888. The action of the President was indorsed by the Commissioners present.

A communication was received from Peter Klein, proprietor of the Occidental Restaurant, offering to lease a portion of the hall for a café, in which a first class lunch would be served, and only such wines and brandies as were furnished by the Commission from the exhibits, charging the prices fixed by the exhibitors, with a small additional service charge. The communication was referred to the Executive Committee, with power to act.

The Chief Executive Officer reported that Mr. Shorb had consulted with the officers of the Commission in reference to employing an expert to examine into the vine disease in Southern California; that they had agreed that something should be done by the Commission at once, and had engaged Mr. Ethelbert Dowlen at a salary of $150 per month to examine the disease, and report on the same. On motion, the above action was indorsed.

Mr. Krug reported that wine making was about finished in his district; that white grapes had fermented well, but that they had had some difficulty in fermenting Zinfandels; also, that the wine made from Zinfandels was very light in color.

Dr. Manlove reported that the wine yield in his district was short; that a great many vineyardists had dried their wine grapes, and had received satisfactory prices for the dried product; and that unless good prices were offered for fresh grapes next year, nearly all of the wine grapes would be dried.

The meeting then adjourned.

CLARENCE J. WETMORE,
Secretary.

BOARD OF STATE VITICULTURAL COMMISSIONERS,
SAN FRANCISCO, December 12, 1888.

The regular semi-annual meeting of the Board was held on the above date, and was called to order at 11 o'clock A. M. by President C. A. Wetmore.

The following Commissioners were present: Wetmore, Krug, West, DeTurk, Doyle, Shorb, and Manlove; also Chief Executive Officer Wheeler and Secretary Clarence J. Wetmore.

The minutes of the previous meeting were read and approved.

A communication was received from Miss Kate Field stating that she would soon deliver her first public lecture, and that the expense of the same would be about $500. On motion of Commissioner Doyle, Miss Field was authorized to expend an amount not to exceed $500 in the necessary expenses of a public lecture, to be delivered as soon as possible in some eastern city, in the advocacy of California wines. Miss Field also wrote that she had recently introduced Miss Mary Anderson to sound California wines, and that the charming actress was delighted to find that her native State produces so excellent and pure a beverage. She also inclosed letters from many noted persons in the East to show that her work for the Commission was well received.

In referring to the disease which is devastating the vineyards of Southern California, Mr. Shorb stated that Mr. Ethelbert Dowlen, the expert appointed by the Commission to investigate the disease, was working very hard and was studying the whole disease from a scientific standpoint, but that up to the present time he had not discovered the true cause of the disease, but that he was positive it had not been caused by any insect. Mr. Shorb further stated that thousands of acres were being destroyed by the disease, and if it was not checked that all the vineyards of the south were doomed. He also was of the opinion that the same disease had appeared in the northern part of the State, and advised the other Commissioners to be on the lookout for it. He

thought that the Commission should use every means in its power to find out the cause of the disease, and, if possible, to check it. He further stated that he had written a letter to Hon. Norman J. Colman, Commissioner of Agriculture at Washington, D. C., asking the assistance of his department in the erection of a conservatory where the disease could be studied during the winter, and also that he send an expert to work in conjunction with the expert employed by this Commission. In answer to this letter, Mr. Colman had stated that the department could not furnish any money for building the conservatory, but that next spring he would send out an expert to assist the Commission in its work. Mr. Shorb also stated that through instructions from the Executive Committee of this Board, he had built a small conservatory where the temperature could be regulated and the green leaves forced out on the vines, and so the disease could be studied during the winter.

The Commission then indorsed the work done by Mr. Shorb, and on motion of Mr. Doyle, Mr. Shorb was appointed a committee of one to continue the investigation of the disease, and to correspond further with the Department of Agriculture at Washington, stating the importance of the work, and that the department should send on the expert at once, so that the work can be carried on during the winter.

On motion of Mr. Krug, the Chief Executive Officer was instructed to prepare a circular describing the disease, and to send it out at once to all the vineyardists of the State, with the request that they keep a lookout for the disease, and to report it immediately to this office when discovered.

The Commissioners then took up the subject of the Permanent Exhibit in Platt's Hall, and after considerable discussion the details outlined in the circular sent out by the Secretary were adopted, and on motion of Mr. Shorb the Secretary was made General Manager, with a salary of $150 per month, and to do the work of the Secretary without extra pay. The Executive Committee was instructed to carry out the plans as determined upon.

On motion of Mr. Krug, the following Committee on Legislation was appointed: Messrs. Doyle, Manlove, and West.

The President then stated that at the last meeting of the Board it was decided best to gather together representative samples of California wines and brandies, and send them as a State collection to the Paris Exposition, and he asked the Commissioners to take the matter in hand at once, and to forward samples from their districts to the Secretary, so that he may prepare them for shipment.

The Chief Executive Officer reported that he was making selections of dried Zinfandel grapes for the purpose of sending them to Paris and Bordeaux, in order to ascertain their value for wine-making purposes, and also to find out what sort of market there would be for large quantities of them.

Dr. Manlove stated that some dried wine grapes in his district had sold for $3\frac{3}{4}$ cents per pound by the carload, and also that the Chasselas and Burger made very fine dried grapes, and that the Zinfandel was one of the easiest to dry.

Mr. Krug reported that he was gathering statistics in his district, and would soon be able to hand in his report for 1888.

The meeting then adjourned.

CLARENCE J. WETMORE,
Secretary.

Board of State Viticultural Commissioners,
San Francisco, March 31, 1889.

A special meeting of the Board was called by the President for the above date, to consider the resignation of the Chief Executive Officer, but there being no quorum present, the meeting adjourned to meet at the call of the President.

CLARENCE J. WETMORE,
Secretary.

Board of State Viticultural Commissioners,
San Francisco, April 20, 1889.

A special meeting of the Board of State Viticultural Commissioners was held on the above date at its office in Platt's Hall, and was called to order at 11 o'clock by the President, Charles A. Wetmore.

The following Commissioners were present: Wetmore, Krug, West, DeTurk, Doyle, and Rose.

The minutes of the previous meeting were read and approved.

Mr. DeTurk, Chairman of the Executive Committee, reported that the work of the present officers had increased so much that the committee recommended that all of the offices be filled; also, that full power should be given to the Executive Committee to act in cases of urgency, so that there will not be a necessity of calling so many special meetings of the Board. Acting on this report, Mr. Rose offered the following resolution, which was unanimously adopted:

Resolved, That all matters of detail involved in the execution of the work laid out by this Board, and in conformity with the defined policy as expressed by resolutions and the laws governing the Commission, and all other business of the Commission during the intervals between meetings, not otherwise provided for by the Commission at its regular or special meetings, shall be under the control of the Executive Committee, with full power to act in the name of the Commission. Said committee shall keep in a book in the office full minutes of its proceedings, with records of the work authorized or undertaken, which shall be subject to any member of the Board, and be laid before the Board at its next ensuing regular or special meeting, accompanied, when necessary, by a detailed report. The Board shall, at any time, have authority to change the action of the committee from the time such change is declared.

Mr. Doyle then offered the following resolution, which was carried:

Resolved, That on the written request of any two members of the Board, the Secretary shall call a special meeting of the Board, to be held within ten days after presentation of such request, stating therein the objects of the meeting as expressed to him by the members requesting the call.

The work so far done by the Executive Committee in organizing the Permanent Exhibit and café was indorsed, and the committee was requested to make detailed report of the work done and to present it at the next meeting.

Mr. J. H. Wheeler, having informed the members that owing to private business requiring his constant service he would be compelled to resign the office of Chief Executive Officer, his resignation was accepted, to take effect May 1, 1889, and on motion of Mr. Doyle, the President, C. A. Wetmore, was elected Chief Executive Officer.

Owing to the increase of work devolving upon the Manager and Secretary, and acting on the recommendation of the Executive Committee, that all the offices should be filled, Mr. Rose moved that Mr. C. B. Turrill, Manager of the Chamber of Commerce of San Diego, be appointed Secretary, and that Clarence J. Wetmore be retained as Manager of the Hall and Experimental Cellar, the Manager to receive the same salary as heretofore fixed. The motion was unanimously carried.

J. B. J. Portal, of San José, who is on his way to France to attend the Paris Exposition, was made a special agent of this Commission to inquire into the dried grape business; to find out the quantity used in that country, and the possibilities of a market for our dried wine grapes. The sum of $200 was voted Mr. Portal to cover expenses in getting such information.

Mr. Krug moved, and the motion prevailed, that a State Convention be called as soon as possible, and that the time and arrangements be left with the Executive Committee.

On motion of Mr. West, the Executive Committee was requested, with the aid of the officers of the Board, to investigate the laws of different counties respecting the sale of fermented and distilled liquors, collecting the same, and showing the effect on public morals, and any amendments that should be made to make the same effective. Also, that the same committee should do all it could to find out the markets for dried wine grapes, and to coöperate with the Grape Growers and Wine Makers' Association in this work, and to lend them all the assistance possible.

The subject of a market for dried wine grapes was discussed freely, and was considered to be one of the most important works of the Commission for the ensuing year.

The Secretary was instructed to forward the thanks of this Commission to Miss Kate Field for her able lectures delivered in Washington, D. C., and Boston, and to send their greetings and well wishes.

The Commission then adjourned.

CLARENCE J. WETMORE,
Secretary.

Board of State Viticultural Commissioners,
San Francisco, June 10, 1889.

The regular semi-annual meeting of the Board of State Viticultural Commissioners was held at their office, in Platt's Hall, at 11 o'clock A. M.

Present: Commissioners Wetmore, West, Manlove, and Doyle.

There being no quorum present, the Board adjourned to Tuesday, June 11, 1889, at 11 o'clock A. M.

CHARLES B. TURRILL,
Secretary.

Board of State Viticultural Commissioners,
San Francisco, June 11, 1889.

The adjourned meeting of the Board of State Viticultural Commissioners was held at the office of the Commission, Platt's Hall, at 11 A. M.

Present: Commissioners Charles A. Wetmore, Isaac DeTurk, W. S. Manlove, John T. Doyle, George West, and L. J. Rose; also, General Manager C. J. Wetmore and Secretary C. B. Turrill. President Wetmore was in the chair.

The Secretary read the minutes of meetings held April 20, 1889, and June 10, 1889. By a unanimous vote these minutes were approved.

The minutes of a meeting of the Executive Committee, held June 10, 1889, were submitted and approved.

The next order of business was the election of officers for the ensuing year. The ballots being counted, the following result was announced: Charles A. Wetmore, President; Isaac DeTurk, Vice-President; Charles Krug, Treasurer; Charles B. Turrill, Secretary; Charles A. Wetmore, Chief Executive Officer.

It was moved by Commissioner West that the present appointed officers be continued in office, subject to the future action of the Executive Committee. The motion was seconded and carried.

Chief Executive Officer C. A. Wetmore reported progress in his department, and outlined a large amount of work which he wished to carry through. In his opinion, one of the most important things to be undertaken would be the preparation and publication of an original work on fermentation and distillation. He also thought it important to issue a work on hygiene, as related to the wine interest. He thought it would be a good thing to inaugurate a series of monthly lectures in the hall.

The report of J. H. Wheeler, late Chief Executive Officer,* was then read, discussed, and placed on file.

The report called up a general discussion of the disease. In the absence of Commissioner J. DeBarth Shorb, who had been appointed a special committee on the subject, Commissioner Rose described the manner of the spread of the disease, saying that it traveled with the wind, and that its effects were very sudden and fatal. He had noticed that different varieties of grapes were differently affected. Those whose fruit contained the largest amount of sugar were first to be attacked, and others in proportion, until the Zinfandel, having but a small proportion of sugar, resisted longest. His observations convinced him that the disease does not travel in the winter, but rather when the vines are in foliage. The vines die down from the top. He had noticed no vines exempt when surrounded by affected vines. The vineyards at Anaheim and Orange were practically destroyed, with but one small exception. The owner of this vineyard had treated his vines in some manner which he had not disclosed. Outside of the districts mentioned, about 10 per cent of the vineyards of Los Angeles County are destroyed. He had noticed no difference in the progress and effects of the disease, either on low land or on gravelly soil with good under-drainage. He thought a careful examination of the fungus found on the diseased vines in Los Angeles County, and of that supposed to be the same on vines in the northern part of the State, would disclose a difference.

Commissioner Wetmore suggested, in order to better compare the disease being studied by Mr. Dowlen under the supervision of Commissioner Shorb, and to identify it and to determine whether the same disease is prevalent in other parts of the State, that, in his opinion, it would be important to get Dr. H. W. Harkness, who is the best authority on fungoid growths in the State, to go to Los Angeles and report on the disease.

Commissioner Rose and the others present fully indorsed this plan, and as Mr. Wetmore stated that he would soon go to Los Angeles County

* This report will be found elsewhere in this volume.

to personally inspect the infected district, it was decided that Mr. Wetmore should endeavor to get Dr. Harkness to go with him.

President Wetmore submitted a letter from Kate Field detailing her work in the East. After discussion, the matter was referred to the Executive Committee.

President Wetmore then brought up the matter of a State Convention. After discussion the subject was left with the Executive Committee. In the discussion Mr. Wetmore stated that he thought that only matured wines (1887 and older) should be exhibited at the coming Convention, as at former Conventions new wines had been exhibited and tested, and now we should devote more attention to the matured wines. This view was fully indorsed.

Mr. DeTurk favored a good exhibit of grapes in the hall during the grape season, as well as during the time of the Convention.

Chief Executive Officer C. A. Wetmore suggested that experiments be made in the manufacture of sherries in the experimental cellar. This matter was referred by the Board to the Chief Executive Officer, and he was authorized to take such action as he thought proper.

On motion of Commissioner Rose, duly seconded and carried, the President and Commissioner Doyle were authorized to take all necessary action in regard to getting special duties fixed on cherry juice, so as to regulate importations.

There being no further business, the Board adjourned.

CHARLES B. TURRILL,
Secretary.

Board of State Viticultural Commissioners,
San Francisco, June 12, 1889.

Ordered by the President this day that all standing committees as at present constituted be continued, and that the members of the same are reappointed.

CHARLES B. TURRILL,
Secretary.

Board of State Viticultural Commissioners,
San Francisco, December 9, 1889.

The regular semi-annual meeting of the Board of State Viticultural Commissioners was held at the office of the Commission, 216 Montgomery Street, San Francisco, on the above date.

Present: Commissioners C. A. Wetmore, Charles Krug, J. DeBarth Shorb, John T. Doyle, W. S. Manlove, and George West, and Chas. B. Turrill, Secretary of the Board. Commissioner I. DeTurk arrived during the reading of the minutes. President C. A. Wetmore was in the chair. On being called to order, owing to the fact that alterations were being made in the hall, the Board adjourned to the Occidental Hotel.

The Board reassembled in one of the reception rooms of the Occidental Hotel, Montgomery Street, San Francisco.

The minutes of the meetings held June 10 and June 11, 1889, were read and approved.

Commissioner J. T. Doyle made a verbal report on behalf of the committee appointed to take action in regard to getting special duties fixed on cherry juice. The recommendations made were later in the proceedings incorporated by Mr. Doyle in resolutions which he presented.

Commissioner J. DeBarth Shorb, as special committee on the Anaheim vine disease, reported the progress thus far made in endeavoring to ascertain the cause of the trouble and to find a remedy. Mr. Dowlen has from time to time reported to the Commission the progress of his work under Mr. Shorb's direction. Mr. Shorb stated that specimens of the diseased vines have been sent to the best experts in Europe, in the hope that they can give information, as it is feared that the complaint is mal-nero, a disease which has devastated the vineyards of Italy. Photographs of the disease, as it appears under the microscope, are being made for extensive circulation among the most noted savants of the Old World.

On motion of Commissioner George West, duly seconded, it was decided to vigorously continue to push the investigation of the disease in Southern California.

The Secretary then presented the following financial statement (made by the General Manager), which, upon motion, duly seconded, was received and placed on file:

The following will show the expenditures for the first four months of the forty-first fiscal year:

July	$2,343 18
August	1,514 80
September	1,835 11
October	1,579 45
	$7,272 54

Estimated expense for the remaining eight months of the year:

Rent	$2,800 00
Salaries	4,400 00
Southern California vine disease	1,200 00
Kate Field	200 00
State Analyst	800 00
Gas and water	480 00
Coal	60 00
Commissioners' expenses	250 00
Express charges	125 00
Postage, stamps, and incidentals	200 00
	$10,515 00

Making the expenses for the year as follows:

Amount expended from July to November	$7,272 54
Amount estimated balance of year	10,515 00
Total	$17,787 54

The amount appropriated by the last Legislature for the two years beginning with July 1, 1890, was $35,000, of which amount not more than $17,500 can be used the first year. Unless some of the expenses can be cut down for the balance of the year, there will be a deficiency at the end of the year.

After the report had been discussed by the members of the Board, on motion of Commissioner J. T. Doyle, duly seconded, it was

Resolved, That the State Analyst and his assistant be notified that owing to the scarcity of funds, and the pressing demands of other parts of the work of the Commission, the regular appropriation made for their services would have to be discontinued, greatly to the regret of the Commission, at the end of the present month.

The Secretary then read the report of the General Manager of the Exhibition Hall and Experimental Cellar,* which, on motion, duly seconded, was received and placed on file.

Commissioner DeTurk stated that he would leave for Washington, D. C., in a few days, and offered to do anything he could for the Board while there.

The Board then took a recess to 2:30 P. M.

On reassembling in the same place at 2:30 P. M., all were present who were present at the morning session.

President Wetmore read a letter from B. F. Clayton, of Washington, D. C., giving an account of the prospective outlook for legislation relating to California viticultural interests.

President Wetmore then submitted his report.†

After a full discussion of the report by all the members of the Board of Commissioners, John T. Doyle introduced the following resolutions:

Resolved, That in the judgment of this Board the Internal Revenue tax on distilled spirits should not be repealed, except as regards spirits used in the arts and fruit spirits used in the fortification of sweet wines and dry wines for exportation only.

Resolved, That no general reduction in the tax on distilled spirits intended for use as beverages should be permitted, except on fruit spirits, and on them only, so far as may be necessary to equalize cost of production between grain and fruit spirits. The abolition of the tax on fruit brandies should be opposed as a measure dangerous in the extreme.

Resolved, That our Congressmen should be impressed with the truth that the market value of alcohol controls the average market value of all ordinary wines, because alcohol is the base of all imitations of wine.

Resolved, That the relief demanded by the sweet-wine producers should be granted, but strictly limited to the producers at the original place of fermentation, and to a stated quantity, not exceeding fourteen per cent of alcoholic strength; wines so fortified, and containing not to exceed twenty-four per cent of alcohol, and should not contain less than four per cent of saccharine matter; no use of saccharine matter other than the pure product of the grape to be recognized as legitimate, excepting pure crystallized cane sugar, and no spirits for fortification to be free from tax, excepting pure fruit spirits. Producers of pure wine who ferment their own products should be permitted to procure fruit spirits free of tax, out of bond, for fortification, subject to careful supervision of the Internal Revenue officers to prevent fraud.

Resolved, That in our opinion the advantage to be gained by the privilege to fortify sweet wines free from taxation would not compensate for the harm that would be done by violation of any one of the principles stated above, or by failure to enforce any of the limitations and restrictions mentioned.

Resolved, That in amending the tariff, provision should be made taxing "fruit juice not containing alcohol, distilled or otherwise," at whatever rate Congress thinks fit to impose, and providing that "fruit juices containing alcohol, and not classed as wines or brandies," shall be classed as alcoholic compounds, which they really are.

Resolved, That Section 3328 of the Internal Revenue Act shall be amended so as to read as follows: "No. 3328. On all beverages containing alcohol, designated or sold as wine, or as a substitute for wine, not made from grape juice and prepared in accordance with methods recognized as legitimate in standard published works on the subject, there shall be levied and collected," etc., as in the present section; "*provided*, that beverages made from the juice of fruits or berries, in accordance with approved methods, shall be exempt from tax if labeled or branded with the name of the fruit from which the same was made," etc.

Resolved, That the bonding period for brandy should be extended to five years.

Mr. Wetmore presented the following:

Resolved, That ample facilities under Internal Revenue regulations to prevent fraud should be given for the fortification of any kind of wine, for exportation only, free of tax, provision being made against reimportation of the same without paying tax.

The resolutions introduced by Messrs. Doyle and Wetmore were seconded and passed with but one dissenting voice.

Commissioner Shorb, in voting, explained that he differed from his colleagues only in one particular contained in the resolutions introduced

*This report will be found elsewhere.

† This report related to the proposed Sweet Wine bill, and will be found elsewhere.

by Mr. Doyle, viz.: if the Sweet Wine bill could not be passed without conceding the use of grain spirits as well as of fruit spirits free from tax for fortifying sweet wines, he would be willing to make this concession rather than lose the bill.

It was moved by Commissioner John T. Doyle, duly seconded and unanimously passed, that a committee of three be appointed to draft a letter to the Senators and Representatives of California in Congress, setting forth the legislation desired on the part of the Commission. The committee appointed consisted of Commissioners John T. Doyle, George West, and J. DeBarth Shorb.

There being no further business before the meeting, the Board adjourned.

CHARLES B. TURRILL,
Secretary.

BOARD OF STATE VITICULTURAL COMMISSIONERS,
SAN FRANCISCO, June 9, 1890.

The regular annual meeting of the Board of State Viticultural Commissioners was held at the headquarters of the Commission, Platt's Hall, 216 Montgomery Street, San Francisco, at 10:30 A. M.

The following Commissioners were present: Isaac DeTurk, G. G. Blanchard, J. DeBarth Shorb, George West, John T. Doyle, Charles Bundschu, E. C. Priber, and R. D. Stephens.

Charles Bundschu took his seat, vice Charles A. Wetmore, for the San Francisco District.

E. C. Priber took his seat, vice Charles Krug, for the Napa District.

R. D. Stephens took his seat, vice Wm. S. Manlove, for the Sacramento District.

L. J. Rose was absent. G. G. Blanchard was not present at roll call, but came in at the part of the proceedings at which his arrival is mentioned in these minutes.

A quorum being present, the Board was called to order by Vice-President Isaac DeTurk, who presided during the meeting.

Secretary Charles B. Turrill, General Manager Clarence J. Wetmore, Chief Executive Officer Charles A. Wetmore, and representatives of the press were also present.

The meeting was called to order by Vice-President DeTurk at 10:30 A. M.

The Secretary read the minutes of the meeting of the Board, held December 9, 1889, except the report of Charles A. Wetmore therein, which, by unanimous consent, he was excused from reading. The minutes were approved as read.

The Secretary then read the report made by Ethelbert Dowlen, and submitted by Commissioner J. DeBarth Shorb, this report being numbered forty-two in the series of Mr. Dowlen's reports made to the Board.*

After the reading of the report, it was moved by John T. Doyle, that wherever in the report the word "California" appears, as applied as a name to the disease, the word "Anaheim" be substituted by the Secretary. The motion was seconded and carried. The report as amended

* This report will be found printed elsewhere.

was then, on motion of John T. Doyle, duly seconded, received, and ordered placed on file.

At this point of the proceedings, J. DeBarth Shorb asked the privilege of introducing Mr. C. Furley Oldham, of England, who has been visiting various points in California for the purpose of making arrangements looking to the further introduction of California wines in England. On motion of Mr. Shorb, duly seconded, it was unanimously resolved to suspend the regular order of business and listen to Mr. Oldham's account of his experience in introducing California wines into England.

Mr. Oldham thereupon made a very interesting address, explaining the difficulties he had met with and had overcome, in placing California wines on the English market. Among other things, he stated that while, as a rule, the English do not drink much white wine, he had found that the California white wines met with a hearty reception.

At the conclusion of Mr. Oldham's remarks, John T. Doyle moved that a vote of thanks be extended to Mr. Oldham for his very entertaining and instructive address. The motion was seconded and unanimously carried.

During Mr. Oldham's speech, Commissioner G. G. Blanchard arrived and took his seat.

On the resumption of the regular order of business, the Secretary read the report of the Manager of the Exhibit and Experimental Cellar.*

After the reading of the Manager's report, on motion of John T. Doyle, duly seconded, the report was received and ordered placed on file.

The Secretary then read his annual report.*

After the reading of the Secretary's report, it was moved by John T. Doyle that the report be received and ordered placed on file. Motion was seconded and carried.

The Secretary then read the financial report made by Clarence J. Wetmore, Manager. It is as follows:

RECEIPTS AND EXPENDITURES FOR THE THIRTY-NINTH AND FORTIETH FISCAL YEARS, JULY 1, 1887, TO JUNE 30, 1889.

Receipts.

State appropriation		$30,000 00

Disbursements.

Salaries	$5,438 74	
Experimental work	2,228 29	
Reports	445 62	
Traveling expenses Chief Executive Officer	225 19	
Commissioners' expenses	251 45	
Conventions	438 60	
Library	373 15	
Statistics	160 90	
Distributing information	298 50	
Experimental Cellar	1,251 38	
Office expenses	13,127 71	
State Analyst	2,427 40	
Lectures	3,057 50	
		29,724 43
Balance unexpended		$275 57

Bill of E. C. Hughes, for $135, not approved.

*This report will be found elsewhere.

FORTY-FIRST FISCAL YEAR.

Expenditures from July 1, 1889, to June 30, 1890.

July, 1889	$2,343 18
August	1,514 80
September	1,835 11
October	1,579 45
November	1,203 31
December	1,442 65
January, 1890	1,213 25
February	1,548 15
March	1,191 35
April	1,215 48
	$15,086 73

Estimated Expenditures for May and June.

Salary	$1,100 00
Rent	700 00
Southern vine disease	450 00
Gas and water	80 00
Incidentals	200 00
	$2,530 00

Expended	$15,086 73
May and June (estimated)	2,530 00
Total	$17,616 73
Amount to be used	17,500 00
Deficiency	$116 73

After the reading of the Manager's financial report, Chief Executive Officer Charles A. Wetmore stated to the Board that he had agreed that any deficiency for the forty-first fiscal year should be deducted from his salary as Chief Executive Officer. Therefore, on motion of John T. Doyle, the financial report was received and ordered placed on file. The motion was seconded and carried.

The Secretary then read the report of the Chief Executive Officer.*

After the reading of C. A. Wetmore's report it was moved, by John T. Doyle, that the report be received and ordered placed on file. It was carried.

On motion of J. DeBarth Shorb, duly seconded and carried, the Board hereupon took a recess until 2 P. M.

The Board reconvened at 2:10 P. M. Present: all the Commissioners who were present at the morning session; I. DeTurk was in the chair.

John T. Doyle moved to suspend the regular order of business and proceed to the election of officers of the Board. The motion was seconded and carried by a vote of four ayes and three noes.

The Chair announced that the first officer to be elected was President.

George West nominated I. DeTurk.

E. C. Priber nominated Charles Bundschu.

There being no other nominations, the members prepared their ballots, which were collected and counted. Seven ballots were cast, as follows: I. DeTurk, four; Charles Bundschu, two; J. DeBarth Shorb, one.

It was moved by E. C. Priber that the vote be made unanimous in favor of I. DeTurk for President. The motion was seconded and passed. The Secretary thereupon announced that I. DeTurk had been elected President of the Board.

*This report will be found printed elsewhere.

The Chair then announced that the election of Vice-President would be the next business in order.

John T. Doyle nominated J. DeBarth Shorb.

J. DeBarth Shorb withdrew in favor of George West.

There being no other nominations, the members prepared their ballots, which were collected and counted. Eight ballots were cast, as follows: J. DeBarth Shorb, six; George West, two.

The Chair announced that J. DeBarth Shorb had been duly elected Vice-President of the Board.

The Chair then announced that the election of the Treasurer would be the next business in order.

George West nominated John T. Doyle.

Charles Bundschu nominated E. C. Priber.

There being no other nominations the members prepared their ballots, which were collected and counted. Eight ballots were cast, as follows: John T. Doyle, six; E. C. Priber, two.

The Chair announced that John T. Doyle had been duly elected Treasurer of the Board.

The Chair then announced that the election of Secretary would be the next business in order.

John T. Doyle nominated Charles B. Turrill.

George West nominated Winfield Scott.

There being no other nominations the members present prepared their ballots, which were collected and counted. Eight ballots were cast, as follows: C. B. Turrill, three; Winfield Scott, five.

The Chair announced that Winfield Scott had been duly elected Secretary of the Board.

The Chair then announced that the election of Chief Executive Officer would be the next business in order.

George West nominated Chas. A. Wetmore.

Chas. Bundschu nominated George Husmann.

R. D. Stephens nominated E. W. Maslin.

There being no other nominations, the members present prepared their ballots, which were collected and counted. Eight ballots were cast, as follows: C. A. Wetmore, three; Geo. Husmann, two; E. W. Maslin, three.

The Chair announced that there had been no election on the first ballot.

Chas. Bundschu withdrew the name of George Husmann; the members then prepared their ballots, which were collected and counted. Eight ballots cast, as follows: C. A. Wetmore, four; E. W. Maslin, four.

The Chair announced that no choice had been made on the second vote. After speeches by R. D. Stephens, E. C. Priber, and John T. Doyle, supporting the two candidates, the members prepared their ballots, which were collected and counted. Eight ballots were cast, as follows: C. A. Wetmore, four; E. W. Maslin, four.

The Chair announced that no choice had been made.

C. A. Wetmore asked the privilege of making a statement, which was granted. He stated that Mr. Maslin was already holding one State office, and could not legally hold another.

E. C. Priber moved that when the Board adjourn, it adjourn until to-morrow at 10 A. M., and that the Board then proceed to the election of a Chief Executive Officer. The motion was seconded. After discussion, Mr. Priber, with the consent of the second, withdrew his motion.

The Chair then announced that the fourth ballot would be taken. The members thereupon prepared their ballots, which were collected and counted. Eight ballots were cast, as follows: C. A. Wetmore, three; E. W. Maslin, five.

The Chair then announced that E. W. Maslin had been duly elected Chief Executive Officer of the Board.

It was moved by John T. Doyle that the regular order of business be resumed. The motion was seconded and carried.

The Secretary read a number of letters from various parties.

John T. Doyle moved that the matters therein be referred to the Executive Committee. The motion was seconded and carried.

President Isaac DeTurk then announced the following committees:

Executive Committee.—George West, G. G. Blanchard, John T. Doyle.

Auditing Committee.—J. DeBarth Shorb.

Finance Committee.—L. J. Rose, J. DeBarth Shorb, John T. Doyle.

Committee on Vine Pests and Diseases of the Vine.—George West, E. C. Priber, J. DeBarth Shorb.

Committee on Distillation, Counterfeits, and Adulterations.—J. DeBarth Shorb, George West, Charles Bundschu.

Committee on Table Grapes.—George West, L. J. Rose, R. D. Stephens.

Committee on Experimental Wine Cellar.—George West, J. DeBarth Shorb, Charles Bundschu.

Committee on Anaheim Disease.—J. DeBarth Shorb.

Delegates to the World's Fair Convention, to be held September 11, 1890.—J. DeBarth Shorb, G. G. Blanchard, R. D. Stephens, Charles Bundschu, E. C. Priber.

J. DeBarth Shorb, George West, and John T. Doyle spoke regarding the investigation of the Anaheim disease, made by E. Dowlen. All of the speakers agreed that the work should be continued on the same plan thus far pursued.

John T. Doyle asked that the Executive Committee be instructed to secure the services of any other parties in the investigation of the Anaheim disease.

Under instructions from the President, the Secretary read that part of C. A. Wetmore's report which referred to asking the California delegation in Congress to pass the pending bill "authorizing the several States to control the sale of fermented and alcoholic drinks free from all interference on the part of the National Government."

George West asked Mr. Wetmore to make a statement regarding the matter. This Mr. Wetmore did.

It was moved by Mr. Doyle that it is the sense of the Board of State Viticultural Commissioners that all matters relating to the control of the sale of intoxicating liquors should be left to the several States. The motion was seconded by J. DeBarth Shorb, and carried.

The President was requested to notify the members of Congress from California of this action of the Board.

There was some discussion as to the action to be taken provided that E. W. Maslin should decline to serve as Chief Executive Officer, but no definite action was taken.

There being no further business, the Board adjourned.

CHARLES B. TURRILL,
Secretary.

APPENDIX.

RESISTANT VINES BEST SUITED TO CALCAREOUS (LIMEY) AND MARLY SOILS.

Report of Professor Pierre Viala to the Minister of Agriculture at Montpellier, on his recent viticultural mission to America. Translated from the French.

DEAR SIR: By resolution of March 1, 1887, you have done me the honor to intrust me with a mission to the United States of America. The object of this mission was to search for varieties of vines which would thrive in calcareous or marly soils.

This mission has been rendered necessary by the failure of the attempts to utilize the actually known American vines, either as grafting stock, or as direct producers in the chalky soils, which cover a large area of the vine-growing district in Southern France, and particularly in the departments of the Charente; the possible outcome, however, of this mission appeared, and it must be added, with good reason, to be very doubtful.

I will not enter, dear sir, into the details of the difficulties which I had to overcome during my researches in the United States, beginning with June 5th, and ending December 3, 1887. I will only recapitulate in this memoir the conclusion which I have drawn from my observations relating to the special object of the mission with which you have intrusted me, in order that the viticulturists shall be informed without delay about this matter. The numerous facts on which the following results (conclusions) are based, shall be brought forward in a report which is to follow, together with other viticultural studies which I have made in the United States—diseases of the vine, cultivation, vinification, economic and commercial questions, etc.

The first information which I obtained at Washington from the Department of Agriculture and from the United States Geological Survey did not give me much hope that I should find vines that would thrive in soils of a mainly calcareous character. Not only the geographical distribution of the native species was very little known, but it was also an established fact that in the United States there was an immense area, the greater part of which belongs to the cretaceous formation, which does not contain any chalk soils, similar to those of the Departments of the Charente and of the Champagne. Of the magnitude of the above mentioned area, an idea can be formed when we state that it stretches from Montana to the south of Texas; from the Rocky Mountains to the Mississippi, and comprises partly the States of Tennessee and Pennsylvania. As far as the marly soils are concerned, it is possible they have been formed by the decomposition of rocks which belong to the various geological formations, and that they are distributed quite irregularly over the whole area of the United States. Here I must state that during the six months which I have spent in the United States, I was able to take a survey but of a very small part of this country.

First of all it was necessary to find calcareous soils, which had to be, if not identical, at least similar to the calcareous and marly soils of France; further, to find native wild vines, which show a vigorous growth in such soils. It was also necessary that these vines should be able to resist the attacks of the phylloxera, that they should take the graft, and last, not least, that they could be multiplied by cuttings. Finally, it was desirable that these species or varieties should be already existing in France, in order to avoid costly importations of the same; besides, being sent out on a scientific mission, I cannot overlook this side of the question.

During the first period of my mission I have explored various regions of the States of New Jersey, Maryland, Virginia, North Carolina, New York, and Ohio. The species which grow wild in these States, as well as in all the States of the North and East, are: *V. riparia*, *V. æstivalis*, *V. labrusca*, and *V. rotundifolia*. This last mentioned species, which grows only in the sandy and moist soils of the Atlantic Coast, is of no value whatever; it has been known already a long time in France.

The *V. labrusca* (Linne) has never been found in good condition, except when in sandy soils, rich loams, or red fertile soils. In poor soils, for instance, yellow marls, it is destroyed in the long run by the phylloxera. This applies particularly to States of the North and of the East, where the frosts are severe during winter and spring. In the Southern States also it succumbs quickly to the attacks of the insect, even in tolerably rich soils. The same can be said of the varieties directly derived from the *V. labrusca*.

The wild *V. æstivalis* (*V. æstivalis* of Michaux and *V. bicolor* of Le Conte) thrives only in sandy or rich loams, also in red soils, which are rich and mellow. As soon as the soil is marly, clayey, calcareous, and dry, this vine shows little vigor, although its roots are not injured by the phylloxera.

The *V. riparia* (Michaux) is the most common species in the region between Canada and the frontier of the Indian Territory. Few specimens only of this vine are met with on the banks of rivers in the south of Texas. These species, when growing wild, reaches its full development when growing in the United States only in very rich soils. In red soils and in alluvial loams, the varieties, with cordated (heart-shaped) thick and glossy leaves, are thriving remarkably well, but the trunk, though stout enough, has never the thickness of the southern varieties. It is by studying the soils in which the numerous varieties (simple or complex) of the *V. riparia* naturally grow, that one becomes convinced that they can be of real value only when growing in rich soils. I have never noticed this hardy species in marly or white and dry calcareous soils. Only once I have seen growing the *V. riparia* in a calcareous soil; this was on Kellys Island, which is one of the isles of Lake Erie; but was not a strictly calcareous soil. It was in the fissures of the compact Devonian limestone, where rich alluvial earth had accumulated, that I noticed the *V. riparia*. When calcareous fragments were predominating, the vines were chlorotic; the same remark could be applied to the vines that are growing in the yellow marls of Sandusky. I have often noticed in the woods specimens of *V. riparia*, whose leaves were covered with phylloxera galls, and whose roots were infested by numerous phylloxera; but I have never seen a case of death of a vine belonging to this species, which was due directly to this insect. Not one of the varieties of the North and the East has therefore a value for the "calcareous and marly soils."

During the second period of my voyage in the United States, I traveled over Tennessee, Missouri, Indian Territory, and California. Some important observations had been made in Tennessee and Missouri, but it was necessary to combine them in Texas.

The *V. rubra* (Michaux) or *V. palaraat* which is met with only in isolated spots, in the sandy and black loams of the Merrimac and of the Mississippi (twenty miles north of St. Louis) and in Illinois, seems to be without any value as grafting stock, because it grows only in these very rich soils. Southwest of the Missouri and northeast of the Indian Territory I have observed the *V. rupestris* and its various hybrids, *Cordifolia rupestris, Riparia rupestris;* also the *V. lincecumii.* The *V. lincecumii* of Buckley (sometimes called *post oak*, or large-grained *æstivalis*) can have, through certain of its varieties, some value in the central regions of the United States, where particularly the black rot, the mildew, and severe frosts, have always rendered impossible, not only the successful raising of the European vines grafted on resistant stock, but also of certain American varieties.

It is my belief that the varieties of the *V. lincecumii* have no future whatever for any of the vine-growing districts of our country; their small productions compared with that of our vines, the harsh and unsavory taste of their berries, which are above the middle size but rather devoid of juice, justify this belief. Besides all that, this species grows only in rich or sandy soils, never in white calcareous, or yellow marly soils; this applies to Missouri as well as to Arkansas, the Indian Territory, and Texas. On the banks of rivers, and in the black soils of the prairies, as well as in the pebbly and siliceous soils of the rich hills of the Indian Territory, individuals of this species attain a fine development at the trunk.

The *V. rupestris* (Scheele), which begins to meet the botanist's notice only in Tennessee and west of the Missouri, occurs further towards the south in the Indian Territory and in Texas; there, also, numerous derived varieties are to be found. It grows generally in river beds, which are dry after springtime, where no arborescent vegetation exists. The bottom of these ravines consists of a siliceous conglomerate, or of hard limestone, mixed with some alluvium; these constituents form together a dry and rather poor soil. The *V. rupestris*, however, thrives tolerably well in such soils. The trunk, which is sometimes very thick, is always better developed than that of the *Riparias*, which grow in alluvial soils; its branches are deprived of their leaves at base and creep on the soil. It is in the same soils that the hybrids of this latter species grow, *Cordifolia rupestris*, *Riparia rupestris*, which were first observed and imported into France by Mr. Taeger.

These hybrids are as hardy or even hardier than *V. rupestris* and *V. riparia*. They grow sometimes in the cavities of calcareous rocks (Devonian or Jurassic), which hold only small quantities of alluvial earth. All these varieties may prove very valuable as grafting stock in certain poor soils, but I do not think they are adapted for chalky soils, for I have not noticed them in such soils. There is still another proof for this assertion. Whenever the ravines in which generally the *V. rupestris* and its hybrids are found have a bottom of friable limestone, these vines disappear.

The varieties of vines which are peculiar to Texas grow exclusively in cretaceous limestone. The cretaceous region occupies the north of Texas, from the Panhandle to the Rio Pecos in the south, and from New Mexico in the west, eastwards, where it is limited by a line which unites Sherman, Dallas, Austin, and San Antonio; there it joins the Rio Pecos, following the latitude of San Antonio. With the exception of some small areas which belong to other formations (Carboniferous, Silurian, and Cambrian) this whole territory belongs by its fossils to the cretaceous formation, which reaches besides far into New Mexico, Colorado, and Arizona, States which I had no opportunity to visit, and where interesting observations could have been made.

The surface soil of the great plains (prairies) has generally everywhere almost the same composition; it is a black earth of an extreme fertility. The subsoil is a white calcareous rock; this rock is fissured and possesses variable hardness, but is always soft and has in many instances a texture which is intermediate between tufa chalk and the chalk which is peculiar to the Champagne. This subsoil is more or less deep (as deep as five feet), but it often crops out on the surface, where it disintegrates rapidly and forms a white earth, which contains an admixture of small chalky stones and a small amount of humus. The soil which results from such a mixture, is not so rich as that of the departments of the Charente.

The above described cropping out of the subsoil occurs sometimes without interruption over large areas, particularly on the sides of hills which are higher than four hundred or five hundred feet. The great table lands, which form the summits of these hills, have a richer soil; there the limestone is mixed with a reddish earth and numerous flinty pebbles, which often occur in nodules in the cretaceous formations of the subsoil.

It is in these soils that grow: *V. berlandieri* of Planchon, *V. cinerea* of Engelmann, *V. cordifolia* of Michaux, *V. candicans* of Engelmann, *V. monticola* of Buckley, a new variety which has been considered a species by Mr. T. V. Munson, the *V. Novo-Mexicana*, and numerous hybrids which result from the very various crossings between these species.

The *V. Novo-Mexicana* (T. V. Munson), which was observed for the first time in 1847, in New Mexico, by A. Fendeer (herbarium of Cambridge), reminds one much of certain varieties of the *V. riparia*, and particularly of the *Solonis*. It occurs, according to Mr. T. V. Munson, in the part of Texas (Panhandle) which lies between New Mexico and the Indian Territory. I have observed but few plants of this species on the banks of the Red River. This vine grows in the soils of the cretaceous formation, but only in spots where black earth has accumulated, or in the alluviums of the banks of the great rivers; it is also in these soils that Mr. T. V. Munson has first found it growing. It will be perhaps of some value, on account of its luxuriant growth, as grafting stock; perhaps in this regard it will not be inferior to *Cordifolia rupestris*, *Riparia rupestris*, * * * in rich soils, but I do not think that it is fit for yellow marly or white calcareous soils. The same applies to the series of hybrids called *Champins;* they may result from the crossing of *V. rupestris* and *V. candicans*, or *V. rupestris* and *V. monticola* (Buckley).

I have observed the first mentioned varieties (*Rupestris* by *Candicans*) in Johnson County, in the beds of ravines, which are few miles west of Cleburne. They were growing in a soil which consisted of calcareous pebbles, with an admixture of a considerable quantity of rich alluvial earth.

The *Champins*, which result from the crossing of *V. monticola* and *V. rupestris*, and which are very hardy, grow in the same kind of soils as the species I am going to mention now. The *V. monticola* of Buckley, (herbariums of Philadelphia, Washington, New York, Cambridge), which is nothing else but the *V. Montana* of the same author, or *V. Texana* of Mr. T. V. Munson, or *V. Foexeana* of Mr. S. E. Planchon, occupies only a very limited region in the southwest of Texas. It was observed by Buckley in Bell, Burnett, and Hays Counties; Mr. T. V. Munson has recently found it again in Bell and Lampasas Counties; it is asserted that it occurs also in Uvalde County, which is in the extreme southwest. I have noticed it in Lampasas and Bell Counties. The *V. monticola* (Buckley), which is very well characterized and quite different from *V. berlandieri* of Mr. Planchon, reminds one of some *Rupestris* varieties of rampant habitus. It is not common in the few counties where it exists, and its trunk and branches attain but a very feeble development. It is met with only on the table lands, where it grows in soils consisting of limestone fragments and numerous flinty pebbles, mixed with blackish or reddish earth. This species, it seems to me, has very little value as grafting stock for calcareous soils, on account of its feeble growth in the comparatively rich soils in which it occurs; as a direct producer it has no value whatever, notwithstanding its rather large pale rosy berries.

The geographical area of the *V. candicans*, or *Mustang*, comprises the whole south of the Indian Territory from the Arkansas River, and extends across the whole of Texas into Mexico. The *Mustang*, the hardiest of the vines which is to be found in the United States, does not thrive very well but on banks of rivers (Red River, Trinity River, Brazos River, and Rio Grande). Less frequently it occurs on cretaceous hillocks, but there, and in blue, very calcareous marl, it does not thrive as well as on the banks of rivers. It seems to me, altogether, that the *Mustang* variety is of less value for calcareous and marly soils than the three following species, on account of the difficulty in rooting the cuttings, even though special processes be used; still, it behaves well as grafting stock, and resists well the attacks of the phylloxera.

The three and only species which, by their actual behavior in their native soils, make me believe that they would do well in "calcareous and marly soils," are: the *V. berlandieri* (Planchon), the *V. cinerea* (Engelmann), the *V. cordifolia* (Michaux). I had already observed the *V. cordifolia* and the *V. cinerea* (sometimes called *Wichita*) in the argillaceous, or white marly soils (crawfish soils), which have been formed by the decomposition of rocks belonging to the Silurian and Devonian periods; these observations were made in Tennessee (Pleasant View and Ashland, in Cheatham County), and in the State of Missouri (near the village of Peocly, Pleasant Valley, on the western boundary of Jefferson County). These two species, which are common in the Eastern Central United States, are not to be met with beyond the Brazos River, which forms the southern limit of their occurrence in Texas. In the States of the East their trunks and branches grow much larger than is the case with *Riparias;* this applies particularly to the rich and deep sandy loams of the Mississippi, but they remain green and hardy in the poor and dry soils of Texas, where the soil and the subsoil consist of the white, brittle limestone; which we have mentioned already.

The *V. berlandieri* (Planchon), which by no means should be confounded with the *V. monticola* of Buckley, begins to make its appearance with few specimens only in the county of Johnson. This is the species which, together with the *Mustang*, I have observed to be the most common in the whole of Texas south of the Brazos River, and far into Mexico; this means in a dry region where *V. cinerea* and *V. cordifolia* do not exist any more. The *V. Berlandieri* predominates in regions, the soil and subsoil of which are formed by the decomposition of cretaceous rocks, on which only some few rare plants grow and remain green, such as: *Melia azedarach, live oak, Quercus virens, smilax, Juniperus Virginiana*, etc.

V. berlandieri grows more vigorously in rich soils, just as the *Cordifolia* and the *Cinerea* do, but the first mentioned vine does not turn yellow in calcareous soils. In other respects, also, it can be compared to these two species, for it not only resists very well the phylloxera, but stands also very well grafting when it grows in chalky soils. I have seen very conclusive examples of this fact at Belton, where some Spanish vines, which had been grafted two years ago on four years old *Berlandieri*, were perfectly green and vigorous in these poor soils.

The *V. cinerea* and the *V. cordifolia* of the calcareous soils are particularly abundant in the region which comprises the counties, Collin, Dallas, Ellis, Hill, Tarrant, Parker, Johnson, and particularly in the neighborhood of the towns, Dallas, Fort Worth, Waxabachie, McKinney. The *V. berlandieri*, of the same geological formation, is particularly common in the counties, Bell, Williamson, Travis, Hays, Comall, and above all, in the neighborhood of the towns, Belton, Temple, Austin San Elmo, New Braunfels.

The varieties of the *V. berlandieri* and of *V. cordifolia*, which are met with on calcareous soils, possess as a rather special characteristic feature thick, cartilaginous leaves, the inner side of which has a golden yellowish green color. The *V. cinerea* has on the same soils less cordated and shorter, but more cartilaginous leaves, which besides have stiffer bristles. The hybrids between these three species, or between them and other varieties, appear to me to be of quality inferior to the original species, and I have observed them mostly in rather rich soils simultaneously with certain new varieties, which I do not think worth while to mention, on account of their inferiority.

Two more species had to be studied in their native soils, the *V. Californica* (Bentham) and the *V. Arizonica* (Engelmann).

The occurrence of the *V. Arizonica* is limited to the States of New Mexico and Arizona, which I had no opportunity to visit. The few attempts which were made in the vineyards of Northern California to replace by this species non-resistant stock, and which I have seen, impress me with the opinion that its qualities are to be compared with those of *V. rupestris*, as far as the question of adaptation is concerned.

As to *V. Californica*, whose vigorous growth and thick trunk are equaled only by the *Mustang*, I had an opportunity to study the same in the ravines (cañons) of the southern part of Los Angeles County. This vine grows only in rich and moist soils; it shows little vigor, and becomes chlorotic in poor and dry soils. The *V. Californica* would not offer much resistance to the phylloxera, as I was able to ascertain by several facts which I had observed in Napa County; in the southern California, which the phylloxera has not yet invaded, I have never noticed the insect on the leaves or roots of the *Californica*. I do not believe that the *V. Californica* will be of any importance for the vineyards of France. Besides, the majority of the California viticulturists,

who follow the processes which are used in our southern vineyards, restore their plantations, if the soil is rich, almost exclusively with varieties of the *V. riparia*.

From all this it is evident that only the vines which I have observed on calcareous soils can be of value as grafting stock. It has been always the great endeavor of the viticulturists of the East and Northwest to produce new varieties which would resist the black rot and the mildew. The severe frosts of the winter did not allow them to use anything but the varieties of *V. labrusca*, which are adapted for these regions, to which vine growing was limited to for a long time.

The California viticulturists, who were more favored by the climate, have (it must be mentioned here) never introduced into their country the direct producers from the East, but employ the French varieties. These reasons, combined with the habit of the eastern people to prefer foxy or sweetened wines, make them accept every day with great expectations each direct producer which is thrown on the market by the nurserymen, who try to improve the original varieties of *Labrusca*, either by crossing it with other varieties, or by seedlings. The fame, which certain of these new vines have acquired in the United States, has been often the unfortunate reasons for their introduction (adoption) by French vine growers.

Without entering into long details concerning these new direct producers, I believe it is my duty to say that the Niagara and the Empire State are varieties with white foxy berries, and inferior in quality to the Noah, which is already known in France. The Secretary loses almost all its fruit under the influence of black rot, and is badly affected by the phylloxera. The Montefiore has no more value than the Clinton, of which it is the parent; without value for our viticultural districts are also the varieties Duchess, Prentiss, Bacchus, Beauty, etc. The Yoakum and the McKee are nothing else but the Herbemont; the Robinson Seedling nothing but the Rulander. The Ironclad, which is far from being absolutely proof against the ravages of the black rot, is not as prolific a bearer as the European varieties, and yields an inferior and foxy wine. The Othello exists in the United States only in the collections of amateurs, and is not appreciated because the black rot, the mildew, and the drying up of the leaves in summer make its cultivation impossible; the same can be said of the Triumph. The Canada, Brant, Black Defiance, etc., are considered in the United States to be of little importance.

After my return from the United States, I remain still more convinced that we must particularly rely on the American grafting stock, in combination with our native species, in order to secure the restoring of our vineyards and to keep up the well deserved reputation of the French wines.

In summing up my statements, in order to bring forward clearly the practical facts which result from the preceding indications, I will say that for "calcareous and marly soils" the *V. berlandieri*, the *V. cinerea*, the *V. cordifolia* represent the grafting stock which offers the best chance for success.

These conclusions are based solely on the study of the soils in which wines grow in the United States. Still it could be that the facts which I bring forward would not stand the test of practical application in France, but I do not think so.

It could also be that other varieties, such as *V. Novo-Mexicana, Cordifolia rupestris, Hybrids champins*, would have some value in cretaceous soils, as the elasticity of certain species, as far as the adaptation to certain soils is concerned, is well known, but I do not believe this either.

The *V. berlandieri*, the *V. cinerea*, the *V. cordifolia*, have, however, one fault: The cuttings from the typical species root only with difficulty, when they are multiplied by the ordinary processes. But, besides that, among the numerous varieties of this species certain varieties may exist which root easily. It will be possible, I believe, to multiply them by adopting methods which are already used in France and quite common in America; I refer to rooting the single eyes under glass, a process which is not expensive.

I would have certainly preferred to find vines which root easily, but not one of the species which possesses this quality remain green and vigorous in chalky soils.

Such are the principal facts which I have observed in the United States. Everywhere the Americans have facilitated my studies with a devotion which is above all praise, and I am sorry that at present I am not able to mention all those who have helped me. I cannot finish, however, this note without thanking Mr. T. V. Munson, Mr. Hermann Taeger, Messrs. Bush and Meisener. The impartial advice of Mr. Taeger has partly allowed me to solve the majority of questions on which I have reported to you, and I am happy to say they have agreed with my conclusions in the presence of facts, even if these facts should be contrary to their commercial interests. Last, not least, the Department of Agriculture and the United States Geological Survey at Washington have furnished me with valuable information, which greatly helped me to accomplish my task.

Mr. N. J. Colman, Commissioner of Agriculture of the United States, was not satisfied to put at my disposition everything which could advance my researches, but he delegated Mr. L. F. Scribner, Director of the Section for Vegetable Pathologic, to accompany me in all my explorations. Mr. L. F. Scribner has followed me constantly, and, although my studies were only of secondary interest to him, his devotion and help have not left me for a moment. It is not in my power to express how I appreciate this sign of benevolence which was shown to the French delegate by Mr. N. J. Colman and Mr. L. F. Scribner, and I can only express here my deep thankfulness.

Accept, dear sir, the expression of my entire devotion.

PIERRE VIALA,
Professor of Viticulture at the National School of Agriculture, Montpellier.

PARIS, December 17, 1887.

HOW TO DESTROY THE CALIFORNIA GRAPEVINE HOPPER.

The description of this insect and its habits are taken from "Harris' Insects Injurious to Vegetation," page 227, which reads as follows:

"The vine hoppers, as they may be called, inhabit the foreign and the native grapevines on the under surface of the leaves, on which they may be found during the greater part of the summer; for they pass through all their changes on the vines. They make their first appearance on the leaves in June, when they are very small, and not provided with wings, being then in the larva state. During the most of the time they remain perfectly quiet with their beaks thrust into the leaves, from which they derive their nourishment by suction. If disturbed, however, they leap from one leaf to another with great agility. As they increase in size, they have occasion frequently to change their skins, and great numbers of their empty cast skins, of a white color, will be found throughout the summer, adhering to the under sides of the leaves and upon the ground beneath the vines.

"When arrived at maturity, which generally occurs during the month of August, they are still more agile than before, making use of their delicate wings as well as their legs in their motion from place to place; and when the leaves are agitated, they leap and fly from them in swarms, but soon alight and begin again their destructive operations. The infested leaves at length become yellow, sickly, and prematurely dry, and give to the vine at midsummer the aspect it naturally assumes on the approach of winter. But this is not the only injury arising from the exhausting punctures of the vine hoppers. In consequence of the interruption of the important functions of the leaves, the plant itself languishes, the stem does not increase in size, very little new wood is formed, or, in the language of the gardeners, the canes do not ripen well; the fruit is stunted and mildews, and if the evil is allowed to go on unchecked, in a few years the vines become exhausted, barren, and worthless. In the autumn, the vine hoppers desert the vines, and retire for shelter during the coming winter beneath fallen leaves, and among the decayed tufts and roots of grass, where they remain till the following spring, when they emerge from their winter quarters, and in due time deposit their eggs upon the leaves of the vines, and then perish."

As observed in California, the hopper makes its appearance much earlier, and has been seen on the vines with the first warm weather of April. It continues its depredations even up to October, and has been observed infesting the rubbish of some vineyards all winter long. The most injury is done by them in defoliating the plant, thereby subjecting the grapes to sunburn and causing their failure to ripen. Their first appearance in spring is usually on the outside rows of the vineyard, particularly on those rows bordering grassy plots or uncultivated fields; from these they spread in a few weeks to the other portions of the field vineyard. With a knowledge of this fact the vineyardists may often head them off from a greater part of the vineyard by treating the first infested vines at an early date.

The ordinary operations of spring vineyard work, viz.: plowing, cultivating, and clod-mashing, destroy the eggs and larvæ of the insects, which are found on rubbish and leaves of the previous year, but they may still be looked for coming from the surrounding fields if such there are about. Burning the adjoining fields would prove a valuable auxiliary to their destruction.

THE REMEDY.

Little difficulty has been experienced of late in destroying insects which prey directly upon the foliage of the plant. A resort to poison, where it may be had, has usually proved satisfactory. The subject of this treatise, however, is much more difficult to eradicate, in that it derives its nourishment by sucking the sap from the cells, to poison which would mean the destruction of the same. Most prominent among the remedies proposed in the past few years have been spraying with toxical solutions, whale-oil soap being foremost. Sulphuring in the early part of the season has been advocated as a partial remedy. Carrying a lighted torch through the vineyard has also been suggested. An important aid to their destruction has been brought about by turning sheep into the vineyards in the fall, whereby the eggs and insects are eaten on the foliage or trampled under feet. This, however, has proved inconvenient in many cases, and cannot be recommended as a general remedy.

During the past week experiments have been conducted by myself at the "Olivina" Vineyard, near Livermore, where, with the assistance of Mr. Smith, the proprietor, I have been able to devise a means which proves a complete success.

First, however, to test the value of previous experiments, we resort to spraying, sulphuring, etc. The following solutions were employed:

First—One pound of whale oil, mixed with one pint of syrup, and then diluted with one gallon of water.

Second—One half gallon of syrup with one gallon of water.

Third—Two pounds of whale-oil soap to one gallon of water.

Fourth—Four pounds of whale-oil soap with one gallon of water.

Each and all of these were carefully applied to the infected vines by means of the Cyclone nozzle.

The strongest solutions of soap were such as to burn the tender leaves of the vine, so noticed a day or two later. The strongest solutions of the syrup likewise proved detrimental to the foliage; but with all, alike, the hoppers continued their work undisturbed. Twenty minutes after the applications were made (and they were made thoroughly), the hoppers were found on any and all of the vines treated, and in as great abundance as before. In many cases they had been forced to the ground by spraying, where it was thought the wings would become clogged, and their further recovery thereby prevented. A short time afterward, however, careful search revealed their absence from the ground, and remedies of this character were accordingly abandoned.

Sulphur has been dusted on the vine to such an extent as to render the foliage yellow, but shortly afterwards the hoppers were found uninjured, and continued so.

A torch carried at night has proved a failure.

EARLY MORNING TRAP.

A contrivance for holding petroleum in pans was then arranged so that it could be placed under the vine. This employed night and morning will prove an effective trap; for on shaking the vine the hoppers drop into the liquid, and so become destroyed. Still, the apparatus for this purpose must be so elaborate and expensive as to form a potent objection to its use for operations on a large scale. For this I therefore substitute a screen made out of green wire gauze, such as is ordinarily employed for window screens. The gauze should be stretched over a frame made of stiff wire, forming a screen circular in shape and about two and a half feet in diameter. A slot in one side will enable the screen to be placed immediately under the vine, the whole being attached to a stick in such a manner as to form a handle. We now have a trap for morning and evening work, for, by placing the screen under the vine, the hoppers will fall readily onto it; when there, they expire immediately if disturbed. Previously, the screen has been coated or smeared over with common kerosene. A piece of canton flannel or other heavy cloth, fuzzy side up, may be stretched under the gauze, and will serve to keep the screen oiled; for after some exposure the oil loses its property of killing at first contact. In fact, for this screen a cloth without the gauze may be employed, if desired.

THE MIDDAY TRAP—HOW TO MAKE A TRAP FOR MIDDAY WORK.

For day work, which is the time when most of the operations must be conducted where large areas are to be treated, a different contrivance must be formed. For particular instructions, the following will direct any one:

For short prune varieties, first: The operator should be provided with twenty feet one-fourth inch iron rod, or an equal length of heavier wire approximating to this in size. Cut two pieces seven feet long each and two pieces three feet long each. With these, two semi-spheres may be made with a diameter of about two feet (these measures may be increased proportionately to make a large trap). A strip of green wire gauze six feet long and three feet wide will answer to cover the trap. The gauze should be material commonly used in window screens, and worth about 2½ to 3 cents per square foot. Do not try substituting cloth for gauze, for our experiments proved it inapplicable. Bend the seven-foot length in a circle three feet in diameter, turning the ends together and twisting them outward to serve as a handle. Cross the circle with a second piece three feet long, which should also bend in a circle outward; this forms a semi-sphere. Now cover the whole with gauze, which may be sewed on like the parts to a cover of a baseball, attached by means of a string.

Make a second semi-sphere similar in every respect to the first, and such that the two when brought together form a complete sphere.

The circle of the first semi-sphere may be provided with a notch to accommodate the body or trunk of the vine, thereby enabling the operator to completely cover the plant and provide against the escape of the hoppers.

Care should be taken in forming the notch to see that it is so placed in relation to the handle as to enable the operator to stand partly over the vine when bringing the trap together.

The gauze of this trap, if rubbed over with a cloth or swab saturated with kerosene, will retain enough to kill immediately the hoppers alighting thereon; experience has proved, however, that after a little exposure the kerosene loses its greatest effectiveness and the hoppers are therefore enabled to take a second jump, and assisted by falling may escape through the opening or joint below. To obviate this and avoid the necessity of replenishing the kerosene so often, a piece of flannel or similar cloth should be drawn tightly and sewed over the bottom part of each semi-sphere, the edges turning upward into the trap as it appears when closed, so that any of the victims tumbling down will lodge between it and the gauze, where the density of the oil will end their endeavors to escape.

ANOTHER AND BETTER FORM OF TRAP.

I find that for different vines, different shapes are preferred. The following described appliance is the best and most commonly used at the time of this writing, though somewhat more expensive than the first named:

Frame two semi-cylinders, using for this purpose iron bands one eighth inch thick and one half inch wide, which should be joined with rivets at the corners. These parts should be hinged together with small butts, which may be riveted to the frame, such that, when covered with green gauze, it may be opened and closed over the vines. This trap needs no top, but should be provided with a bottom of either heavy cloth or, what is better still, two semi-circular tin pans about one and one half inches deep, and so formed that in coming together to form the circle a space is left for the stump of the vine and stake, say eight inches long and three inches wide. A cloth or sponge should project from the edges of the hole to close completely about the vine when in use.

For vineyards under ten years old, and some even older, eighteen inches is a sufficient diameter for the cylinder, which should be about two and one half feet high to accommodate long primed varieties. The last dimension may, however, be modified to accommodate the shape of particular vines. A portion of the upper part of the frame left free will serve as handles, or these may be added if desired, in which case they should be attached near the upper center of each semi-cylinder.

Smear the gauze over with ordinary kerosene oil, to which a small amount of crude petroleum may be added if convenient, as this will serve to thicken it and render it more lasting; the oil to be applied by means of a brush or cloth as often as seems necessary.

The operator now approaches each vine cautiously, and, inclosing it in the trap, kicks the stump of the vine below, if using the spherical trap, or disturbing it above if the cylinder is employed, which causes the hoppers to fly off, and, encountering the gauze, come in contact with the kerosene, which kills them immediately, or causes them to drop to the bottom, where a second contact with the oil leaves them unable to move. The trap should be retained about the vine for a moment to insure the destruction of all the victims before opening it again for their escape.

In our work, after making the parts according to the above description,

and operating on a few vines, the green gauze was changed to a yellowish hue by the myriads of insects captured. Either apparatus is light and easily handled; they should not weigh over five pounds each.

With one appliance a man should get over several acres per day, and the total cost of treatment, including oil used, should not much exceed 50 cents per acre.

To use the trap with best success it should be employed at the present season. With the increase of foliage and enlargement of the vine the trap must also be enlarged, becoming more cumbersome and more difficult to wield, though equally effective.

Very windy weather should be avoided for this work, as many retreat into the ground at such a time, and the few remaining on the leaves are disturbed with great difficulty at such times.

When the air is still, or but little wind is blowing, and when the warm sunshine has removed the dew from the foliage, then is the most favorable period for general success.

A great advantage in early season work accrues from the destruction of the insects previous to the time of laying their eggs, thereby lessening the chance of damage.

Vines laying on the ground, like those pruned on the Chaintre system, or those tied to wires, would require a semi-cylindrical screen, lined with cloth at the bottom, which latter should be turned up to prevent their tumbling off, the screen being so formed as to cover the foliage. Extermination in this case would prove difficult, as we have no means of catching those which drop on the ground. But by operating in the heat of the day, and when a slight breeze would take them on the screen, the insect will fly to it and be completely entrapped by the oil which has been placed on the gauze and cloth.

Before closing this treatise, I desire to express particular acknowledgment to Mr. J. P. Smith, of the Olivina Vineyard, and to his foreman, for their kind assistance and interest in the experiments which have been conducted at Mr. Smith's place. To successfully accomplish our work has required no small degree of patience on their part, and I have to thank them for it, and for their advice in devising the different means tried.

The hoppers have increased in the Olivina Vineyard, during the past three years, to such an extent as to become alarming. Many leaves already put forth are withered by their attacks, and some other sections report a similar condition of affairs.

It is now my belief that prompt and energetic attention to the above detailed method will remove all fear of damage to the grape.

In the past two years the Commission has experimented with and provided ample remedies for all insects consuming directly the foliage of the plant. The arsenic and bran remedy enables us to meet the grasshopper plague successfully, and Paris green or London purple, mixed at the rate of one pound to one hundred and sixty gallons of water, will destroy other foliage-consuming insects, and has been proved innocuous to the fruit, vine, or raisin. The scribe, the flea beetle, and other insects, may likewise be trapped by the above described apparatus.

Up to this time, the vine hopper has proved a constant menace to the grower, but from this it is to be hoped dates our victory in the field.

J. H. WHEELER,
Chief Executive Viticultural Officer.

THE DESTRUCTION OF ANIMAL AND VEGETABLE PARASITES OF THE VINE.

Recommendations by the Chief Executive Officer of the State Viticultural Commissioners. A resumé of rules and remedies adopted to the present season.

The present being the season of greatest activity in the operation of combating vineyard pests and diseases, many of which appear so suddenly in some of our vineyards as to leave no time for the proprietor to waste in looking up the results of former experiments or remedies described in some lost paper or publication, it has seemed a fitting time to publish a brief abstract or summary of the principal vine pests abroad at the present moment, together with the best known means of destroying them.

CUT WORMS

May, if few in number, be found at night with the aid of a lantern, when they are preying on the leaves or young shoots. Another method is to dig them out of their hiding places near the roots of the infested plant in the daytime, as they retreat with the appearance of daylight just below the surface of the ground.

If in sufficient numbers to warrant, spray the vine with a solution of Paris green (which must be agitated continuously while using to prevent settling), one pound to one hundred and fifty gallons of water. This will not harm the fruit or plant, even though the grapes have attained half the size of a pea. If it is feared that live stock may get to the foliage, and thereby become poisoned, apply the same solution to cabbage leaves, which, if placed near the troubled vines, will attract the attention of cut worms and destroy them. Afterwards these cabbage leaves may be picked up and destroyed, or left to wither without danger.

To apply the Paris green solution, use any good spray pump; or even a syringe will answer for operations on a small scale.

SPHYNX MOTH, OR ARMY WORM,

As sometimes improperly called: Spray with Paris green as above, using one pound to one hundred and fifty gallons of water. Treat particularly well the outside rows of the vineyard, and they will never get farther than these. If only a few worms infest the vines, they may be hunted on the foliage and destroyed by hand.

GRASSHOPPERS.

This plague has been successfully met by the use of arsenic and bran remedy, prepared as follows:

Forty pounds bran, fifteen pounds middlings, two gallons cheap syrup, twenty pounds arsenic, mixed soft with water; a tablespoonful thrown by the side of each vine or tree. Cost, per acre: for trees, 25 cents; for vines, 50 cents.

If placed on shingles about the vineyards, much of the poison may be afterwards gathered up and saved.

Complete success has resulted from the use of this remedy, as the grasshoppers eat it greedily and die in their tracks.

For this may be substituted with equal effect the Paris green spray, applied as for cut worms.

THRIPS

Are best trapped by means of two semi-cylinders framed with band iron and covered with window gauze; these hinged together on one side should be provided each with a semi-circle pan for a bottom, so arranged that the whole may be closed about the vine. Rub the gauze over with a rag saturated with coal oil and place a little also in the pan at the bottom; then when the whole is closed about the plant, kick the stump of the vine or disturb the foliage by introducing the hand or a stick from the top, and the insects fly to the gauze, where contact with the coal oil destroys them. For full particulars regarding the construction and method of operating this trap, see second appendix to Report of Chief Executive Officer for 1888.

Thrips cannot be poisoned on the vine, as they subsist on the sap alone, which is sucked from the leaves, thus causing them to wither and dry up.

THE FLEA BEETLE

And others of this class which consume the foliage of the plant, giving to the leaves a riddled appearance, may be trapped also with the above named contrivance, for commonly any slight disturbance causes them to drop to the ground, where they secrete themselves.

A better method, however, where circumstances will permit, is to spray the vines with the Paris green solution described above.

THE FALSE CINCH BUG

Is of a grayish brown color with pupa of about the same color. Both are, when full grown, about one eighth of an inch in length. They appear occasionally in spots in the vineyard, infesting such vines in great numbers and consuming the leaves. They fall to the ground when the vine is disturbed, where they are scarcely visible. They have caused our vineyardists no serious damage, as they disappear after a short season, and have not at any time in the past become general. They may be easily caught with the gauze trap and kerosene, or may be poisoned by the Paris green spray.

HARES, RABBITS, AND SQUIRRELS.

Have been a constant menace to young plantations made in new districts. A tight fence affords the most perfect immunity from their attacks. Squirrels may be kept out by making a tight fence along the side of their approach. They will not travel far to go around this, unless the place is very much isolated, because of their fear of dogs, hawks, and other natural enemies.

Hares which come a long way to devour the vines will be noticed to confine their attacks to a few vines at different places in the vineyard, which they eat down as regularly as the new growth appears. A weak solution of asafœtida prepared by dissolving in alcohol and then adding water, has been applied to the afflicted vines with good success.

These animals will also be destroyed by the Paris green solution if applied frequently during the early growing season.

VEGETABLE PARASITES (OIDIUM OR POWDERY MILDEW)

May be best prevented or removed by using sulphur, which should be applied, first, when the vine is in full bloom, being careful to dust or blow it well over the flowers. Repeat the dose about the middle of June, and later again, if any sign of the disease appears.

If for table grapes, the sulphuring may be continued monthly until they begin to change color. Sulphuring should, however, never be done to wine grapes after the berry has attained two thirds its full growth, as by so doing it reaches the wine and gives it a bad odor.

Let it be remembered that the disease begins its development where the average of day and night runs up to 52 degrees Fahrenheit; it spreads rapidly at 70 degrees Fahrenheit, and is checked in its growth where the thermometer indicates near 100 degrees Fahrenheit. Above 100 degrees its damage is rapidly diminished, and at 112 degrees—a temperature quite common throughout the interior vineyard districts of California—the germs lose their vitality and the effects of the disease entirely cease.

The sulphur used may be either finely ground or sublimed; the former is most commonly employed, as it is cheaper and answers the purpose equally well. It should be applied so as to lodge as much as possible on and near the growing parts of the vine. This secures a dense sulphur vapor in direct contact with the diseased organs. Sulphur on the old stump, or even on the surface of the ground, will destroy the oidium, but a larger quantity would be required.

COULURE,

Though not itself a direct disease, results from other evils. It is, in a measure, prevented by sulphuring at the time of blossoming, when oidium, which would otherwise interfere with the fertilization of the the flower, is removed. This is not always a cure, however, as other causes exist for the evil, principally sudden changes in weather, either hot and dry or cool.

The most successful treatment for the trouble when so occasioned results in *pincage*, the process of pinching off the ends of the fruit-bearing shoots when flowering begins. Also, the annular incision may be adopted, which consists in ringing out with an appropriate tool a band on the outer bark of the fruit-bearing cane or shoot just *below* the point where the bunch stem joins the shoot. Nipping off the end of the long bunches will also aid in keeping the remaining fruit on, and cause it to ripen large and full.

The foregoing disposes of those enemies most common to our vineyards in the past, with the exception of the phylloxera, which, though most formidable of all, has been discoursed on at sufficient length before.

J. H. WHEELER,
Chief Executive Viticultural Officer.

GRAFTING TO MUSCATS.

The following circular and questions explain the objects of this publication:

STATE OF CALIFORNIA, BOARD OF STATE VITICULTURAL COMMISSIONERS,
OFFICE OF THE CHIEF EXECUTIVE VITICULTURAL OFFICER,
SAN FRANCISCO, August 15, 1888.

DEAR SIR: During the next spring many grape growers, who have in the past cultivated grapes for wine making, will graft their vines onto Muscats for raisin-making purposes. From those who will make this change there have come to me numerous inquirers as to the suitability of ordinary varieties for such grafting.

The experiences of the past on the subject are somewhat conflicting, but, knowing there have been trials enough already made with this grafting to determine its value, if the results were but known, I am endeavoring to collect them for the instruction of the public.

Believing you may be able to assist me with your knowledge or experience, I have taken the liberty of addressing to you the following questions, which you will please answer by mail, at your earliest convenience.

If unable to answer these questions from your own experience, will you kindly note, under the head of "Remarks," whatever information you may have received from others regarding the success of grafting Muscats onto other stocks.

Very respectfully,

J. H. WHEELER,
Chief Executive Viticultural Officer.

The questions were as follows:

1. Have you ever grafted Muscats on the roots of other varieties; and if so, what were the other varieties?
2. When was your grafting done—what year and month?
3. About what percentage of the scions grew?
4. Do they now appear as healthy as do Muscats on their own roots?
5. Does the fruit set well and ripen equal to that of Muscats on their own roots?
6. Would your experience lead you to advise others to employ this method in preference to pulling up the old vines to plant Muscat cuttings?
7. Remarks.

ANSWERS.

A considerable number of the vine growers addressed were unable to report any experience; many, however, were kind enough to write me their opinions, for which I desire to publicly express thanks.

I have selected from the many letters received the following, which have been condensed as much as seems consistent with clear expression. To indicate the questions above given, their numbers are employed:

J. Knauth, Sacramento.—7. Would prefer grafting on most any kind of robust grower if Muscats are desired.

H. G. Ellsworth, Niles.—1. Various. 2. Varying throughout twenty years past. 3. Good results generally, but followed by knotty accretions on roots. 4. A small per cent. 5. Think it is not so good. 6. Would not graft old stock; would graft stock one, two, or three years old.

J. C. Merithew, Cupertino.—1. Grafted one hundred Muscats onto Trousseau. 2. March, 1880. 3. 99 per cent. 4. In good order. 5. The same. 6. I would advise grafting.

W. E. Cole, Brooks, Yolo County.—1. Grafted three hundred Mission onto Muscats. 2. 1878. 3. 85 per cent. 4. Produce better wood than Muscat roots. 5. They are the heaviest bearing Muscats I have ever seen. 6. Yes. 7. The Mission is preferred for this grafting, because it best stands the summer heat, and is a strong grower.

John T. Doyle, Cupertino.—1. Grafted on Charbono. 2. March, 1888. 3. 99 per cent. 4. They look perfectly well. 5. Cannot yet determine. 6. I should graft by all means. 7. I think you can graft any one sort on another, and if the work is well done your grafts will grow perfectly.

J. A. Brun, Oakville.—1. No; we never have, but we have grafted other varieties on Muscats which did not prove a desired success. Would advise grafting Muscats onto other stocks.

W. A. Sanders, Sanders, Fresno County.—1. Yes. 2. February. 3. 90 per cent. 4. Yes. 5. Yes. 6. Yes. 7. Grafted three thousand vines, part to White Corinth.

Wm. M. Johnston, Anderson.—1. Yes, onto Mission, Feher Szagos, and a nameless seedling. 2. March 1, 1881. 3. 90 per cent. 4. No. 5. No. 6. No. 7. Vines made feeble growth after first year, small bunches, much inclined to coulure and sunburn; old stumps decay and become unhealthy. Grafts strike roots.

E. W. Maslin, Sacramento.—1. Grafted ten Muscats on Vitis Californica roots two years old. 2. April, 1887. 3. 80 per cent. 4. Unable to judge from experience. 5. Not yet old enough. 6. I should certainly graft. 7. The union is perfect—grafted *at* surface and hilled soil about it. I prefer this to deep grafting; as, if graft fails, we have still the old vine.

R. C. Kells, Yuba City.—1. Yes, onto Mission, Riesling, Hamburg, Rose of Peru, and others. 2. March and April, 1887, 1888. 3. 90 per cent in 1887; 75 to 80 per cent in 1888. 4. They do on the Mission root. 5. Yes, on the Mission but not on others. 6. Yes; but on Mission only. 7. Have grafted Seedless Sultana and Zante currants on Mission and they do well. Mission does not sucker as do the others.

Robert Barton, Fresno.—We have never grafted Muscats on other roots, but have noted it done in this section to considerable extent and apparently with success. Colonel Forsythe has grafted on Zinfandel. J. W. Pew on Sultana. Growth of the grafts seems to be first class.

F. D. Rosendahl, Kingsburg.—1. Have grafted Muscats onto Zinfandel. 2. February and March, 1886, 1887, 1888. 3. All grow when the work is well done. 4. Better and stronger than on their own roots. 5. The first year only a few bunches, but full crop next year, and fully as good as on its own root. 6. "Don't pull up the old vines, but have them grafted if you want a good vineyard."

Capt. J. Ch de St. Hubert, Fresno.—1. Upon Tokay and Malvoisie. 2. January, 1883. 3. A fair average grew. 6. No.

G. W. Linderman, Madison.—1. Yes; on Mission. 4. They do better than when grown on their own stalk; berries good size and bunches large. To raise Muscats, would plant Mission roots and graft to Muscats.

B. R. Woodworth, Fresno.—1. Have grafted Muscats onto Feher Szagos. 2. March and April, 1887. 3. 40 per cent. 4. Apparently so. 5. Fruit ripens later. This year had considerable crop; some of it will not mature. 6. If old, would tear them out and plant Muscat roots in preference to suckering grafts, etc.

Thomas Rose (for A. M. Witham), Woodland.—Grafted one hundred Zinfandel over onto Muscats in 1887. Ninety-eight grew, and this year yielded ten pounds of grapes per vine.

C. A. Crosby, Riverside.—1. Yes; onto Mission and Rose of Peru—twenty-five vines. 2. January, 1886. 3. All grew. 6. No.

J. F. Winsell, Balls Ferry.—1. Yes; on Flame Tokay and Mission roots. 2. March, 1884. 3. 50 per cent; attribute great loss to my grafting too late, as sap drowned the graft. 4. They do. 5. Alongside of others from cuttings, I can observe no difference. 6. I certainly should; it is less trouble to graft, and they bear the second year. 7. A friend grafted Missions to Muscats fifteen years ago, and they still bear fine grapes.

——, Escondido.—1. Grafted onto Mission, Rose of Peru, Black Hamburg, Zinfandel, and Carignane. 2. February, March, April, 1885, 1886, 1887. 3. In 1886, 85 per cent on two thousand four hundred Zinfandels; in 1886, 60 per cent on six hundred Hamburgs; in 1886, 90 per cent on five hundred Rose of Peru; in 1887, 60 per cent on five thousand Carignane, grafted in March and April. 4. Yes; on the Hamburg and Rose Peru—not so well on Carignane and Zinfandel. The thriftiest growth was on the Rose of Peru. 5. Better on the Hamburg and Rose of Peru—about same on Carignane, but not so well on Zinfandel. 6. Much better to graft unless stock is too young; even then it is all right on vigorous varieties.

Dr. W. S. Manlove, Perkins, Sacramento County.—1. Grafted Muscats on Mission and Feher Szagos. 2. March, 1873, 1878, 1884, and 1888. 3. 98 per cent. 4. On the Mission they do not; on the Feher Szagos they do. 5. It does not on the Mission. 6. No. 7. Would not graft white varieties on purple stock. Fifteen years ago grafted Tokay onto Dutch Sweetwater; they grew and bore well, but never colored as it does on its own stock, or when grafted on purple varieties.

W. H. Wells, Dixon.—1. Grafted three thousand onto Mission roots, which were ten or twelve years old. 2. March and April, 1873–4–5–6. 3. 75 per cent. Where not successful first time, regrafted until I got a good stand. 4. They are more thrifty, longer canes, and more foliage than Muscats on their own roots. 5. Fruit sets and ripens well, and the grafts yield better crops in every respect than Muscats on their own roots. 6. Graft instead of pulling up; for if well done, the grafts will yield more second year than vines five or six years planted.

Chas. Wilkinson, Etiwanda.—1. Grafted Muscats onto Mission, Tokay, Seedless Sultana, Rose of Peru, Zinfandel, Malaga. 2. March, 1887. 3. 95 per cent. 4. Grow well on all these varieties as strong as on their own roots. 5. Bore three to five pounds per graft this year, clusters large and good as those on five-year old Muscats. 6. Would graft every time. 7. I have planted Peru for express purpose of grafting to Muscats.

H. Dugdale, Etiwanda.—1. Yes; on Mission and Zinfandel. 2. Early in March, 1887. 3. 75 per cent. 4. More healthy. 5. Equally as well. 6. Would advise it, by all means. 7. All wine grapes may be so grafted. To graft successfully, remove the earth deep about the stock; saw off beneath buds or sprouts; split with chisel and mallet; scion six inches long, wedge-shaped, to fit the split when opened; make bark even on outside; wrap with strip-cloth, to keep dirt out, then fill up hole with earth.

C. O. Tucker, Ballena, San Diego County.—1. Grafted onto twenty other varieties, principally Mission, Black Hamburg, Rose of Peru, G. Chasselas, and Zinfandel. 2. March, 1880; March and April, 1881; April, 1882; May, 1883, and May, 1884. 3. In 1880, on Mission roots, 98 per cent; 1881, on same, 93 per cent; 1882, on a variety of roots, 80 per cent; 1883, same, 76 per cent; 1883, same, 81 per cent; 1884, same, 60 per cent. 4. Ora Mission, Black Hamburg, and Rose of Peru, yes; on other varieties, except Zinfandel, no; on Zinfandel, more healthy, but don't set fruit so well as on their own roots. 5. On Mission and Black Hamburg, fruit sets better than Muscats on their own roots; on Rose of Peru, don't set as well, and suffer from coulure; on Zinfandel, don't set well, but ripen well; on other varieties, no. 6. With Mission, Black Hamburg, Rose of Peru, and Zinfandel, yes; other varieties I have tried, no. 7. Prefer common cleft graft, eight inches deep on old stocks; two or three inches on young stocks. I employ with best results a wax—one part beeswax, two parts resin, three parts tallow. Had most failures when I used equal parts of clay and cow-dung. Graft in cloudy weather. For scions, use laterals. Would not graft on Pineau, Chasselas, Riesling, Tokay, or Sauvignon. Employ no man of bilious temperament.

Geo. H. Craft (for others), Redlands.—Grafted miscellaneous varieties to Muscats; results always satisfactory.

G. F. Merriam, Escondido.—1. Have grafted twenty-four vines to Muscats, viz.: Rose of Peru, Black Morocco, Mission, and others. 2. March 20th to April 10, 1883. 3. All. 4. Yes. 5. Yes; so far as I see. 6. Yes. 7. Where I used common cleft graft most of scions grew; but I one year used Dr. Cougar's machine and lost over half. Do not let any one use the machine. Raisin growing in this locality very unsatisfactory.

J. J. Stephens, Madison.—1. Yes; have grafted onto Mission stock. 2. March, 1872. 3. 94 per cent. 4. Yes; more vigorous. 5. A great deal better. 6. Yes; with us Muscats do better on Mission roots than on their own.

John Hall, Riverside.—1. Yes; onto Mission. 2. March and April, 1879 and 1880. 3. 90 per cent. 4. Yes. 5. Yes. 6. For a whole vineyard, would advise planting Muscats; but for occasional Missions or other varieties, would graft.

E. Z. Clanton, Woodland.—1. Yes; onto Mission, Hamburg, and Tokay. 2. December, 1886–7. 3. 99 per cent. 4. They look healthier. 5. Yes. 6. By all means. 7. Have had grafts bear the first year; they bear well the second year. Have had difficulty in getting cuttings to grow where old vines were pulled up; lost 50 per cent.

J. M. Asbell, Millville, Shasta County.—1. Have grafted Muscats onto Mission roots three and four years old. 2. 1869 and 1870. 3. 90 per cent. 4. About the same. 5. They set fruit well, and ripen fruits equal to Muscats on their own roots. 6. Would advise grafting, as it loses no more time than one year.

George W. Applegate, Applegate.—1. Grafted onto Mission roots. 2. March, 1880. 3. Used cleft graft, and scarcely scored a miss, using two scions to the vine. 4. Yes. 5. Yes. 6. Yes, you secure by grafting an enormous growth the first year, and the second year a crop of fruit; the only difficulty is that of suckering. 7. Used cleft graft, two scions to each subject, spreading the vine with a wedge to insert the scions; used clay as a mastic. Would graft any kind rather than pull them up, as they bear grapes the first year.

H. Goepper (for his neighbors), Santa Ana.—1. Grafted onto Mis-

sions. 2. At different periods, but with best success at time buds were about to open. 3. 80 per cent. 6. It would.

A. J. F. Whitthouse, Fresno.—1. Yes, onto Zinfandels. 2. Latter part of March, 1887 and 1888. 3. 75 per cent in 1887. 40 per cent in 1888. 4. Yes. 5. Yes. 6. Yes. 7. If grafting in alkali lands, would cover union with grafting wax, as I found many stumps rotten and scions dead.

C. K. Kirby, Fowler Station.—1. Yes, onto Trousseau. 2. March, 1888. 3. 90 per cent. 4. They do. 5. Not yet crop enough to tell.

Charles McLaughlin (per Kirby), Fowler.—1. Grafted onto Mission, Feher Szagos, Zinfandel, and S. Sultanas. 2. 1887. Find Zinfandel and Feher Szagos best stock to graft on, and Muscats do better on Mission and S. Sultana than they do on their own roots. If desiring a Muscat vineyard, would plant strong growing roots and graft Muscats onto them. Other experiences in this section confirm the above.

C. O. Rust, Anaheim.—1. Grafted onto one hundred Zinfandels. 2. March, 1882. 3. 80 to 90 per cent. 4. Yes. 5. Yes. 6. Would advise grafting in preference to pulling up, provided the vines are not too old, and in good shape.

C. M. Silva & Son, Newcastle.—1. Yes; principally on a Mission. 2. March, year forgotten. 3. 95 per cent. 4. Yes, if not better; growth is stronger, but soil may be better. 5. Yes. 6. Yes; if old stocks were perfectly healthy. 7. Grafted by digging down three or four inches below the surface of the ground, sawing stock square off, split it down with a chisel, cut the graft wedge-shaped; inserted one in small, two in old stocks; brought the soil up around them, pressing it carefully around the graft, allowing one bud of the scion exposed; greatest loss was by knocking out in cultivating.

H. C. Morrell, Wrights.—1. Yes; onto Feher Szagos, Miller's Burgundy, Franken, and Gray Riesling. 2. February, 1875. 3. 95 per cent. 4. Much more so. 5. Much better; do not coulure like Muscats on their own roots. 6. Would graft on any strong grower, but not on Burgundy or Riesling, as the vine takes the habit of the old root, and the berries are then small, tough, and unfit for market.

D. C. Feely, Alma.—1. On Mission, Black Hamburg, and Catawba. 2. March, 1870 and 1877. 3. 95 per cent. 4. Yes. 5. Can notice no difference in respect to the fruit. 6. If stocks are healthy, would graft in preference to digging up. 7. I cut my scions early in January; then I dig a shallow trench on the north side of a building or fence, and lay my cuttings in and cover with soil to the depth of two or three inches. I sometimes cover them over with boards, to prevent the rains of winter from rotting them. A good way would be to put the scions in a cellar and cover with sand. The buds should be kept in a dormant state until the grafting is done. The best time to graft is when a flow of sap is moving to swell the buds and bring forth the leaf on the vines in the early spring. This may occur earlier in some localities than in others; but, as a rule, March is the best time to do the work.

N. D. Harwood (by C. A. McDougall), Escondido.—1. Yes; on Mission, Hamburg, Rose of Peru, Tokay, and some others. 2. February, 1880–1–2. 3. 95 per cent. 4. Yes. 5. The size and quality of fruit is improved. 6. If roots are healthy, by all means graft them and secure fruit from the start. Have tried grafting by cutting into side of the stump with a chisel, but the grafts fare like the "titman pig."

B. P. Mackoon, El Cajon.—1. Yes; Mission, Zinfandel, Blanc Elbe, Verdal, Sweetwater—first three, chiefly. 2. February and March, 1885-6-7-8. 3. 90 per cent; when great care was used, all grew. 4. Yes; many of the strongest vines in the vineyard are those grafted on other roots. 5. Fruit sets equally well; the first and second year of bearing, the fruit ripens a little later. 6. "A thousand times, yes."

Estate Geo. A. Cowles, by B. P. Mackoon, Superintendent.—The experience on my own place answers for this, as confirmed by the foreman, who was on the Cowles place when the grafting was done. When the graft did not grow, or where injured by accident, we have dug a little lower and cut off and grafted the old stock anew the next year, with just as good results as in first grafting.

A. F. Anderson, Blacks Station, Yolo County.—1. Yes; onto Mission. 2. When buds are swelling, and just before they put forth, in 1873-4-5. 3. 90 per cent. 4. I think they do. 5. Fully as well. 6. Would graft, as fruit comes two or three years sooner.

———, Anaheim.—1. Have grafted Muscats onto several varieties, with best results on Mission roots. 2. Last of February and fore part of March. 3. 98 per cent. 5. The fruits set fully as well as Muscats on their own roots. 6. Would not graft again.

T. F. Miller (for a neighbor), El Cajon.—1. The general appearance of the grafts the first year was good, and they appear as healthy as Muscats on their own roots. I would graft in preference to pulling up old roots.

Wm. C. Walsh, Escondido.—1. Onto Mission and Rupestris. 2. March, 1886. 3. 100 per cent. 4. Yes. 5. Equally as well. 6. Would graft in order to secure a large grape and large bunch. 7. Have had twenty years' experience in this work. I put two scions in a stock of one inch or more in diameter, which is split with a chisel or sharp hatchet. I cross scions on the liber or inner bark just the least particle, and put a piece of folded paper between the scions on the crown of the stock to keep the soil out, and if both grow, destroy the weaker scion.

J. H. Harlan, Woodland.—1. Mission. 2. March, 1887. 3. 80 per cent (grafting done by inexperienced hands). 4. Yes; and far better. 5. Yes. 6. Yes; would graft on any strong grower to secure fruit sooner and a better stock.

H. Davenhill, Fresno.—1. Have grafted Muscats onto Malagas, Feher Szagos, Mission, and Rose of Peru. 2. March (early), 1887. 3. 75 per cent. 4. Yes; the most of them. 5. Fruit sets well, bunches good, and ripens equal to Muscats on their own roots. 6. Decidedly so; without any doubt. 7. The year I grafted I gathered fruit, very fine bunches—mostly second crop. This year I gathered about twenty-five pounds from each vine—first crop.

Levi Chase, San Diego.—1. My foreman grafted Muscats on white wine grapes—name unknown. 2. March, 1888. 3. 90 per cent. 4. They appear perfectly healthy and made, this summer, an extraordinary growth. 5. But few small bunches set on them this season. 6. I think it a success and shall graft more next spring. 7. The old stocks are cut off below ground and a hole bored into it with a bit; the graft is then fitted snugly into it and covered with earth, except one bud.

CONCLUSIONS.

From the above, it may be safely inferred that with the exercise of proper care in the operations of grafting the Muscat forms no exception to the general rule, viz.: that the placing of any variety on a stronger root than its own will produce better results than will the same variety on its own root.

Of the total number of experiences reported above, forty-eight in all, we find but five where the writer unqualifiedly would not advise grafting other varieties to Muscats in preference to pulling up the old roots and planting anew. Four would advise grafting only under certain favorable conditions. While many of the large majority who advocate the method, speak enthusiastically of their success. I should venture the opinion that, if those who might object to grafting instead of replanting were called upon to make cuttings or even roots grow in land which had been drawn upon for many years by old vines, they would find the undertaking far more serious than they might at first suppose. Let no person believe that the young vines will grow in the exhausted soil of an old vineyard as they would in new ground.

Many vineyardists advocate the planting of such strong growers as the Rose of Peru for the express purpose of grafting to Muscats, and this, too, after many years of experience in the matter. Few would wish to graft such varieties as Rieslings, Pinots, or Burgundies, so that the objection to them as weak stocks need not be dwelt upon. The Mission and table grapes form the favored stocks, and have afforded us the greatest number of examples, though the Zinfandel has also proved satisfactory.

The conclusions shown in the above answers need no comment as to the general result. They prove plainly that *those who contemplate the grafting of Muscats onto wine or table grapes are by wide experience safe in the undertaking.*

Incident to the results here named, there has appeared with these reports other important information, seen under the seventh head—"Remarks."

Grafting by machine has proved unreliable, and growers are warned against their use, notwithstanding they may, on certain occasions, have proved satisfactory when operated by their inventor. L. Chase, of San Diego, describes a method which has before been unsuccessfully employed by others, and which in the hands of his foreman has succeeded admirably; but I should caution others about adopting these novelties for work on a large scale, as a long and dear experience has proved that for general utility the wedge graft is surest and best.

Several of my correspondents have favored me with particulars as to the methods employed in their work; several of these I have given in full, particularly if their results proved favorable, thereby confirming their methods. For instance, see reports of Wm. C. Walsh and H. Davenhill.

Many dispute the value of applying any mastic or wax to the point of union. My own experience leads me to conclude that it is wholly unnecessary. Many successes are recorded where not even clay has been used, simply piling up the loose dirt about the graft. If, however, anything is to be employed, clay is the best.

It may be concluded that it is safest to tie in the graft. For this purpose strips torn out of cheap cotton cloth, or raphia, which is sold by some of our seedmen, answers the purpose. Some of the above writers lament their loss by knocking the grafts out in cultivating, etc., and by examining their work we find that they have failed to tie in the scions.

Too much emphasis cannot be given to the value of properly caring for the wood to be used for scions, which should be cuttings, or, better still, whole canes, as pruned from the vine. From these the operator may, in the spring, cut scions large or small, long or short—wasting no buds. These should be imbedded, when taken from the vine, on the north side of some building, in trenches covered well with earth. For this purpose they may be tied into bundles or left loose. Do not be afraid that they will rot. A little mold on them will prove no injury. Where, for any cause, the grafts fail to grow the first year, experience indicates that the same subjects may be grafted again the following August, using for scions cuttings which have been heeled in. Or, the following spring, we may regraft this with the same chance of success as was had at first grafting.

If you wish to secure the full advantage of the strong plant onto which the Muscat is to be grafted, care should be taken to remove all roots proceeding from the scion.

In concluding this inquiry, let it be understood that this work is not offered as one furnishing complete instructions for grafting; that has already been given to the public in a translation from the French, made by me some years since, entitled "Different Methods of Grafting the Vine," and forming Appendix III to the report of the Chief Executive Officer. This work was copiously illustrated, and copies may yet be had by applying to the Secretary of the Board.

WINES.

THEIR CARE AND TREATMENT IN CELLAR AND STORE, TOGETHER WITH A SHORT TREATISE ON VINIFICATION.

By Raimond Boireau. Translated from the French by E. A. Schneider.

INTRODUCTION.

California wine makers are often heard to give expression to the hope that they may some day visit Bordeaux. They would inspect celebrated cellars and learn the "tricks" by which the merchants of that place attain their famous excellence. Several Californians have visited France for this purpose—returning abundantly provided with grape-growing information, but still deficient in knowledge pertaining to the cellar and store.

The reticence observed among French merchants and manipulators is a trait common to all good merchants, for which fact we may properly withhold our censure. Nor do the French wine merchants come to us to deal out gratuitous information as do foreigners representing many other branches. We find them too zealous in the interest of domestic productions for this; too patriotic to leave home. And, then, a term of apprenticeship in foreign wine houses will not supply one with all that is requisite in this branch; we are obliged to look to their literature for further aid.

The present volume is compiled from a long term of experience in the cellars of Bordeaux and Paris; and, although no book alone can make an efficient cellar master, it is thought the contents of this work, added to the practical experience already possessed by many of our wine makers, will serve to improve those qualities of our goods which render them more marketable.

The theoretical part of wine making has been abundantly developed in California. The need of the present is practical knowledge of finishing operations. Accordingly, this translation contains no chemical formulæ, nor is anything given which the common laborer who reads will fail to comprehend. Boireau's work cannot be called an elementary work. Still it does not imply any theoretical explanation of reasons for the facts stated. The explanations are found in the previous knowledge of practical work and natural, every-day operations familiar to any one working in wines.

This book, it is thought, will assist in determining how to make the most palatable beverage with the materials at hand; how to make our wines attractive and sought after. It describes many of the so called "tricks" which will properly improve our "stock wines," and details fully the best methods of guarding against their deterioration and loss.

It is evident from recent experience that greater care is needed in maturing and aging California wines. We have had the "age of grape growing," and the present may be properly styled the "age of merchants." These merchants, whether evolved from the grape growers or originating as such, must see that our wines are better nursed for the first eighteen months. They must be watched, as the French aptly term it, "jus like ze little baby." Much wine is spoiled in making, but more of it suffers defect after it leaves the fermenting vat.

This appendix will be found to be a strict translation; and, relating more or less as it does to a technical subject, may not be as smooth reading as if it had originated in the English language. With this in mind the reader will forgive any defects found in expression of the text.

Chapters X, XIV, and XV of the original work have been omitted as being of little value in California. The first provides instructions for dealers and buyers, and is purely local. Chapter XIV relates to processes of distillation—a subject on which I am already engaged in preparing a handbook of instruction, one which will be more comprehensive than the chapter named.

Chapter XV contains the rules, laws, and regulations pertaining to the sale and delivery of vineyard products, and would be of little use here.

Part first is a single chapter from Boireau's Volume I, and as it is the only portion of this volume which relates to the cellar, it is combined here with the second volume. The subject of Part I is akin to that treated in Mr. Rixford's excellent compilation made some years since, and will, with that work, I think, adequately cover the ground.

Dr. Bleasdale's little translation on "The Vinification of Claret" should, in addition to Rixford's "Wine Press and Cellar," be in the hands of every wine maker. These will serve to perfect all operations preliminary to the subject of this appendix, and with the latter will form a fair beginning in the œnological literature of California.

Many of the instructions only casually stated in the following pages we discover to be those occasionally whispered about as secrets of great value known only to a few. Men among us have professed to be "wine doctors" (more aptly applied here than the term œnologists), with less than half the knowledge recorded in chapters ten and twelve. Among other novelties, the first chapter teaches the best mode of keeping wine sound for ulling purposes; close and moist cellars, it is stated, are needed to guard against sherry flavors and the taste of rancio—and the whole shows that far more regard for cleanliness must be had than is noticeable in many California cellars.

When told in the second chapter that, in racking, the bung-starter must not be used for fear of raising the lees, we are lead to believe that truly wine must be like "ze little babie," and that some modification of our rough and careless treatment must be had. The work on clarifying will be found a valuable addition to our literature, and will be useful to even the best informed. So on throughout the book, the cellar-master will encounter many surprises. In the illustrations, simple devices are furnished for diminishing labor and insuring improved results.

The chapter on aging wines could be advantageously improved by a description of Dr. Frazer's process of aging wines by electro-magnetism. A process not only producing good results in practice in California, but one receiving distinguished praise and recognition abroad, as attested by the conference recently reported at Dijon, where distinguished jurors pronounced strongly in its favor.

Pasteurizing has received a new impetus with the improvements made in apparatus, and this process is now a common resort among French

wine merchants. In the recent additions made to Mr. J. Gallego's cellars, at Irvington, may be seen an apparatus of the most finished nature—one particularly approved by the eminent expounder of the process called after him. An examination of this machine will convince the reader that more importance is now attached to the process than is accredited in Chapter X of this work.

No doubt some will find other parts of Boireau's work which appear somewhat antiquated or at trifling variance with the experience of the present day, or that belonging to California; but there is still enough of instruction left to make the study of the complete work well worth our while.

"Americans," it is often said, "do not take kindly to wine." This is because they begin with the cheap wines, which have received careless treatment and thereby lost their greatest charm. The mellowness, the pleasant aromas, and delicate sweetness have disappeared, replaced by hard acids, bitter newness, or excessive astringency. It is only another proof of their good taste that our people do not readily become customers for such goods.

Our numerous Conventions and sampling tests, together with the entertainment of eastern visitors on frequent occasions, affirm the conclusion that *Americans do like good wine and will drink the best and pay well for it* when they know where to find it.

The reasons why wine has not become an American beverage are many and apparent. If Americans had ever once become habitual wine drinkers, like many of the people who come to us from foreign shores, then, perhaps, not even harsh, sour, or poor wines would serve to alienate them from their desire for it. We might be able to dump into the market everything we could make, or as some one has jocosely remarked, "even wine made from grapes." But to successfully inaugurate the custom of drinking light wines proper for every day use, to make the benefits we claim for it common to all, we must have wines which *taste good* to all.

We find our eastern visitors and lady friends like sweet wines—principally for the sugar contained—to drink which they are made uncomfortable by the spirits commonly accompanying such wines. This, we must remember, too, causes wine drinking to be stigmatized as intemperate, and relegates the liquid to the category of stimulants, instead of classing it with health-giving beverages for daily use.

Give them the best mild light wines our California vineyards are capable of producing, treated as detailed in this book, as a substitute for the truly intemperate "sweet Catawba," common to the East but unknown here, and wine will cease to be a luxury, becoming a necessity, and a marked revolution will grow up in the opposition ranks. The arguments commonly urged by eastern prohibitionists emanate from the use of fortified wines, which they attempt to drink as we drink the lighter beverages. These arguments must be turned in our favor, and prove our earnest endeavors to be in behalf of true temperance.

But the proof of the pudding is truly in the eating thereof, and to insure the drinking of our wines they must be made tempting and wholesome. It is to the aid of the California wine merchants, in their endeavors to secure this end, that this translation is humbly inscribed.

JOHN H. WHEELER,
Chief Executive Viticultural and Health Officer.

PART I.—VINIFICATION OF WINES OF THE GIRONDE, AND OF ALL ORDINARY WINES.

CHAPTER I.

GENERAL REMARKS—DIFFERENCE IN THE PRICE BETWEEN THE FINE AND THE ORDINARY WINES.

General remarks.—Difference in the price of the fine and of the ordinary wines. Preliminary measures to the vinification of red wines. Vinification of high-grade wines of the Gironde. Varieties producing high grade wines. Nature of the soil and varieties suited to the production of fine wines. Vintage, stemming, foulage, fermenting tanks. Drawing off the murk. Vinification of the white wines. Vinification of the high quality white wines of the Gironde. Varieties. Varieties of a lower class. Picking the grapes; fermenting. How to augment the destiny of the must.

The fermentation has a decisive influence on the quality of the wine, according to the favorable or unfavorable conditions under which it was effected. The phenomena of the vinous fermentation have been the subject of serious study and observation by a great number of chemists and of physicists. In the beginning of this century a celebrated scientist, Count Chaptal, wrote a book on "The Art of Making Wine." Since the appearance of this work, a great number of books on wine making and on viticulture have been issued, but they offer to the viticulturist, as far as the practical vinous fermentation is concerned, but very few ideas which have not been hinted at by the illustrious author of "The Art of Making Wine."

Long ago, even before the publication of the work of Count Chaptal, the majority of the producers of fine wines in the Gironde applied to the fermentation of grape juice all of the improvements which are *taught by œnology, a science* whose *objects* are the vinifi*cation* and *the* treatment of wines. The proprietors of inferior vineyards act very differently. It is painful to see how this class of people are neglecting the precautions which vinification requires. Good advice, however, has been given them often enough. Nevertheless, every year a great quantity of wine is made, which has already, on leaving the fermenting tanks, the germs of acidity in it; and the warmer the weather has been, and consequently favorable to the maturing of the grapes, the more frequently this defect is met with, a defect which has often no other cause than the neglect of the wine makers to prevent the access of air to the caps in the fermenting tank, and to draw off the murk at the right time.

The considerable difference which exists between the prices of the finest wines of the Gironde and those which are made from inferior varieties can be explained partly by the endeavors of the proprietors of first class varieties to improve their wines by all possible means, while the majority of those who possess ordinary varieties are only after the quantity of their output.

The proportion of the prices is on the average as one to ten. Thus, while the ordinary wines realize 300 francs per barrel, it not unfrequently occurs that 3,000 francs are paid for the same quantity of a wine of the highest quality, and sometimes much more. It is not possible, however, to give exact figures concerning this subject, because the average price of the ordinary wines is fluctuating every year, according

to the abundance of the grape crop; on the other side, the prices of the fine wines are varying according to their excellence. It is not uncommon that the price of superior wines is ten times higher than that of ordinary wines in exceptionally good years; while in bad years, if the wines are tart and poor in body, their price is hardly more than double that of the ordinary wines.

It is, therefore, the direct interest of the producers of fine varieties to obtain perfect wines, in order to sell them at higher prices, while the producers of inferior wines are only anxious about the quantity. These latter calculate in the following manner: If we should stock our vineyards with fine varieties, we would have one fourth or one fifth less yield than from our varieties, which are ordinary ones, and the higher value of our wines would not cover the loss which we would undergo.

If the output of wines had not been diminished by the diseases of the vine, and if the price of the ordinary wines had remained on a lower level, there would be in the trade a demand only for wines which are able to improve on aging. Under such conditions it would be the direct interest of the wine maker to produce better wines in order to obtain a good market and higher prices; for then the higher value of the wines would be equivalent to the value of a more abundant output.

The inferior wines, though they may have been grown on good soil and in favorable sites, owe their inferiority but to poor varieties and to insufficient precaution during their vinification. But what can be the reason of this negligence of the wine makers? It can be attributed but to carelessness, because it is possible to improve the wine, beginning with the first year, without expense, simply by perfecting the processes of vinification and by selecting the proper varieties; thus we may obtain within a few years high-prized wines, instead of poor, ordinary wines.

We are going to speak in detail in the following pages of the various methods of vinification which are used in the Gironde and in the adjacent provinces. These methods can be reduced to two principal types: the vinification of the fine wines, which involve the practical application of improvements indicated by vinology; and the ordinary methods with their faulty customs and manipulations, which should be avoided. It is our intention to describe here only the *practical making of wine from grapes,* without the use of substances foreign to the juice of the grape. We reckon among the artificial wines those in whose preparation sugar, glucose, cream of tartar, water, tartaric acid, etc., have entered; we condemn the use of these substances in the production of fine wines.

MEASURES PRELIMINARY TO THE NORMAL VINIFICATION OF RED WINES—METHODS WHICH ARE USED IN THE VINIFICATION OF THE HIGH-GRADE WINES OF THE GIRONDE.

The finesse and taste of the high-grade wines of the Gironde is founded on the totality of the labor and attention which have been devoted to the wines, to the gathering of the grapes, to the vinification, and to the choice of good varieties as well as to the nature of the soil. The proprietor of a large vineyard can correct the imperfections and natural defects of his wine by blending the varieties intelligently. It is known that a wine is perfect if, after having reached its maturity—or, to use another expression, when it is bottle-ripe—it joins to a brilliant color a full body without being dry, an aromatic, agreeable flavor and bouquet, and if it is mellow, and has preserved a decided fruity taste.

A wine is defective, even if it possesses fineness, if it is not supplied sufficiently with color and with body enough to keep a long time, if it lacks in flavor and bouquet, or if it is dry, harsh, and without fruity taste, etc. Most of these defects can be corrected, in case the soil is good, by using *the varieties which yield an excess of the quality which the wines that were made from the poor varieties have been lacking.*

VARIETIES PRODUCING HIGH-GRADE WINES.

The best red wine varieties which are cultivated in the Gironde are, according to their merit: (1) The *Carmenet*, or *Petite Vidure*, which is called in the Medoc *Cabernet-Sauvignon, Petite Vidure Firsée;* (2) *Gros Cabernet*,* of which there exists several varieties, often confounded with the *Carmenére*—many grape growers call these varieties *Grosse Vidure;* (3) the *Petit Verdot;* (4) *Gros Verdot;* (5) the *Malbec*, which is also called *Mauzac* and *Noir de Pressac*, and (6) the *Merleau*.

In second line stand the *Cruchinet*, the *Massontet*, and the *Tarney*, which also yield good wines, but only when blended with the preceding varieties. The *Carmenets* or *Petite*, and *Grosse Vidure*, which are called in the Medoc *Cabernet-Sauvignon, Gros Cabernet*, as well as *Carmenére*, appear to be as their names indicate, three varieties of the same species. The *Carmenets* produce grapes and berries of medium size, which ripen at the same time as the majority of the other varieties; they yield a fine wine, which is highly flavored, and has a strong bouquet; the color is not deep; it undergoes changes in contact with the air less readily than wines which are made from other varieties.

The *Carmenére* has larger berries and yields an oily wine, which is deeper colored than that which is made from the *Carmenet*. In other respects, it shows the same qualities. These excellent varieties are the groundwork for the majority of the high-grade wines; several wine makers do not have any others in their vineyards, for they alone yield perfect wines.

The *Petit Verdot* and the *Gros Verdot* are two varieties of the same species. The *Petit Verdot* produces loose bunches with small berries; it ripens rather late; it is the latest of the varieties of the Gironde. In years when the *Verdot* ripens completely, the wine which is made from it has, besides a fine color, much body, much alcohol, and a fruity taste. The oily, mellow taste, which this wine from pure *Verdot* possesses, does not disappear with time—a rare quality, which is difficult to obtain, and which places it in the first rank; it shows also some harshness, which is due to the great quantity of tannin it contains, and which separates out in aging. The wines which are made from this variety improve slowly; they acquire gradually flavor and bouquet, and are the ones which keep the longest time, which stand long voyages better than any other wines, and which change the least in contact with the air. The *Gros Verdot* produces bunches with larger berries, which are also slow in ripening. The wine made from this variety keeps a long time, and has some of the good qualities of the *Petit Verdot*.

The *Malbec*, which is also called *Mauzac Noir de Pressac*, is a black grape and an early ripener; the wine possesses an agreeable flavor, the

* Known in California as Cabernet Franc.

color is deep, the taste mellow and fruity, but destitute of vigor; it is, therefore, not easy to preserve the wine in a good condition, particularly if it is stored in a cellar which is subjected to variations of temperature.

The *Merlot*, the *Massontet*, the *Tarney*, are not cultivated for themselves alone, they are often mixed with the two *Vidures*. The *Merlot* yields, if taken separately, a wine which resembles the wine from the *Malbec*. Like the latter, it has a decided fruity taste. The ripening of this variety is sometimes uneven; in rainy years there are frequently found on the same stock ripe and green bunches together. The wine which is made from this variety is agreeable, rather fine, but destitute of vigor and poor in alcohol; it becomes rapidly acid if the necessary precautions to preserve it from contact with the air are not taken. This variety, in order to give good results, should be blended with other varieties which yield a strong, full-bodied wine, such as the *Vidure* and the *Verdot*.

The *Massontet*, the *Cruchinet*, and the *Tarney* are not very common; they occur generally together with the preceding varieties. They yield wines which have partly the same qualities as the wines made from the *Vidure*.

NATURE OF THE SOIL—CHOICE OF VARIETIES WHICH ARE SUITED TO PRODUCE GOOD WINES.

Our object is not to study the nature of soils which are adapted to the culture of the vine. Aside from that, as far as the Gironde is concerned, the vine grows in soils of very diversified character, from arid sand up to the alluvial marshes of the Garonne. We are going to speak here only of the improvement of the wine through the choice of the varieties according to the nature and the position of the soil. The truly practical study has to be made by the vine grower himself—we can give but the outlines and a general idea of it.

Let us first examine the defects of the ordinary wines of the Gironde. The ordinary wines have one, several, and sometimes all the defects which are enumerated below: Low alcohol-percentage, dull, leady color, slow clearing, loss of color after fining, disagreeable earthy taste, taste of stems, bitterness, harshness, roughness, tartness, tendency to become pricked. On aging, these wines lose the fruity taste which some of them could have, and instead of improving, they become harsh and dry, and have no keeping qualities.

We have already said that the excellence of wines was due to the attention and labor which has been bestowed on them—the vinification, the choice of good varieties, the nature of the soil, and the site favorable to the growth of the vine. On the other hand, there are obtained but inferior wines if the opposite conditions prevail—such as the neglect of the necessary precautions during vinification, the choice of the wrong varieties, and the poor nature of the soil.

The varieties which yield ordinary wines are the *Mancin*, the *Teinturier-Alicante*, the *Peloye*, the *Petite*, and the *Grosse Chalosse Noire*, the *Ciontat*, the *Pied de Perdrix*, the *Balonzat*, the *Jurancon*, etc.

Of all the defects of the ordinary wines, the worst are deficiency in alcohol and in body; these defects make it impossible to keep the wines good; and if the deficiency in alcohol is combined with a like deficiency in tannin, they cannot be long preserved from alteration. The cause of this defect should be looked for in the nature of a very fertile soil, and in the use of varieties which yield an abundance of watery fruit. If these wines have been made from varieties which have grown on strong soils, or on alluvial loams, they can be improved by replacing a part of the varieties which yield grapes that are too poor in sugar by the *Verdot*, which is the variety par excellence of the marshy soils, and which imparts to the wine not only body, color, and strength, but also tannin, which is necessary to its conservation. If the soil is poor and composed of sand or of gravel, and if the site of the vineyard is on well exposed hillsides, the *Vidure* will give good results, particularly if care is taken to choose the best site for it.

The dull and leady color is often due to the lack of a sufficient quantity of tannin and of alcohol to precipitate the mucilaginous substances, the organic albumen, the soluble color, etc., which are in suspension. If more body is imparted to the wine, the clearing and stability of the color are facilitated. As far as the earthy taste is concerned, it depends essentially upon the soil. It is possible, however, to make it partly disappear, because not all varieties have the earthy taste in the same degree, even on the same soil. It has been observed that the wines which are made from the *Verdot* show this taste less prominently than the wines which are made from ordinary varieties, though they may have grown in the same soils. The taste of stems and the tendency to become pricked are due greatly to lack of precautions during vinification.

If a wine contains sufficient body and alcohol to keep a long time, it may at the same time be too rough, too harsh, too bitter; this is the case with certain wines which are grown on hillsides. It is possible to make this wine mellow and to impart to it the fruity taste which it is lacking by replacing a part of the vines by *Malpec* and *Marleau*. In one word, in the production of ordinary wines we should endeavor, if a wine does not contain enough alcohol, to give to it a convenient amount of body by the proper choice of varieties. In order to be able to keep a wine without undergoing changes it should contain about 10 per cent of alcohol; and if the wine contains naturally a sufficient amount of alcohol, but is rough, the endeavor should be made to make it mellow. Such a result can be obtained only with good varieties and by the use of good methods of vinification.

VINTAGE.—Grape growers desirous of making fine wines, which are not tart, should resolve to have their grapes picked only when they are perfectly ripe. It is a well known fact that the different varieties of the Gironde do not mature all at the same time, the conditions of the site and of the soil being the same. Thus the *Malbec*, the *Merlot* ripen earlier than the *Cabernet* (or the *Vidures*), and these again more so than the *Verdot*, etc. Therefore, the necessity arises of gathering the grapes several times. Besides the influence which the difference in the varieties, the age of vines, the locality, and in the nature of the soil exercise, the grapes of the same vine do not all reach at the same time an equal degree of maturity; the grapes which are the most exposed to the sun, those which are next to the stump and which are first reached by the sap, ripen earlier and contain more sugar than the grapes which are distant from the trunk and which are hidden by the leaves, or whose period of bloom was late.

This shows that the same varieties should be picked several times. First, the perfectly ripe grapes should be picked, and the rest should be allowed to mature on the stock. The proprietors of ordinary varieties

make the objection that the picking is more expensive if the grapes are picked from the same varieties at various times; and this is the motive, together with an insufficient supply of vessels for the purposes of vinification, which makes them gather the whole crop of grapes at once. They can avoid the increase of expense, by picking the grapes of each variety when they are completely matured, and then separating them from the green, dried, or rotten and overripe ones; the defective grapes should then be fermented separately and would make a second-class wine.

Complete maturity can be easily recognized by the deep, bluish color of the berries, by the color of the stems, by the softness of the skin, and particularly by the frank, sweet taste, and still easier by the specific gravity of the must.

When the grapes are not ripe the color of the berries is rather red than blue, the skin is still hard, and the taste is rather sourish than sweet. If picked at this stage of incomplete maturity, the grapes yield a wine which retains a tart taste, which is due to the excess of tartaric acid. There is also less deep color and less fineness of taste if the grapes are overripe and rotten. This is due to the fact that when the grapes are in this condition the skin is already partially destroyed. It is also the explanation of the lack of intensity of the color, which, as it is well known, has its seat in the skins of the grapes. Aside from that, wines which are made from such material have a taste which is less frank; they are sweetish, contain but little tannin, and do not keep well.

In hot years the picking may be carried on without inconvenience from sunrise to sunset. It is advisable to let the dew evaporate, in order not to dilute the must. After being picked, the grapes should be carried immediately to the press.

STEMMING.—Before pressing, the grapes should be stemmed, an operation which consists in separating the stems from the berries. For this purpose the grapes are spread on screens, which are placed on the press and are then moved about with the help of forks or of rakes. In this way the berries are detached from the stems and fall to the bottom of the press tank; the stems alone remain on the screen.

Before stemming, the workingmen who attend to this, pick over the grapes a second time, and put aside the berries, or the bunches, which do not appear to them sound, and which have escaped the notice of the pickers.

The question as to whether stemming is useful or not, has for a long time divided viticulturists. It is certain that the presence of the stems gives increased activity to the fermentation. Nevertheless, the stems should not be present in the fermentation of fine wines, when the must already contains a sufficient quantity of ferments.

The stems consist of woody fibers; they contain ferments, juices, which hold in solution some of the substances which are contained in the grapes, tartar, tannin, a bitter substance, and various disagreeable tasting and smelling oils. If the stems contained only tartar, tannin, and the aromatic substances which are peculiar to the grapes, they would be useful in vinification, because they would give increased activity to the fermentation and would contribute to the preservation of the wine by increasing the quantity of tannin; but the fact that the above mentioned bitter and bad tasting substances dissolve in the must makes the presence of the stems in the vinification of fine wines quite inadmissible. These wines contain as a rule quite enough tannin to keep and clear them well, owing to the fact that the pomace remains immersed in the must during fermentation. The stems should be allowed to ferment with the pomace only when the must is poor in sugar, or when the skins have been partially destroyed owing to overripeness. As in such cases the tannin is indispensable to the conservation of the wine, we should endeavor to increase its quantity.

In case of ordinary fermentations in open tanks, the wine makers crush into their tanks the bunches with the stems. Now, it is known that during fermentation a portion of the stems, skins, and seeds rise above the surface of the must and form the cap; as these substances are no longer immersed, they are consequently unable to impart color and tannin to the must; while, on the contrary, by keeping them constantly immersed in the must by the means of a frame, a much deeper color is obtained, with a great deal more tannin, and sometimes too much of it. By adopting this process, and by stemming only a portion of the grapes, it is possible to obtain mellow wines, which still contain a quantity of tannin sufficient for their conservation.

Often the taste of the stems is not due to the fact that the grapes have not been stemmed, but because the wine has remained too long in the fermenting tank. Several experiments which we have made in Southern France, and in Greece, have proved to us that by not stemming very sweet varieties the fermentation was more active. We have also noticed that under these conditions, and particularly *if the must did not contain enough ferments,* the wine which was made from stemmed grapes had less color and tannin than that which was fermented with the stems.

Foulage.—The foulage consists in crushing the grapes and in breaking the cells which contain the saccharine matter, the yeast, and the other constituents of the pulp.

This operation, which is very easy, is performed at the press by men with their naked feet or with wooden shoes.

In order that the crushing should be complete, the must is allowed to run off in proportion as it is formed in a small vessel under the tank, and the charge is again treaded until there remains nothing more in the tank but completely crushed skins and seeds. There have been devised several machines for crushing the grapes; few of the wine makers use them, because the crushing, particularly of stemmed and ripe grapes, is a very simple operation. Aside from that, these machines, which consist mainly of cylinders, *tear the berries without crushing them.* The must, as well as the skins and seeds, should be run immediately into the fermenting tank. When a charge is filled into a tank, it should be done as much as possible the same day, in order not to disturb the fermentation, when it has once started. The violent fermentation begins about eight to twelve hours after the must has been filled in, according to the surrounding temperature of the fermenting-room.

It has been noticed that the wines of the Medoc, which are made without the berries being crushed, have less color than those which are made from the same varieties when they are crushed, but that they possess distinctly a finer taste; therefore, in years when grapes reach their full maturity, the proprietors of the high quality (*grands crus*) vineyards do not have their grapes crushed. They perform this operation only in

Note.—It is preferable that the crushing should be done with naked feet, for thus the crushing of the seeds, which contain a bitter substance, is avoided; also, the trituration of the skins can be done more thoroughly with naked feet than with wooden shoes.

years when the grapes have not acquired a sufficient degree of maturity, and when they have reason to fear that the color of the wine will not be deep enough. If the stemmed grapes are fermented without having been previously crushed, there results a larger quantity of press wine, and often this wine has a sweetish taste. Mixing the latter with the rest of the wine should be avoided as much as possible, as it gives rise to secondary fermentations which destroy the mellow character of the wine.

Fermenting Tanks.—The construction of the fermenting tanks has given rise to many discussions among the inventors who have discovered what practical people have already known for a long time. They have devised various fermenting tanks which, according to them, it is much more advantageous to use than the ordinary tanks. Most of these systems are given up to-day. The practical viticulturists know from experience that the fermentations in covered or in open tanks can give equally good results, if the fermentation is conducted with intelligence, and if the murk is drawn off at the proper time. The method of fermentation, however, which unites the most numerous advantages, and that which has been sanctioned by long practical experience and by the experiments of the œnologists, is the fermentation in covered tanks (the covers being luted to the tanks by means of plaster of Paris or of clay), with an inner frame, the gases being consequently under pressure. The advantages which this kind of fermentation offers, compared with that in open tanks, consist chiefly in the formation of a larger quantity of alcohol and in the superior fine and mellow taste.

The increase in the color is due to the complete and constant immersion of the skins, which produce a good deal more color under these circumstances than if they are carried up to the surface of the must. This happens in the ordinary fermentation in open tanks, owing to the formation of the cap.

The superiority of the taste and its velvety character are chiefly due to the compression of the gases and to the complete solution of the mucilaginous substances.

Most of the high quality red wines of the Medoc, the first crop Saint-Emilion, and the first crop Graves, are fermented in covered tanks. We say "most," because a certain number of wine makers follow yet the ancient custom of making their wine in open tanks.

Drawing Off the Murk.—The fermentation does not go through every year in the same length of time; it is more rapid in hot years than in cold years, aside from the influence which the temperature of the must at the time of its leaving the press exercises—one which increases during fermentation. The use of open or of covered tanks, the density of the must, its composition, the temporary or constant immersion of the cap, or its remaining on the surface, the partial or complete stemming, all these circumstances have an influence on the duration of the fermentation. The fermentation, as a rule, goes through more rapidly, the must and the atmospheric conditions being the same, if open tanks are used, and if the stems are present, and if the cap remains immersed, than if the grapes are stemmed, and if the tank is covered, the cap being allowed to float on the surface of the mash.

That the fermentation is through can be recognized by the taste, if one has a great deal of experience; by the specific gravity of the must; by the temperature of the liquid, and its limpidness (when the liquid is almost cold and clear). The fermentation is not completed if the liquid is warm, sweetish, and turbid.

The wine maker should be extremely careful to see that the violent fermentation is entirely completed in the fermenting tank. Wines which are still fermenting and sweetish should not be filled into barrels, nor should they be allowed to remain in the tank after the fermentation is over. In the first case, the wine remains a long time sweet in the barrel, and after its alcoholic fermentation is over there often remain in suspension ferments which make it difficult to fine and preserve without an after fermentation. They also make it liable to become acid. In the second case, if the tanks are open and no frames are used, the cap is liable to sink down and to impart to the wine acidity and a disagreeable taste of stems.

Vinification of the Inferior Varieties.—Most of the proprietors of the ordinary varieties of the Gironde, and of the south of France, neglect the necessary precautions which should be taken during the critical period of fermentation. They have picked their grapes all at the same time, notwithstanding their vineyards are stocked with varieties which attain their full maturity at different periods; the result is that the grapes of the early ripening varieties are ripe and even partly rotten while others are still green. The must which is made from such material is never in the proper condition. The green berries give to the must an excess of tartaric acid, which imparts to the wine tartness; and the rotten berries, whose skin is partially destroyed, yield only a very small amount of coloring matter.

The grapes which have been picked in this condition are crushed without having been previously stemmed and are thrown into an open tank, in which they ferment more or less rapidly, according to the temperature of the surrounding air.

After the violent fermentation has well started (eight or twelve hours after the tank has been filled), the pomace is carried by the carbonic acid to the surface of the liquid, where it forms a crust called the *cap*.

When the tank is full the cap comes in immediate contact with the atmospheric air, by whose oxygen it becomes acidified, and with the progress of fermentation the surface of the cap passes from acidity to putridity.

When the tank is not quite full the carbonic acid gas is given off freely; but as its specific gravity is greater than that of the air, there remains naturally in the tank a layer which partly protects the cap from contact with the air.

When the fermentation is over, the cap, no longer held on the surface by the evolution of carbonic acid, sinks down in the liquid, and unless the latter is drawn off immediately imparts to it acidity, a bad taste, and even putridity. This happens particularly in years when the weather is very warm during vintage. The fermentation is then very rapid, and it may happen that it goes through in half of the time which is required in ordinary years. Notwithstanding this, negligent wine makers often allow their young wine to remain in the fermenting tank the same time as under ordinary conditions.

The wine makers who ferment their wines in open tanks, should, in order to avoid accidents, *watch attentively the proper time for drawing off the murk;* they should fill the tanks but to a height of twenty inches

from the top in the great tanks, and twelve inches in the small ones; the next day after filling the tank, they should cover the cap which begins to form, not with stems, which acidify too easily, but with a layer of straw, about eight inches thick.

There are wine makers who have the bad habit of filling their tanks not at once, but several times; and after the lapse of several days the first portion of the charge is in the state of violent fermentation, when they add some fresh must in order to fill the tank. They thus expose the wine to the danger of souring, interrupt the fermentation, and may make the wines sweetish or cause them to acquire a taste of stems, because they have remained too long a time in the fermenting tank. When the wine has been drawn off, the pomace remains in the tank. The wine which is contained in this pomace can be recovered by submitting it to the action of the press until nearly dry, after having taken the precaution to remove the upper crust of the cap which has become acid.

The wine thus obtained, which is called *press wine*, is very turbid, very harsh, and sometimes acid, particularly if the upper crust of the cap has not been well removed.

Most of the makers of ordinary wines follow the deplorable custom of mixing their press wines with the clear portion of the wine which has been drawn off from the fermenting tank without first clarifying it. They should put this wine aside, for by doing otherwise they make the best portion of their wine turbid and difficult to fine.

When the fermentation is conducted in closed vessels—aside from the superiority of the wine, there is no chance for the wine to become altered by the acidity of the cap, even if the fermentation should not be attentively watched; for, if the pomace is kept down by frames, the formation of a cap does not take place.

These precautions have a too great importance to be overlooked by the wine-makers. To neglect them, one would have to be the enemy of his own interests.

THE VINIFICATION OF WHITE WINES.

General Observations.—The white grapes are pressed immediately after having been crushed. The must is poured directly into barrels or casks. The vinification of the white wines differs from that of red wines in this respect: that the must is entirely freed from the skins and seeds.

The fermentation starts in the barrels more or less rapidly according to the initial temperature of the must and of the fermenting-room, and according to the amount of saccharine matter contained in the liquid. As a rule the white wines are in violent fermentation twenty-four hours after the must has been filled into the barrels. The fermentation begins in the same way as with the red wines in tanks, by the evolution of bubbles of carbonic acid, which rise to the surface of the liquid and carry with them light matters (such as fragments of skins, woody substances, etc.), which they meet on their way. These various matters which form in the fermentation of red wines produce in the white wines a foam, which rises to the surface of the liquid, and is thrown out of the barrel through the bunghole if care is taken to fill up with new must every day. In this way the wine is freed from a part of its lees, and of the superabundance of ferments. If the barrel is not full, the foam sinks back in the wine, the fermentation becomes more active, and a less mellow wine results than when the escape of the foam has been promoted by keeping the barrel full.

The rise in the temperature of the must is generally not so great in the fermentation of white wines in barrels as in that of red wines in tanks.

The decomposition of the saccharine matters, and their transformation into alcohol, require a much longer time than is the case with red wines, particularly if the must is rich in sugar; this fermentation lasts sometimes until the month of March. In order to facilitate the escape of the foam, and the irresistible evolution of carbonic acid during the violent fermentation, the bunghole should be only covered by a chip of wood, or by vine leaves loaded with sand, when the fermentation becomes less active. Ultimately the bung is driven in loosely, as soon as no more foam escapes.

The barrels with white wine should be placed with the bunghole up, and should be filled regularly every day when the fermentation is violent, and at least twice a week when the fermentation is less violent.

THE DIFFERENT VARIETIES OF WHITE WINE.—There are three species of white wine: (1) Dry white wines; (2) mellow white wines; (3) sweet white wines.

These differences are chiefly due to the density of the must.

The dry white wines are those whose alcoholic fermentation has been complete and whose entire saccharine matter, which could be recognized either by the taste or the saccharometer, has been transformed into alcohol.

These wines are fermented as soon as the grapes are perfectly ripe (without, however, allowing them to rot). The specific gravity of the must varies according to the more or less favorable weather, according to the site of the vineyard, and according to the varieties; but the maximum rises seldom above 13 degrees Baumé.

The mellow white wines are those which retain after the violent fermentation a small quantity of fruit sugar which is not transformed into alcohol. The small quantity of mucilaginous substances imparts to the wine the mellow and the oily taste. In order to obtain such a wine, it is necessary to increase the density of the must. In the Gironde this is done by allowing the white grapes to become mellow, and by picking them only when the skin has acquired a brownish tinge.

The density of the musts is from 12 to 15 degrees Baumé. Such is the specific gravity of the musts of the Sauterne, Barsac, Bommes, Presgnac, etc., in vintages favorable to the maturity of the grape crop. These wines stand between the dry and the sweet wines.

The sweet white wines are those which retain, after their alcoholic fermentation, a considerable quantity of saccharine matter, which makes them very sweet. It is important that the specific gravity of the must should be greater than that, which is necessary to obtain simply mellow wines; and in order that they should remain sweet on aging, the specific gravity should be from 15 degrees to 20 degrees Baumé.

VINIFICATION OF THE HIGH QUALITY WHITE WINES OF THE GIRONDE.

VARIETIES OF VINES.—The varieties which produce the high quality wines are the *Sauvignon* and the *Semillon*. There are some vineyards which are stocked with *Raisinotte*, or sweet *Muscadet*.

The Sauvignon.—This variety yields small bunches with small berries, which press one against the other; their musk taste is very fine. The wine which is obtained from this variety has much flavor and bouquet, and also a high alcohol-percentage.

The Semillon.—Bunches and berries of medium size; fine, mellow taste. The wine which this variety yields retains (the specific gravity of the musts being the same) more of a mellow taste than the *Sauvignon;* it soon becomes flat, however, and turns reddish if it has been allowed to remain in contact with the air.

These two varieties form the foundation of the high quality white wines. They combine the qualities which, taken together, make a perfect wine—fineness of taste, agreeable and decided flavor and bouquet, joined to a very mellow taste.

The Raisinotte (also called *Sweet Muscadet*).—This variety, which some grape growers of Barsac cultivate, together with the two first mentioned ones, yields bunches and berries of medium size, whose taste is similar to that of the Muscat and of the Sauvignon. When perfectly ripe the berries show brown spots; the skin, which is very thin, bursts very easily if rain happens to fall during the time of the vintage. The wine which is made from this variety shares the qualities of those which are made from the two above mentioned varieties.

The three varieties which we have described are the only ones which are actually grown in the vineyards producing the best wines. In former times some poorer varieties were raised, but at present they have been entirely discarded.

VARIETIES YIELDING SECOND-CLASS WINES.—The varieties enumerated below are frequently found with the varieties which we have already mentioned, particularly in the districts adjacent to Barsac and Sauternes. These varieties are: *Prueras*, *Malvoisie*, white *Verdot*, *Cruchinet*, white *Muscat*, golden *Chalosse*, or *Petite Chalosse*, *Enrageat*, called also *Piquepoule Folle-blanche* (which is very prolific), the *Blagnais*, the *Verdot gris*, the *Jurauncon*, and the *Grosse Chalosse*. These latter are prolific, but yield only ordinary wines.

PICKING THE GRAPES.—When the grapes are overripe, and have reached a convenient stage of desiccation, the vintage may begin. The picking should be done only by degrees, sorting as we go. First, the overripe and sufficiently dry berries are picked. It often happens that a portion of the bunch, the one which is turned toward the south, and which is consequently most exposed to the sun, is already overripe, while the side which faces the north is not yet ripe. In this case, berry after berry is picked, and the berries which are not yet overripe are left on the stem.

A second picking is done as soon as there is a convenient quantity of overripe or dry bunches and berries. The number of times which the picking may be repeated is indefinite; this depends upon the temperature, upon the weather being dry or rainy, and upon the more or less favorable site of the vineyard. When the temperature is favorable the grapes are picked at least three times. When it is cold and very moist—in order not to lose the whole crop—it is necessary to pick the grapes not only before they are overripe, but also some time before they are at all ripe; for the humidity, by dilating and bursting the skin, exposes the fleshy and liquid part of the berries to the contact of the air. Under such conditions these berries begin to ferment and pass rapidly from alcoholic fermentation to acidity, and even to putridity, particularly if the rain continues.

It is necessary in unfavorable years to watch the crop attentively, and to detach the spoiled berries, in order to prevent the contagion from spreading. But, anyhow, too great haste should not be made in harvesting the crop; a sudden change in the temperature may occur; it may stop raining; in a word, the grape grower should not sacrifice the quality of the crop except when there is no hope of obtaining any, and when the crop threatens to become a total loss.

Filling the Must into Barrels.—The precautions and manipulations in washing the press are the same as for the red wines, with the exception that the sponging is done with water, and not with alcohol.

The barrels destined to be filled with wine should be prepared in advance. This preparation consists of washing them with boiling water; rinse them afterwards and let them drain.

The must should be poured in not later than the evening of the day when the pressing is done; the barrels to be filled up to two inches from the bunghole, in order to leave only the necessary space for expansion, which is produced by fermentation. As soon as the foam appears the next day on the surface, some must should be added, in order to remove the foam from the barrel, and thus to free the wine from a portion of its natural ferments.

Various Proceedings to Augment the Density of the Musts.—In the following are given various means of increasing the density of musts from white or red grapes, with the object of making sweet or mellow wines, without *using saccharine matters foreign* to the grape. The processes which we are going to describe are particularly used in cold countries—in Germany, etc.—either for making sweet wines or simply for improving the ordinary wines. These additions make them mellow—destroy the tartaric acid, which the green grapes contain in excess.

Sweet wines may be made where the density of the must is higher than 25 per cent. Below 25 per cent the wines do not remain sweet; it is, besides, very easy to regulate the density which it is desired to obtain by preliminary experiments.

These processes should be used only in case when it is impossible to increase the density by the solar heat in a natural way, or if the varieties ripen slowly, or if they have a thick skin. They are consequently used but for the improvement of ordinary wines.

1. The grapes are picked as ripe as possible; the spoiled berries are sorted out, and the rest exposed to the sun on straw or on boards during several days. At night they are stored in dry and well ventilated garrets.

2. If the weather is rainy, or if it is cold, the solar heat may be replaced by the heat of a furnace. For this purpose the grape bunches are placed on screens and introduced in a baking furnace after the bread has been taken out. The desiccation is stopped after the density has been conveniently increased by the volatilization of a part of the water, and by the transformation of the tartaric acid into glucose.

As far as the increase of the density by a foreign saccharine matter is concerned, aside from the expense caused by these operations and the

bad taste imparted to the liquid, we disapprove of their use; they do not fulfill their aim. We speak now of the ordinary wines of cold countries, where the grapes do not easily reach their maturity, and where they contain an excess of tartaric acid. The heat, as is well known, transforms this acid into glucose (fruit sugar), which imparts the tart taste to the wine. In the absence of natural heat, artificial heat accomplishes the same purpose. Sugar or syrup are only used to increase the density of sweet wines from the south of France of ordinary quality. The introduction of a certain quantity of candy syrup into musts showing a low density, produces, it is true, a mellow wine without bad taste; but this sweet taste is insipid, and has nothing in common with the taste known as "rôti," so called by Frenchmen. Only the sun can produce this, and it makes the white wines of the Gironde stand without rivals in the world. Besides, if syrup is added to wines which are already fermented, it is necessary to fortify them so as to give them 15 to 16 per cent of alcohol; because otherwise they could not be preserved under the ordinary conditions without fermenting and becoming turbid.

PART II.—WINES, THEIR CARE AND TREATMENT IN THE CELLAR AND STORE.

CHAPTER I.

GENERAL TREATMENT OF WINES.

General remarks. Influence of contact with the air. Influence of the variations of temperature. Influence of the deposition of the ferments, and of the lees; measures by which a sudden spoiling of the wine can be avoided. Suitable premises for storing wines; cellars, store-rooms, etc. Precautions which should be taken to avoid the loss by evaporation, and to maintain a regular temperature in the cellars; ventilators; difference between the loss by evaporation in a ventilated and in an air-tight cellar. Humidity; methods of diminishing the same. Arrangement of frames and supports for casks; materials suitable for the purpose. The piling up of the casks; utensils and apparatus; Bordeaux method. The piling up of casks in the warehouses of Paris. Machines for piling up. Racking of the wine; utility and various objects of racking; most favorable conditions of time and of temperature for racking. How to do the racking; Bordeaux method. Cleanliness. Macon method. Transfer of wines from one barrel to the other; various systems of pumps, syphons, etc., for racking. Sulphurous acid gas; its nature and properties; its use in the treatment of wines. Sulphur wicks; their manufacture, etc.

General Remarks.—The care and attention which should be bestowed upon wine making includes not only the manipulations which are necessary to keep the wines in a good and sound condition, but also the means necessary to promote their aging, by developing in them all the qualities which they are capable of acquiring. It comprises also the remedies against the diseases or defects to which they are subject. Three important conditions should be fulfilled in order to reach this end:

1. The wine should be preserved from contact with the air.
2. The wine should be maintained at a uniform temperature.
3. The wine should be freed from the ferments and lees, and its complete clarification obtained without injury to its future development.

Aside from these precautions of a general character, it is very important to taste and to watch continuously the progress of the wine, in order to prevent by the proper measures after-fermentations, which originate particularly in mellow wines, and which, by transforming the mucilaginous substances into alcohol, destroy the fruity taste. The details of these measures will be given on each occasion, when speaking of the particular treatments which are adapted to each kind of wine.

The remarks which follow are applicable to all *natural* table wines—that is, to unfortified wines. These wines contain from 7 per cent to 15 per cent of alcohol, according to the climate and variety of the grape. We reserve a special chapter for the liqueur and sweet wines, as the conditions which should be observed to preserve them in a sound state are different.

INFLUENCE OF CONTACT WITH THE AIR.—If the wine is allowed to come in immediate contact with the air, several changes occur in its condition. A part of the alcohol evaporates as well as the bouquet and the flavor, and if the contact is a prolonged one a whitish scum called "flowers" is formed on the surface of the liquid. These "flowers" are nothing else but mold of a peculiar nature, which is produced by the growth of microscopical fungi, called *Mycoderma vini* and *Mycoderma aceti*, and which develop rapidly by budding.

This mold, which is impregnated with acidity, communicates to the wine a disagreeable taste, known under the name of *flatness;* it also renders the wine turbid and introduces acid ferments in the same. Sometimes when the wine contains an appreciable quantity of sugar this mold will not thrive, but then the wine undergoes an alcoholic after-fermentation. If not speedily protected from the contact with air, it will become pricked, and will be transformed later into vinegar. Science explains this transformation of wine into vinegar by the action of the oxygen of the air, which, oxidizing the alcohol, changes the same into acetic acid. All the alcoholic liquors are susceptible of undergoing acetic fermentation on coming in contact with air, water, and a ferment. It is also known that most wines contain ferments. According to M. Pasteur, the acidity is due to a special ferment—the *Mycoderma aceti*. However this may be, the wine can be transformed into vinegar more or less rapidly and completely (and often without the mold appearing on the surface) at temperature ranging from 32 degrees to 212 degrees, but the temperature which most actively hastens this transformation is between 77 degrees and 104 degrees Fahrenheit. The alcohol which is contained in the wine changes gradually into acetic acid.

The vinegar which is allowed to remain in contact with the air loses its strength in its turn, excepting in cases where there is still a certain amount of sound wine present; the acid is by and by destroyed, and at last the liquid becomes entirely spoiled or rotten. On the whole, wines to which the air has access can undergo three different fermentations: The alcoholic after-fermentation—which is often termed in the business "the working"—changes into alcohol the different mucilaginous substances which are contained in the wine. This fermentation will proceed, if it has once started, without the air having access. Sometimes this fermentation is very injurious to the future of the wine, as it destroys the fruity taste. We shall have an opportunity to speak of this subject later.

The acetic fermentation transforms the alcohol of the wine into acetic acid, and the wine thus becomes vinegar.

The putrid fermentation is, as its name indicates, a decomposition of the acid. At this stage neither the taste of wine nor of vinegar can be recognized; it is nothing but a spoiled liquid.

These different transformations may take place in wines of every quality, whose alcohol-percentages are below sixteen, if they remain exposed to the air.

Wines whose alcohol-percentage is a very low one become putrid and decompose without a preliminary acetic fermentation. The reason for that must be assigned to their relative weakness; as they contain but little alcohol, they can yield but little acid.

As far as the liqueur wines—for instance, port, Malaga, Alicante, etc.—are concerned, two agents retard their transformation under the influence of the air; the quantity of alcohol which exceeds 16 per cent, together with the large quantity of sugar, which several varieties contain, keep up in them, if the air has access, a slow fermentation, which, by transforming a part of the mucilaginous substance into alcohol, stops and often even prevents the beginning of the acetic fermentation. Their high alcoholic percentage, which is very often increased by the addition of alcohol, retards the alcoholic fermentation and prevents putrefaction.

IMPLEMENTS FOR TASTING.

1. Hammer for using in tasting. This tool is used to make gimlet holes by means of the awl, which is screwed onto the extremity of the handle *c; a* serves for pinchers with which to take out the pigots, and may be used as a hammer and the sharp side for cutting plugs.
2. Gimlet, such as used in Macon.
3. Crystal glass for tasting old wines with considerable bouquet.
4. Ordinary tasting glass.
5. Pocket thief of silver or tin.
6. The same in glass.
7. Silver cup, Macon pattern.
8. Silver cup, Bordeaux pattern.
9. Graduated measure of glass.

These wines, however, are not always exempt from changes under the influence of the air. Their alcohol-percentage and their bouquet decreases; an alcoholic fermentation sets in which destroys their sugar, and this loss, combined with the decrease in alcohol, favors a rapid setting in of the acetic fermentation; it happens even often that the presence of the acid shows itself plainly before all the sugar is changed into alcohol.

The wine can be considered protected from the immediate contact with the air, if the barrels are made of sufficiently thick and well-fitting staves, and if neither porous nor dripping wood has been used for this purpose. It is necessary, besides, that the casks should be completely filled and well bunged.

On the contrary, the wine can be considered to be in contact with the air if the barrels are not completely filled, if they are not carefully bunged, or if they have leaks.

INFLUENCE OF A VARYING TEMPERATURE.

It is important that the premises in which the wine is stored should have a constant temperature. In our climate, the average temperature of the cellars is from 59 to 62 degrees, but these variations of temperature depend upon a more or less favorable location, and upon the precautions which are taken to prevent the access of the air. We shall speak a little later of the places which it is most advisable to choose for this purpose. The variations of temperature produce in the wine, in the same way as in other liquids, changes of density and of volume—a lowering of the temperature produces contraction of the liquid; a rising, on the contrary, an expansion. Thus, if a barrel is completely filled with wine and placed in a cellar, the temperature of which is lower than that of the wine, the wine will decrease in volume, and an empty space in the cask will appear. In most instances, this contraction is favorable to the deposition of the lees, but it has the disadvantage that it produces in the casks an empty space, which often results in the drying up of the exterior surface of the staves, and thus affords a passage to the air.

In this case it is necessary either to fill the cask or to draw off the wine in order to preserve it from contact with the air.

When the temperature of the store-room is higher than that of the wine, the latter will expand, In addition to the danger which results in leaving the wine in such a condition, on account of the pressure it will exert against the staves and against the bottom, the expansion may produce a rising of the lees which had been already deposited, and thus render the wine turbid, and impart to it the bad taste of the lees; besides all that, such an expansion will predispose the wine to all kinds of after-fermentations.

INFLUENCE OF THE SETTLING OF THE FERMENTS AND OF THE LEES; MEASURES BY WHICH SUDDEN SPOILING OF THE WINE CAN BE AVOIDED.

The importance of settling the ferments and the lees is acknowledged; the turbid wines are liable to undergo an after-fermentation, which may be either an alcoholic or an acetic one; they easily acquire the bad taste of the lees, a certain bitterness, etc. In all wines a continuous separating out of insoluble matters is going on; certain matters, among them the coloring matters, several mineral and organic salts, etc., which at first were dissolved in the wine, become insoluble, and form a precipitate at the bottom of the barrel, or remain in suspension; these are the matters which, together with the ferments, form the lees. There is more or less of this deposit in a wine, according to its character, and according to the care which has been bestowed on the same during vinification. The most voluminous deposits are formed in the first year; they decrease in volume and in consistence at every racking, if the wine is carefully treated. When the wine is well nigh free from them, and when it has reached its full development, the deposits amount to almost nothing, but they increase anew if the wine begins to deteriorate.

The deterioration of the wine can be prevented by bottling it before it has lost in the barrel a portion of its alcohol and its fruity taste. Bottled wine, as a rule, keeps well and improves in quality, while if the same wines be left in the barrel they become harsh and dry and lose their flavor, and consequently their full value.

Wines are freed from their deposits and ferments by different means, according to circumstances: by allowing them to settle slowly, by lowering the temperature, by racking, and by treatment with finings. We shall give further on the practical details of these different operations.

THE STORAGE OF WINES—CELLARS, STORE-ROOMS, ETC.

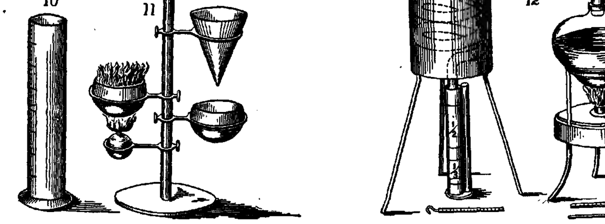
A wine cellar should combine two essential conditions: uniformity and regularity of temperature at all seasons; further, the loss which is produced by evaporation should be as small as possible in a good cellar.

In former times, a third condition was indispensable; it was necessary to avoid the humidity, which, by causing the wooden hoops of the casks to rot rapidly, often gave rise to loss of wine. For this reason the cellars were ventilated by air-holes. Through these openings the air could be constantly renewed, and thus the excess of humidity was got rid of, but the evaporation was thereby considerably increased, and the maintaining of a regular temperature rendered impossible. In those days the casks had wooden hoops only, and it was necessary to watch carefully their exterior surface. In some air-tight cellars they rotted in less than six months. To-day the custom of hooping the casks exclusively with iron has become general, and proves not only more economical than the ancient one, but it is also indispensable for the security of the wines which are destined to age, and which are placed in close cellars. Thus, while checking the humidity of the cellar by appropriate means (which we will mention later on), it is necessary to make the cellars perfectly close, and without direct communication with the outside; vertical ventilators which close hermetically are admissible.

PRECAUTIONS WHICH SHOULD BE TAKEN TO AVOID THE LOSS BY EVAPORATION AND TO MAINTAIN A REGULAR TEMPERATURE IN THE CELLARS. VENTILATORS; DIFFERENCE BETWEEN THE LOSS BY EVAPORATION IN A VENTILATED AND IN AN AIR-TIGHT CELLAR.

The cellars should be exposed as much as is necessary to the north, and should be protected on the south side either by adjacent buildings or by thick walls. The best cellars are those which are dug out of the ground or excavated to the depth of one to three feet, but this only in cases where the subsoil is not too moist. If the cellars are built as above, it will be necessary to surround them by trees, in order to protect them from the heat. Then they should have no permanent communication whatsoever with the surrounding air, neither by windows nor by air-holes; all the openings of this kind should be shut and the ceilings be plastered.

It is important that the cellar should have but one outlet—the door—exposed to the north, if possible. There should be, besides, at the entrance, one or two smaller rooms, which can be utilized as workshops, or as temporary store-rooms. These rooms should have double doors, which should be kept closed, particularly when the weather is warm. The lofts



COMMERCIAL ANALYSIS.

10. Graduated cylinder, holding one liter.
11. Small apparatus for evaporating and filtering liquids according to the system of Guyton-Morvaux. It is used advantageously for ascertaining the nature of the salts, saccharine matters, and residues which liquids contain; also, for filtering samples.
12. Distilling apparatus of Salleron, ancient pattern.

above the cellars should be plastered, and during warm weather ventilated, particularly in large establishments. Ventilators are useful for lowering the temperature of the lofts and of the *warm cellars*. It is the best plan to give them the same form as to those of steamships; they should rise above the roof for at least three feet and be topped off by a vane, which should be soldered on above the air-hole. This vane should be movable, and arranged to present the opening to the wind. If it is necessary to lower the temperature of the cellar, an hour ought to be *chosen when the temperature of the surrounding air is at its lowest* point. It is best to open the valves of the ventilators in summer at about three or four o'clock in the morning, and to close them at six o'clock, after having watered the floor abundantly. If the lofts are not plastered, all the seams between the boards should be calked. Aside from that, *these lofts should be always filled with* various merchandise, boxes, timber, etc., in order to prevent the access of hot air to the cave, else it will be advisable to cover the floor with a layer of fine and dry sand.

As far as the cellars with garret windows, which do not have a loft, are concerned, it cannot be expected that a regular temperature could be maintained in them, even if they are plastered, as the heat penetrates through the roof. The most convenient place for storing wine is a vaulted cellar, which has no direct communication with the surrounding air.

If it is desirable to maintain a regular temperature in cellars which have been constructed in former times, the best way to reach the desired end will be to do away with the air-holes, particularly with those which contribute towards producing draughts; further, by adding a new room at the entrance, by plastering the ceilings, and by constructing the lofts in the manner described above. If, during the great summer heat, the temperature of the cellar rises, which should be always ascertained by a thermometer, it can be lowered several degrees by watering the soil with fresh water at about 60 degrees, and by keeping the cellar well closed afterwards; but if the heat penetrates through the lofts or through the spaces between the boards, the casks must be placed as near as possible to the ground. As a matter of fact, in this kind of cellar there

has often been observed a difference of 20 degrees between the temperature near the surface of the soil and near the ceiling. Thus, on warm days it is not infrequently observed that the temperature in the neighborhood of the ceiling rises as high as 86 degrees, while that near the soil is not higher than 64 degrees. This fact explains itself by the expansion of the warm air, which, being specifically lighter, remains in the upper parts of the cellar.

The loss of wine by evaporation depends essentially upon the manner in which the store-room and the casks are arranged. The loss varies from 3 to 10 per cent, according to the ventilation of the cellar. The laws of France in the dealings of the wholesale merchants recognize, in bonding, an allowance of 8 per cent per annum. In dry cellars, where the air is constantly renewed through air-holes, through the windows, or through the garrets, evaporation attains the limits which are allowed by the law, and even goes beyond, particularly if the wines are kept in barrels with thin staves, barrels which are not well built, and hooped with wood or hoops which they have neglected to drive down. When the hoops become dry, the waste may reach 10 per cent—extraordinary leakage. In cellars which are perfectly air-tight, and particularly in those which are vaulted, the wines which are kept in strong and iron-hooped barrels show hardly a loss by evaporation of 3 per cent per annum.

The cellars of many of the wine makers of the Gironde, and generally also of other wine-growing countries, are in a poor condition for storing wines and for preventing loss by evaporation. Indeed, with the exception of the proprietors of the celebrated vineyards of the Medoc, where it is very important to treat their wines carefully and to reduce to a minimum the loss by evaporation, the cellars of the producers are, in most instances, nothing but barns, in which the air circulates freely, and whose temperature varies, in accordance with the temperature outdoors. Very few of these buildings have either a ceiling or are plastered, and the racking, filling up, and tasting are done with the doors and windows open—all done to economize light, and to avoid that rotting of the staves of casks (which are hooped with wood) which would take place under the influence of darkness and humidity.

Wine makers should consider that by allowing the free circulation of air in their cellars they lose every year, through evaporation, 3 or 4 per cent of their vintage, to say nothing of the difficulty they experience in selling their old wines, owing to the faults which they acquire through the contact with the air and carelessness. These faults are *dryness*, *acidity*, *harshness*, etc.

The decrease in the loss by evaporation would pay them largely for the cost of renewing the wooden hoops, and their wines would have a greater value if the cellars were conveniently built and perfectly close. They may avoid the expense of renewing the wooden hoops by using iron hoops.

In former times the difference in the value between the wooden and iron hooped barrels was great—the price of the wooden hoop was low, and that of the iron hoop high; but to-day the wooden hoop becomes more and more scarce, and its price shows an upward tendency, while that of the iron hoop remains stationary.

If there is good reason for not having the cellars close, as, for instance, where the wines are temporarily stored in magazines, sheds, etc., it is impossible to avoid the loss by evaporation, but it is possible to prevent injurious changes in the wine. Keep the casks always well filled. The filling up should be done every five days, and if the wines are new, they should be permanently bunged. After-fermentations can be prevented by frequent rackings. If the wines cannot be racked, they should be transferred into sulphured casks, without bringing them in contact with the air. They should be often tasted, in order to ascertain if any working is going on in them. If the casks are entirely exposed to the air, they should be covered with tarpaulins, which should, in turn, be frequently wetted.

The same precautions should be taken with old wines; they should be drawn off as soon as the barrel shows a quart or more of ullage.

HUMIDITY—MEANS OF DIMINISHING THE SAME.

Humidity is unavoidable in close cellars. An amount of moisture, not too great, is useful, because it reduces the evaporation of the wine; but too much humidity promotes the rotting, not only of the wooden hoops perhaps, but also of the casks themselves. An excess of moisture is corrected by the following means: The soil of the cellars should be kept clean and well beaten, and thus be made almost impervious; this precaution is indispensable in order to avoid the humid and sometimes putrid emanations of the earth.

If the cellar is built in a marshy place there should be taken off from the surface of the soil a layer of earth about one foot thick, which should be replaced either by pulverized soft rock, by a mixture of lime, sand, and fine gravel, by clay mixed with pebbles, or by the waste from iron works, fragments of iron, and charcoal, which are well beaten into the soil so as to form an impervious layer. These compositions are allowed to dry, and if the moisture which they exhale during drying is too abundant, the drying is hastened by means of a chafing dish. When the soil has well hardened it is covered with a layer of fine and siliceous sand, which has been previously dried in the sun.

If, notwithstanding these precautions, infiltration of water should take place, all the parts of the cellar where this has been noticed should be laid out with stone fragments or bricks, and cemented with concrete.

There should never be left in the cellar any kind of matter susceptible of attack by humidity; for if such a matter is once impregnated with moisture it contributes to make the cellar still moister. Besides this inconvenience, the matter is apt to decompose under the influence of putrid fermentation.

The excess of moisture may be diminished by sweeping the soil of the cellar often, by scraping off the moss and the mold from the walls, by brushing off at every racking the mold from the casks, by taking away the moist sand which covers the soil below and between the casks, and by replacing it with dry sand.

Sawdust should never be used for replacing the sand with which the soil is covered, because if it remains there a long time it becomes impregnated with humidity, and increases the latter; but the greatest inconvenience connected with the use of sawdust is, that in this substance, as well as in all the woody and vegetable matters under the influence of the air and of humidity, a putrid fermentation is produced, which pol-

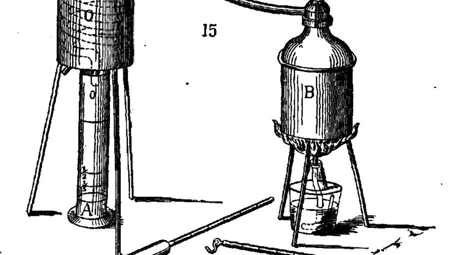
lutes the air, sets the wines fermenting, and, later, transforms the sawdust into manure.

Preference should be, therefore, given to fine siliceous sand, which has been previously well dried.

ARRANGEMENT OF FRAMES AND SUPPORTS FOR CASKS—MATERIALS SUITABLE FOR THE PURPOSE.

The supports are wooden timbers or other material, which are laid on the soil, being from six to eight inches high. The skids are destined to support the barrels in order to protect them from the humidity of the soil, also to facilitate the racking of the wine.

They may be made from different materials. In the country around Bordeaux blocks of wood from the *Pinus maritima* are generally used, for the sake of economy. These blocks are nothing else but young trees, which are roughly squared, of a diameter of six inches, and of varying length (eighteen feet on the average). In order to form a bench, two of these trees are laid on the earth, leaving a distance of two and two tenths feet between them (from outside to outside), if they are destined for Bordeaux barrels, or any other barrels of the same length. If the barrels exceed this length it will be necessary to increase the distance between the blocks in the same proportion. The blocks from pine wood are usually not connected by cross framing; when they are placed on the floor of the cellar they should be exactly level, and if some part of the block shows a protuberance, it should be sawed from below half of its thickness, so as to be brought nearer to the floor under the weight of the full barrels.



13. Ordinary plug for stopping up sample holes.
14. Pinchers (Maconese style) for withdrawing the plug.
15. Distilling apparatus of Salleron (new pattern); *C*, copper cucurbit; *O*, cooler; *A*, test tube used as receiver—used same as ancient pattern.

If blocks cannot be made profitably from pine wood, fir or any other soft wood may be used, which is simply squared. If the joists are cut more high than broad (six inches high by four inches broad, for instance), they should be connected by crossbeams, in order to prevent their upsetting. It is advisable to use hard wood for the frame, such as oak, elm, etc., which resist rotting better and longer, but their high price is an obstacle to their use. In very moist cellars, however, there is no economy in using pine wood, for they rot very rapidly. It is more profitable in this case to build them of hard stone, which are sunk into the soil to a depth of about twelve inches, and which have above the soil the same dimensions as those made from wood; that is, a height of six inches and a width of six inches. The contact of the casks with the stones is avoided by covering the latter with a piece of wooden board. These frames are more expensive than those which consist of blocks of pine wood, but they are very solid, and cost less in the end. Their use makes the renewing unnecessary, which in moist caves has to be done sometimes every year.

We have already said that the blocks or timbers should be placed at a distance of about two feet from outside to outside, in order to support one row of *Bordeaux* barrels; the average length of these barrels being about three feet, it is reckoned that each row occupies in breadth a little more than three feet.

The passages between the rows, which are necessary for racking, rolling, etc., for attending to the Bordeaux barrels or to barrels of the same dimensions, should have the following dimensions, as far as their breadth is concerned:

Passages in which barrels can be rolled freely	4 feet.
Passages in which barrels can be rolled without passing	3½ feet.
Passages for persons only	2⅔ feet.

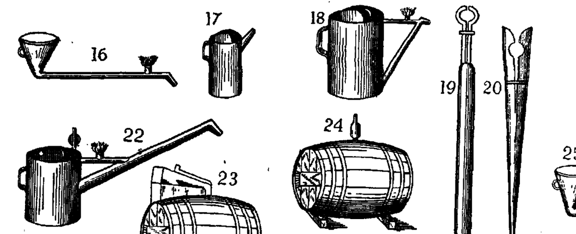
The work is done much easier, and consequently more economically, if all passages of a cellar have the breadth which is necessary for rolling, and in such a case, indeed, it is sometimes possible to place all the barrels which have to be rolled in the passages, leaving a space of eighty to one hundred inches; which allows the workingmen to circulate between the rows of barrels and to carry on with ease the movements of rolling, fixing, *etc*.

This is the most advantageous arrangement for doing the work.

The number of barrels which a cellar can contain is reckoned from its length and breadth; we know that the Bordeaux barrel occupies three feet four inches in length and two feet two inches in diameter, and that the passages have to be from two and two thirds to four feet wide; therefore, it is easy to calculate the capacity of a cellar, without measuring row after row. The supports are arranged in two manners: In the cellars of the wine makers the rows are laid out in the longitudinal sense, while in the cellars of the wine merchant, and particularly if stock consists of a great variety of brands, they are laid out in the transversal sense to facilitate attending to the barrels.

If the rows are laid out in the longitudinal sense, first, one layer is formed from one end to the other of the cellar, on each side of the walls; then either one row is established in the middle, and the two ends of this row are left empty for facilitating the circulation, or several rows with passages between them, according to the dimensions of the cellar. In cellars which are very long, passages are made with a view to avoiding too long turns towards the middle of the row. This is the most frequent arrangement of the cellars of wine makers. In the cellars which are destined for the trade, one broad passage, six and one half feet wide,

is left on the whole extension of one of the walls, and the rows and passages are laid out perpendicularly to this broad passage; all passages end in the large passage, and all the rows rest against the other walls.



16. Z-shaped funnel, for ulling barrels placed in tiers.
17. Ulling can, containing from one half to one gallon, used to feed the Z funnel.
18. Tin can used for ulling. Usually it has on the inside a scale showing contents.
19. Iron candlestick, pointed at lower end, to be stuck into the wall, handle flat, to stand upright on barrel when necessary.
20. Wooden candlestick, made from large hoop, whose one end is sharpened for same purposes as iron candlestick.
21. Cellar candlestick used in north of France, with hook to hang to the crossbars of the barrels.
22. New filling pot, used instead of old Z funnel.
This instrument is filled with wine through a tube in the cover, which is afterwards closed by cork stopper; the air is allowed to enter through a small aperture below the spout, and which does its work as long as there is an empty space in the barrel. As soon as the barrel is full the opening below the nose is covered with the liquid, and the outflow stops; this effects a great saving, and reduces the loss so often occurring with unskilled labor.
23. Ulling bottle in inclined position, called *automatic uller* (system of Chaume).
24. Ulling bottle in vertical position, being a bottle with two necks; the lower one is conical, to fill the bunghole; the other one is an ordinary bottle neck, through which the wine destined for ulling is poured; then this bottle is closed with a conical stopper, after fitting to the bung, by wrapping the lower socket with linen or india-rubber; as the barrel gets filled, the wine in the bottle sinks down. The uller (23) is more complicated on account of its inclined position; the air from the barrel being led into the upper part of the bottle through an india-rubber or glass tube, which dips one end into the opening of the bunghole.
25. Z funnel, with stopcock. This instrument renders great services for filling barrels which are placed with the bunghole sidewise.

To facilitate the finding of certain packages, and the making of inventories, each row should bear a number which is inscribed on a board in the great passage, on the wall opposite to the row. This board should show, besides, the date of the entry of the wines, and the quantities which are in each row.

In the cellars of ancient construction, or in buildings which it is impossible to modify, the rows should be laid out in such a way as to utilize in the best way the existing space without interfering with the necessary work around the barrels. At any rate, it would not be prudent to do away with the passages with the object of storing a greater number of barrels; this causes greater loss, particularly if the barrels are badly placed, for, if it would not be possible to inspect them, it would be also impossible to see the leaks, to stop these leaks, and to pump the wine from one barrel into the other when such operations are necessary.

PILING UP CASKS—UTENSILS AND APPARATUS—BORDEAUX METHOD.

The piling up of the casks consists in their stowage on the supports. The casks should be placed firmly so as not to incline forwards or backwards. They are kept in their place by means of blocks of wood shaped in the form of wedges. These blocks are made usually in Bordeaux from clippings of timber employed in the manufacture of barrels; in certain localities in which wood is dear, for instance in Paris, the wooden wedges are replaced by fragments of hard rock.

The barrels which are in the lowest row should rest on four wedges, two in front and two behind, in order to avoid a displacement which would impair the stability of the row, and which would stir up the lees. This would happen without the slightest doubt if the row should be racked in a direction opposite to its placement, and if it should be supported by wedges only from one side. The last barrel in the lowest row should be supported, besides the four usual wedges, by a great triangularly shaped stone, or by a piece of wood of the same shape, which should rest against the bulge. It is important that this last wedge should not go beyond the diameter of the bulge of the barrel; for otherwise one would run the risk in passing through the passages of displacing the wedge and endanger thus the stability of the rows, particularly *if they are piled four or five high.*

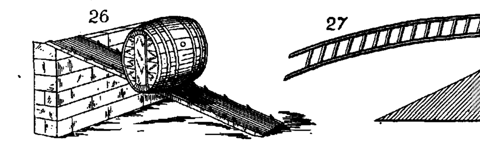
The barrels are piled up to a second, third, and higher rows with the help of wooden bridges. The barrels of these new rows should be supported with blocks with the same care as those of the first row; they are rolled from one end of the row to the other on skids in the same direction as the frames. The skids which are destined for this use are two feet two inches wide (approximately the diameter of the bulge of the Bordeaux barrel), and they are placed without blocks on the barrels which are stored in the first row. Care should be taken that they be firmly bolted together to avoid their spreading. In order that the piling up should be executed quickly, and to diminish the labor of the working man who manages the crowbar, it is necessary, according to the case, that the barrels should arrive on their place either with the bunghole upwards or sidewise.

To attain this result they should be measured before hoisting them up.

The utensils and apparatus which are necessary for the piling up of the barrels are: (1) an iron crowbar which is bent on one end and sharpened on the other; this instrument should have a length of two feet eight inches for Bordeaux barrels, and a length of three feet four inches for packages of larger dimensions; (2) blocks of wood and wooden wedges; (3) skids of varying length, from nine to eighteen feet; (4) a hemp rope (one and two tenths inches diameter approximately) about eighty-five feet long, which is chiefly used for piling up the extreme ends of the rows. The bridges are pieces of supports, which should be as straight as possible and free from knots; after having squared the ends, those which have to rest against the barrels are slightly carved out from below so that they are less apt to slip; the other (lower) end of these blocks of wood are also shaped in a way that insures their resting firmly on the soil. These bridges are not united by crossbars; they have a length of twelve to eighteen feet. The handling of the ropes for hoisting the last barrels of a row is managed in a manner best determined by some experience.

For hoisting the barrel, a supplementary workingman (the foreman who has the piling up in charge manages the crowbar) directs the ropes and helps in hoisting; he also receives the barrel when it has arrived to the top row. For taking down a barrel, ropes are equally useful, and the same precautions are needed, particularly for the fourth and fifth rows. For taking a barrel from the second and third rows, it is let down on to skids; or, after having taken away the wedges under the first barrel of the row in front of which a full barrel has been first placed, the barrels are allowed to slide down slowly and with due precaution, helping them with the crowbar and taking care to place between the supports two blocks which rest against the barrels which remain, in order to avoid all violent shocks. But this method requires great experience, to avoid accidents; and it is advisable to use it only in case when a barrel from the second row has to be taken down.

In Bordeaux the piling up of the barrels in rows is generally done by contract, undertaken by men used to this kind of work and who are organized in crews; the simple arrangements which we have just described, though incomplete, sufficiently explain how to carry on the work rapidly. But if this work would have to be done by the coopers, the great firms would have a real advantage in having more complete arrangements, such as are met with in the great warehouses of the north of France. Thus the workingmen could carry out this work with less exertion, and particularly with more security.



SKIDS, HOISTING APPARATUS, *BENCHES, ETC.*

26. Automatic block skids. This apparatus, constructed by the firm A. Luc, of Paris, has teeth which by an ingenious mechanism fall to the level of the skids as the barrel presses them down, rising to block it when it has passed. It is useful when there is but one man to pile up the casks.
27. Ordinary skids.
28. Inclined plane for decanting with the faucet.

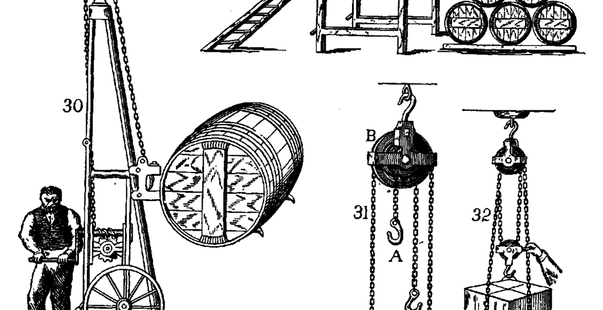
In the following pages we shall undertake to describe these arrangements.

PILING UP BARRELS IN THE WAREHOUSES OF PARIS.

The utensils and apparatus which are used in Paris for piling up the barrels differ very much from those which are used at present in Bordeaux; the pine-wood bridges are replaced by skids; and, besides, a special apparatus called the tabernacle is used. The skids for piling up the casks are joists made from ash, oak, or fir; the best are those which are made of ash wood; they are from five and a half to twenty feet long and about four inches wide, from four and eight tenths to six inches high, and are bound together by flat bars, which are made from oak wood and bent inward; these bars are fitted to the joists at regular intervals of thirteen inches. The disjoining of the ladder, which is twenty-six inches wide, is prevented by bolts which are placed under the bars at the ends and in the middle of the bar; one end of the skids is provided with double iron hooks so as to prevent it from gliding.

The tabernacle is a strong, solidly built oak table, three and two thirds feet long by two and one third wide, and reaching just to the height of the third row; its height should be regulated according to the height of the supports.

The legs of oak wood are about four inches square, and are connected four inches from the ground by crossbars of the same thickness; the upper part of the legs are connected with the table by four arms of the same thickness. The roof of the tabernacle is planked with oak boards one and a half inches thick. A strip of iron about one fourth of an inch thick, and one and a half inches wide, lines the floor of the tabernacle. This strip of iron is fixed there to receive the hooked irons of the skids (which are placed on one of the narrow sides, in order that the apparatus should have more stability). The tabernacle can be easily transported with the help of iron handles, which are imbedded into the posts.



29. Tabernacle or staging.
30. Windlass for hoisting casks. (Patented by Vernay.)
31. Differential pulley. This pulley is the one commonly employed in foundries and machine shops. One man can easily hoist up a barrel with this pulley.
32. Pulley. (Patent of the firm A. Luc, of Paris.) This pulley, as well as the one mentioned under the preceding number, is transportable and often used for hoisting freight from one story of a building to another.

It can be easily seen that with the help of the rope and of the tabernacle, it is an easy matter to pile up the barrels in all directions, and with security. In order to take down the barrels from the upper rows the same utensils are used, and a bag half filled with straw is placed beneath, in order to deaden the concussion.

Machine for Piling up Barrels.—We have noticed at the last industrial exhibition a machine for piling up barrels, which received the particular attention of the jury—patented machine of Louis Vernay (from Batignolles). We give the design of this machine. (Fig. 30.) It is particularly useful for piling up heavy packages in a limited space and with few workingmen. It consists of a movable platform, which descends to the floor, and on which the package is placed which has to be lifted. This platform rises along an iron shaft of peculiar shape. The ascending movement is imparted by gearing, which a crank, turned by a workingman, sets in motion. When the platform has reached the desired height it is made to turn on a pivot in whatever direction it is desired. By means of a special arrangement the platform can be used as a weighing machine. The machine, which is mounted on rollers, can be easily transported. Notwithstanding, however, the advantages which this machine seems to offer, it is little used, because so expensive; and further, because for the piling up of the ordinary packages in the second row, such as the Bordeaux and Macon barrels, there is required the same and even more time with the help of this machine than by the ordinary processes. This machine is particulary useful for piling up in the fourth and fifth rows. We believe it would render great services in countries where wages are high, and in warehouses where big packages have to be lifted.

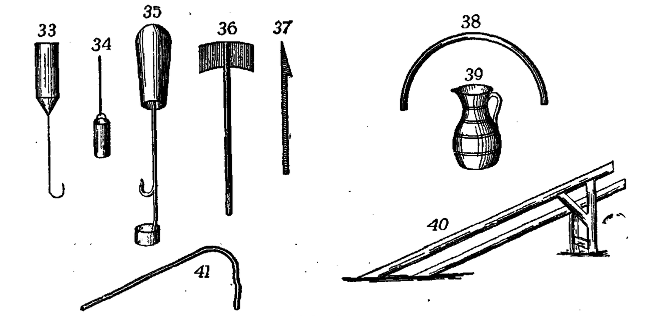
Further on are represented the machines which are established on a post, or on pivots, or on rails, and which are used for hoisting weights from one story to another. Several types and models of these machines are used in cellars, such as windlasses, cranes, etc., according to the arrangements of the premises, and according to the necessity to perform the lifting vertically or on the inclined plane. (See Figs. 126 and 127.)

RACKING—UTILITY AND OBJECTS OF RACKING—FAVORABLE CONDITIONS OF TIME AND TEMPERATURE.

The objects of the racking are: 1. To separate the wine from the lees, which have settled on the bottom of the cask, either on standing or after the use of finings. 2. To prevent, or to stop with the help of sulphurous acid, alcoholic or acetic after-fermentations. 3. To replace in the barrels the wine which has evaporated.

The wine should never be allowed to remain long on the lees after it has become bright, either on standing or after the use of finings; because if the lees are not separated from the wine the after-fermentation, or even the simple expansion which is produced by the increase of temperature, brings these lees back in the wine, which in this case loses its brightness, and assumes sometimes a leady and turbid appearance. It has been also observed that the wine, even if it does not lose its bright condition, acquires through long contact with the deposits a disagreeable taste of lees. This sufficiently indicates the importance of racking. We have constantly observed that the wines in general, and the wines under treatment with finings in particular, which have been racked as soon as their brightness was perfect (from fifteen days, to a month after treatment with finings, according to the finings which had been used, the construction of the cellar, the character of the wine, etc.), were generally brighter, had a better taste, and were less subject to "working" than the wines which had remained in contact with the finings during six months (from one racking to the other). The wines which had not been treated with finings, which were turbid, and which had become clear on standing without the aid of artificial means, have behaved in the same way. Those which are racked as soon as they are perfectly clear are of a quality superior to those which are allowed to remain in contact with their lees from one equinox to the other.

We are going to state precisely, in speaking of the treatment of each kind of wine in particular, the reasons which necessitate racking at other than ordinary times. The chief reasons are the "working" of the wine, the expansion, the too rapid evaporation, turbidity, etc.

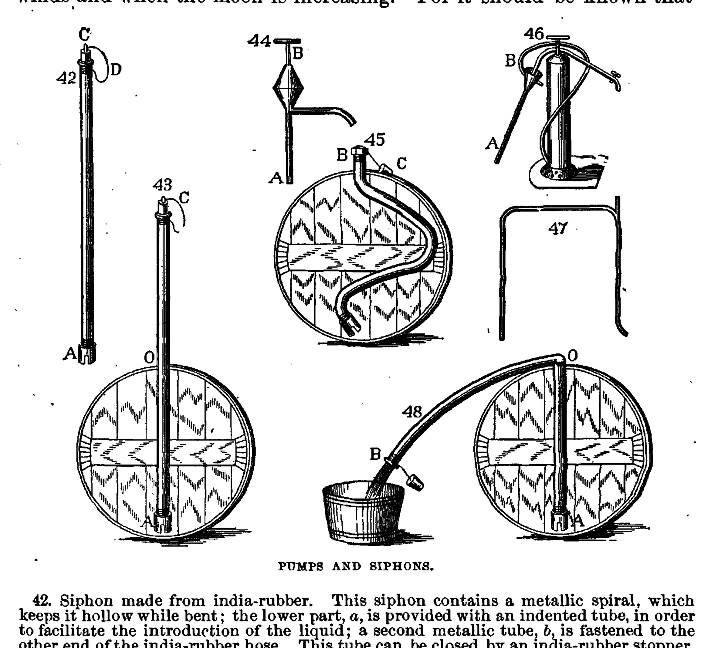


RACKING TOOLS.

33. Sulphur-burner or ordinary wickholder.
34. Cup for collecting the drops of fused sulphur.
35. Improved sulphur-burner.
36. Tilt-hammer or bung-starter.
37. Iron instrument used to assist in bung lifting.
38. Copper tube. This is a siphon, or cast tube of semi-oval form, with an inner diameter of 1 to 1.2 inches.
39. *Can measure, of a pattern employed in Bordeaux.*
40. Horse for the purpose of decanting.
41. *Half siphon (of Sourbé).*

The remarks which follow apply only to wines the vinification of which has succeeded well, which are bright, which do not "work," and which are stored in perfectly close cellars; in this case, the young wines are racked four times during their first year; the first racking is done as soon as the wine becomes transparent, and before the after-fermentation is formed; and if it is not immediately filled up the wine undergoes a change; the second racking is effected in March, before the vines form new shoots, during the spring equinox; the third, during the blossoming of the vine in June; and lastly, the fourth, during the autumnal equinox in September. The old wines should be racked twice a year, in the spring and autumnal equinoxes. But we repeat it here, even if the wine has been racked at the ordinary periods, this should not be considered sufficient, if it has undergone changes or a new fermentation. It is also very important to ascertain if the barrels are full; this is very easily done when the barrels are placed with the bunghole upwards; but if they are placed with the bunghole sidewise, it happens often that owing to several reasons, the chief of which are leaks and a too frequent taking out of samples, a considerable empty space is formed.

To perform the ullage, a gimlet hole is bored in the bottom of the barrel near the bulge, and a small Z-shaped funnel introduced; another hole is pierced through the bulge and the wine poured into the funnel until it flows out of the upper gimlet hole; then these holes are closed, and the stopcock and funnel removed. This operation should be repeated every time when samples have been taken out of the barrel, and in cellars in which the loss by evaporation is considerable in the intervals between the rackings. It is preferable to rack in dry weather, when the wind blows from the north or from the east, and when the moon is decreasing, rather than in rainy weather with south or west winds and when the moon is increasing. For it should be known that



PUMPS AND SIPHONS.

42. Siphon made from india-rubber. This siphon contains a metallic spiral, which keeps it hollow while bent; the lower part, *a*, is provided with an indented tube, in order to facilitate the introduction of the liquid; a second metallic tube, *b*, is fastened to the other end of the india-rubber hose. This tube can be closed by an india-rubber stopper, *c*, which is tied to the hose by the string, *d*. The inner diameter of the siphon is about 0.8 inches. In order to use it, it is introduced open in the full barrel (compare Fig. 45); it bends in *cc* and *c'c'* and fills; the india-rubber stopper is now introduced, and then the hose is lifted vertically, as shown in Fig. 43. By bending it appears in the manner shown in Fig. 48; a vessel is placed under the stopper, which is now taken out; the liquid runs out without the necessity of the tube, as in the case of ordinary siphons.
43. Compare description in 42.
44. Hand pump. The lower rod *a* of this pump has a length corresponding to the depth of the casks with which it has to be used; it is also possible to connect it by means of an india-rubber tube with a movable rod, which can be made longer or shorter, according to necessity. This pump is particularly useful when the liquid has to be drawn from a partly filled cask.
45. Compare description in 42.
46. Planchon pump. This is a compressed air pump described in the text. The rod *a* is introduced into the barrel; *b* fits the bunghole.
47. Siphon of trapeze-form, with tube for carrying a candle.
48. Compare description in 42.

hot and moist winds impart to the liquids an expanding movement, which is apt to disturb the lees. Cold and dry winds exercise, on the contrary, a certain contracting influence by lowering the temperature. The phases of the moon seem to have, also, an influence on the expansion.

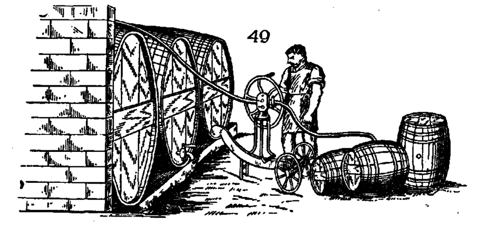
The racking and the pumping over of the wine should be performed sheltered from the direct contact with the air; care should also be taken to burn a piece of sulphur wick in the empty barrels which are intended to contain the liquid, in order to neutralize the oxygen of the air which they contain by means of the sulphurous acid. If the racking is done, the air being allowed to have free access, and without burning sulphur, not only a portion of the bouquet and of the alcohol are liable to evaporate, but also the danger is present that the wine may ferment anew.

How to Do the Racking—Method Used in Bordeaux.—According to this method the wine in the barrels of the lowest and second rows is racked so that the immediate contact with the air is avoided; the wine which is contained in the barrels of the third, fourth, and fifth rows is exposed to the air only for a moment on entering the funnel. However, it is sometimes possible to avoid this contact by making the tubes dip into the funnel.

The utensils necessary for racking, whose description and pictures we have given, are the small adz, a fine smooth glass, a bung-starter and bung-screw, two or three brass stopcocks with straight socket, a wooden basin, two heart-shaped buckets, called bassiots, a specially constructed bellows, air force pump, two wooden funnels and a can, wooden tubs of various shapes and dimensions; one for the barrels of the first row, one for those of the second row, and one for the third, fourth, and fifth rows. The remaining tools are shown in the illustrations.

When the passages are very narrow the racking is done without the empty barrels being placed in the passages, for which a hose or long tube is necessary.

In order to rack the barrels of the first row, if they are placed with the bungholes upwards, the cock is placed as follows: After having wound a strip of linen round the stopcock, a hole is bored with the



49. Rotary pump specially designed for filling and emptying large casks.

auger, or, if a hole has been made already, before the plug is removed, and the stopcock inserted with some slight knocks of the mallet; then connect with the empty barrel which is destined to hold the wine. Around the ends of the wooden tube are wound strips of linen; one end is then inserted in the nozzle of the stopcock, and the other in the hose connecting with the empty barrel, which is placed in equilibrium by wooden blocks.

If the bung is removed it should be taken out with the help of the chisel or bung-screw. In no case should the tilt-hammer be used before racking, neither should the staves be cut or hammered, for that might cause the lees to rise in the wine. For the same reason we should avoid imparting any shocks to the rows of barrels.

The stopcock once open, the wine runs without coming in contact with the external air from one barrel into the other until the liquid has reached the same level in both. Now the bellows are placed on the barrel which is to be emptied and fastened to it by means of a hook. By blowing into the first barrel the air is compressed, and the wine forced to pass into the empty barrel.

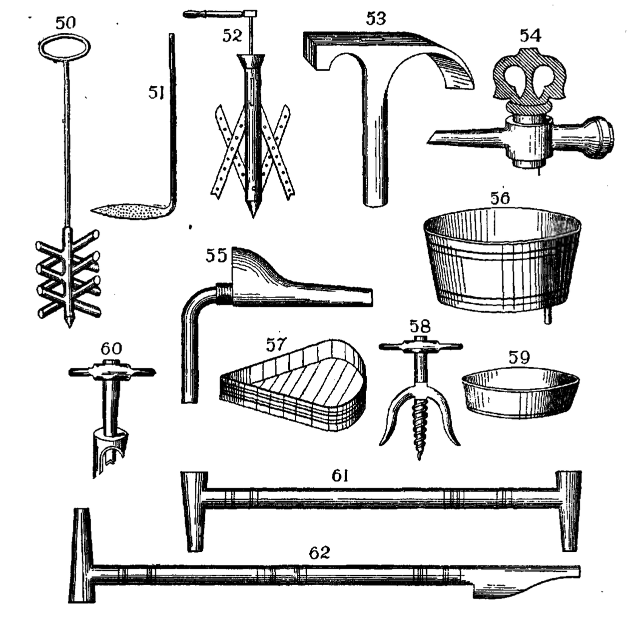
When it has reached the level of the stopcock, a certain noise, a *glou-glou*, which is produced by the air which enters between the stopcock and the wooden tube, can be heard. Then the stopcock is closed, the bellows taken down, and the full barrel is bunged. Then the end of the tube which is in the stopcock is taken out, a little wine runs in the basin, and as soon as the air begins to enter the tube the other end is taken out, and the plug replaced; the tube drains into the bucket. After that the bung is taken out, and a funnel is placed on the barrel, which is not yet entirely filled. The stopcock is opened now, and the barrel which has been racked is lifted in order to get out of it all the clear wine which is collected in the basin. The lifting is done by a second workingman with the hands, or, still better, with the help of a crowbar, or of a jackscrew, but always without concussions or rapid movements. As soon as the wine begins to be turbid, which can be ascertained with the help of a candle, or of a tumbler, which is made of fine glass, the stopcock is closed, and the wine which is in the basin poured into the barrel. Instead of a fine glass, a silver cup may be used, but the condition of the wine is not so well recognized in it.

Lastly, the stopcock is taken out, and a plug inserted into the racked barrel, from which the lees are to be immediately removed.

The plugs are covered with cloth in order to close exactly any unevennesses made by the removal of the same, and to render them easily taken out at the following rackings.

The racking of the barrels in the second, third, fourth, and fifth rows is much simpler. For the second row, after having made a hole in the barrel and introduced the stopcock (always with the bucket below, and with the same precautions as for the barrels of the first row), the empty barrel is placed below. One of the ends of the wooden tube, which is called *dogshead* (see Fig. 55), is introduced in the bunghole of the empty barrel, and the other end, around which a strip of linen is wound, enters the stopcock hole of the barrel to be decanted. When the liquid has run out the tube is taken out and the barrel which has been racked is moved aside. Then a bucket with a funnel is placed under the stopcock to receive the residue of the wine in the barrel. For the barrels of the third, fourth, and fifth rows the tubes enter directly the funnels which are placed on the empty barrels, and the lifting of the barrels for emptying the residue of the liquid is done without moving them.

Cleanliness.—The empty barrels which are destined to be filled should be rinsed until the wash-water has no more color; if the lees are greasy the barrels are rinsed several times with a good quantity of water. They should not be sulphured until the wash-water has been well drained off



UTENSILS USED IN WORKING (*foulage*) AND RACKING WINES.

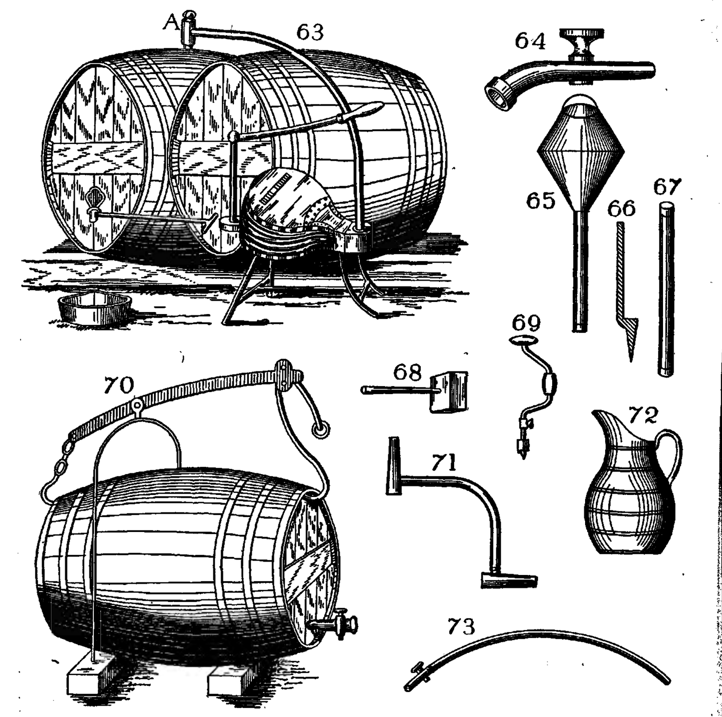
50. Stirrer (Bordelaise).
51. *Dodine.* This instrument, as well as that which is described under the following number, is used most frequently for working and mixing the finings in large casks, barrels, and tanks.
52. Stirrer (Barignan). This apparatus is introduced (being closed) through the bunghole. Its arms are afterwards opened by simple pressure; the stirring is produced by simple rotary movement; it then closes like an umbrella.
53. Adz. This is one of the most useful of cellar instruments.
54. Racking stopcock (Bordeaux style), with straight socket.
55. Dogshead (compare *racking* as practiced in Bordeaux, and described above).
56. Racking funnel. Several kinds are used with simple outlet and with automatic arrangements which stop the outflow as soon as the barrel is full. Their use is not a very common one, because the mechanism is liable to get out of order or the large dimensions of their sockets make their handling inconvenient. However, if the racking and filling up has to be done by poorly skilled workingmen, this kind of funnel renders great service.
57. Heart-shaped filling tub.
58. Plug drawer or bung-screw.
59. Wooden basin used in racking.
60. Auger (wimble). Several patterns are met with in the trade; thus, this one is used simply to round out the bungholes, which have already been made, and to remove the unevenness. Then there are the ancient augers with conical blade. The modern augers have a kind of English screw, which pierce a cylindrical hole of smaller diameter than that of the bunghole or gimlet hole; above this screw is a conical socket with blades to take out the unevennesses and enlarge the aperture made by the gimlet end.
61. Is a wooden tube, and composed of three parts. These three parts are united or held together with leather strips indicated on the drawing.
62. Same as the above. Its construction differs from that of the foregoing only in this respect, that one of its ends is straight.

and just before filling, otherwise the water which is adhering to the staves would become impregnated with sulphurous acid and would communicate to the wine a disagreeable taste of sulphur, which would not disappear for many days. The tools and utensils used for racking should be cleaned and rinsed with plenty of water every day, and when not in use they should be always placed so as to dry, otherwise the adhering wine would soon become acid, and thereby injure the wine with which these instruments are brought in contact. The tubes should be taken to pieces and the lees which stick to their inner walls should be scraped off with bottle brushes which are fastened to long iron rods. This cleaning should be done every week in a well kept cellar. The wine which drops from the leaks and which falls in the bucket should be poured on the lees and not in the wine which has been racked. The basin should not commonly be placed on the dirty floor of the cellar; it should be put on blocks of wood, in order to prevent contamination with earth and dust.

MACON METHOD OF RACKING (used in the warehouses of Paris).—Necessary utensils: An *ascette* or small adz, centerbit wimble, which is provided with a screw of the diameter of the spigot-holes, two or three copper faucets bent round of a shape which is called *Maconnaise* (Fig. 64), two heart-shaped buckets, one basin, two wooden funnels, a wooden hammer, two wooden jugs of a capacity from three to three and a half gallons, two tin tubes which can be joined with the faucets and which can be lengthened or shortened, according to necessity, their ends fitting in each other, a small jackscrew, a silver cup, a gimlet, and spigots.

In order to rack barrels of the first row a heart-shaped bucket is placed under the barrel, in which a hole is made with the centerbit wimble; if there has already been a hole made, the plug is removed. If the barrel is placed with the bunghole sidewise, several gimlet holes are also made in the upper stave in order to let in air, and with the help of the wooden hammer the faucet is driven in. Below the faucet one of the jugs is placed. The empty barrel is now brought in the proper distance, made firm with the help of wooden blocks, and a funnel placed in it. Now the faucet is opened, and, changing the jugs quickly, we avoid closing it every time, which is apt to disturb the lees; the jugs are emptied in the funnel, and when the barrel has to be lifted the remainder is emptied either into the heart-shaped bucket or into a basin. The clear condition of the wine can be ascertained with the help of an embossed silver cup, but a wine which appears transparent in the cup may be found to be turbid if looked at by candle light in a fine and smooth glass. After racking the faucet is taken out and a spigot is inserted.

The barrels of the second row are racked by connecting the end of the tube with the Maconnaise faucet. The third, fourth, and fifth rows run out directly through the tube, which is lengthened according to necessity in the funnel, then, as in the Bordeaux method, there is no necessity of moving the barrels from their place. This system of racking has the objection of making the wine in the barrels of the first row flat, by being racked off jug after jug. The same inconvenience occurs, though in a less degree, for the upper rows. The tubes do not join the faucets tightly, and can only be placed vertically, while the wooden tubes of the Bordeaux pattern can be placed in inclined positions, which allow us, if



TOOLS FOR RACKING AND BLENDING.

63. Racking bellows (Bordeaux fashion). The liquid in the two barrels being on the same level, the socket of the bellows is introduced through the bunghole *a*; by blowing a pressure is exercised on the wine to be racked, causing it to pass from the barrel *a* into the other barrel.
64. Stopcock for racking (pattern used in Macon).
65. Racking funnel (Macon method). Arranged such that it can be hung to the projecting flange of the bent stopcock of the preceding number.
66. Chisel for taking out the spigots (Maconnaise method). Instead of using a plug screw to bore out the spigot, a part is taken out with the help of this chisel, and what remains of it is driven back with the end of the stopcock, which is forced in later with the help of the mallet, No. 68.
67. Piece of pipe, made to fit and extend the tube described in No. 65.
68. Maconnaise mallet.
69. Ordinary centerbit wimble. It is fitted with an English bit of adjustable diameter.
70. Screwjack for the purposes of racking, system Viver.
71. Flexible tube (patent Kehrig). This is an india-rubber tube, with metallic spiral in the interior, which keeps it open at various angles.
72. Maconnaise jug. Capacity, half a gallon to four gallons.
73. Automatic siphon. This is an india-rubber tube, which contains, like the tube, No. 71, and the siphon, No. 42, a metallic spiral, which prevents its closing when it is bent. It is provided with a straight and very short stopcock; it is filled by introducing the open end through the bung of the barrel; then the stopcock is turned, and the tube whose end is kept below the level of the liquid is bent; it is sufficient to open the stopcock to start the outflow.

necessary, to rack from the end of the rows without placing the barrels in the passages.

As far as the rapidity of the work is concerned, workingmen who are familiar with either of these methods will be able to do approximately the same amount of work in the same time.

Pumping the Wine from One Barrel into the Other—Various Systems of Pumps, of Siphons, etc., for Racking.—There are several kinds of pumps and siphons which are specially designed for use in the wine cellar, but none of them fulfills the desired aim, viz.: to extract the whole liquid portion without producing a turbidity through the rising of the lees (avoiding at the same time the contact with the air), and without imparting concussions to the full barrels; and without leaving in them too much of the lees, whether they be in the first or in the upper rows.

Faucet.—in order to transfer the liquid from one barrel to the other by means of the faucet (or racking stopcock), it is necessary to pile them up, to draw them up an inclined plane, or to place them on supports such that we may be able to place below, either empty barrels or vessels, jugs, basins, etc.

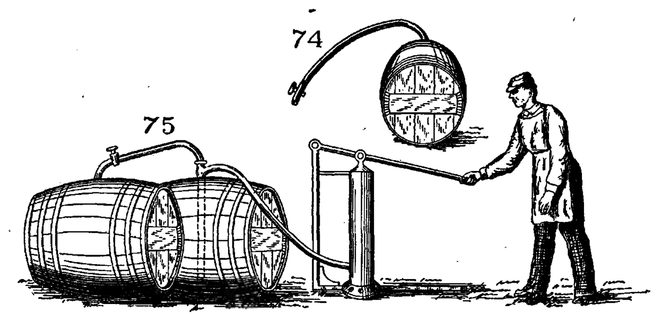
Suction Pump.—The ordinary tin or copper pumps cannot be used for racking, for they would make the lees rise, unless a valve is adapted to the lower end, which would regulate the inflow of the liquid and would leave the lees during the suction far below its level; but they can be very useful for emptying barrels with the bungholes upwards in narrow passages where siphons cannot be used. These pumps can also be used with viscous or disagreeably smelling liquids, such as oils, vinegar, alcohol, etc.

Suction and Force Pump.—This pump, which is constructed after the principles of the fire engine or spray pump, cannot be used for racking unless a special appliance is attached to them with a plunge tube. Already for several years rotary and centrifugal pumps have been used provided with faucet tubes and accessories, which make it possible to use them in the wine cellar. They are used particularly in the south of France. We shall have an opportunity to examine them in describing the new utensils.

Compressed Air Pump.—This pump, which the inventor calls wrongly "*pneumatic apparatus*," is used profitably when liquids have to be transferred and the contact with the air has to be avoided. With a slight modification, which consists of replacing the inner tube by a simple cork, this pump is suited to replace the racking bellows. Its construction is founded on the fact that the air compressed in a closed vessel can drive out by the pressure the liquid which is in this vessel if a tube communicates from this liquid with the surrounding air or other open package.

The action of the pump is analogous to that of the bellows used for racking the barrels in the lowest row. This kind of pump can be profitably used for pumping wines, and particularly alcohol, vinegar, etc., in casks. The full casks should be in good condition; should they have leaks the compressed air would either increase the leakage or entirely whistle out. To use this pump, the needle which is at the end of the tube is so gauged as to leave a couple of gallons of liquid in the barrel. The movement of the piston should be stopped as soon as the air begins to enter the tube; without this precaution the lees would be stirred up. If it should be necessary to obtain a perfectly clear liquid, much wine would have to be left in the barrels. As we have already said, this pump has a movable tube provided at its end with a needle, which is equally movable. This tube is placed in the interior of the cask, whose bunghole is hermetically closed by a kind of casing containing two holes; one of these holes is used as a conduit for the wine with the help of a copper tube which tightly joins the movable tube, and whose end is provided with a stopcock. The second opening has no inner tube, but connects with the bellows or pump by means of a flexible tube and introduces the compressed air into the barrel.

The length of the needle which is adjusted to the inner tube, is regulated according to the quantity of the lees which are presumed to be in the barrel, after which the pump will not work lower than the desired level; it follows that all the barrels are racked to the same level, whatever may be the quantity of lees which they contain; by this means we may either leave too much or carry off a portion of the wine, and the racking is done somewhat blindly. Then, besides that drawback, the lees may be stirred up and mixed with the wine through the introduction of the tube. One is not sure, therefore, of racking off a clear liquid unless much more lees are left in the cask than may be necessary.



74. Automatic siphon, ready for working.
75. Laburthe pump. This pump works on the same principle as the air force pump shown in Fig. 63.

There exists another system of pneumatic pumps, which, by producing a vacuum in the barrel to be filled, suck in the liquid from the full barrel. The liquid in the latter is driven out by atmospheric pressure. This system does not offer the advantages of the force pump or of the bellows.

Siphons.—Several kinds of siphons, made from tin, glass, and copper, are manufactured. The simplest and that most commonly used in the trade are semi-oval or trapeze-shaped tubes. Some are made with a double tube. (Fig. 47.) In order to use them the end is closed, and the liquid sucked slowly up till it fills the tube which is parallel to the great bend. This is a convenient instrument in the hands of people

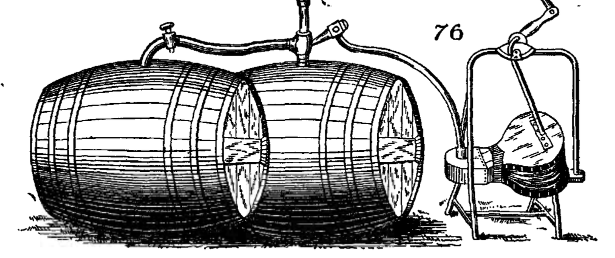
who are not accustomed to the handling of a siphon, and who do not care to suck the end of the siphon direct.

Certain siphons are provided at the end of their great bend with a small stopcock, after the manner of a damper used in stove-pipes. With this kind of siphon it is possible to avoid repeated sucking. There are also made half siphons with short bends. They come very handy sometimes, for instance in testing wines, etc.

The kind of siphon which accelerates in the most effective manner the work, is the copper tube simply bent to a half circle. These tubes are made of various calibers, according to the diameter of the bungholes. A certain experience is necessary in the use of these tubes, but if one knows how to handle them they offer, like the half siphons, great advantages compared with all the above mentioned instruments.

Neither the siphons nor the tubes which we have just mentioned can be used for the racking of wines, because they are apt to carry with the wine some small particles of the lees if they are sunk too deep in the casks. If, on the contrary, they are not sunk in sufficiently deep, there remains too much with the lees in the cask. But they are a great help in the simple transferring of wine from one barrel to another.

The transferring of wine from one barrel to another by means of a semi-circular tube may be done rapidly without exposing the wine to the contact of the air. This is done by lifting the full barrel onto a wooden *horse* (Fig. 40), consisting of an inclined plane ten feet long, two and



76. Racking pump (Viver system). This apparatus is used for racking and decanting wines, and are like the compressed air pumps (Planchon and Laburthe) which have been already described. Besides this, it is used to measure automatically; that is to control the quantity of liquid to be taken out of the barrels, either for equalizing the contents or for blending. A movable vertical tube, which is graduated, reaches into the barrel; the numbers which are marked on the tube correspond to the quantity of liquor which has to be taken out; when this level is reached the introduction of air stops the outflow. This apparatus is fitted with a newly patented rotary blower.

one half feet high, and two and one quarter feet wide. It is framed from pine wood, two 3x5 joists, which are bound together by two cross-pieces. The supports are placed one foot from the end, in order to facilitate the rolling forward of the packages for draining them. These supports have two cross-pieces and two braces well mortised into the uprights, which with the cross-pieces bind the joist with the support which is nearest. The dimensions which we have given are those of a barrel-horse. The horse which is used for larger packages is eleven and two thirds feet long, and two and two thirds feet high; the joists are four inches wide and five inches high.

The full barrel when once lifted is kept in its place by a triangular cross-piece, and the empty barrel is rolled in front of the horse, blocked securely, and the bung taken out. The bung is now taken out of the full barrel, and one of the ends of the semi-circular tube introduced into the bunghole; the other end is sucked and quickly put in through the bunghole of the empty barrel. The wine will rapidly run from one barrel into the other, and its outflow may be facilitated by lifting gradually the full barrel towards the empty barrel until the whole contents of one have run out into the other; the residue of the liquid is emptied with the help of a can and funnel.

Sometimes the contents of a full barrel, particularly if it is a large one, are transferred without the barrel being lifted onto the horse, but always with the help of the semi-circular tube. For this purpose an empty and a full barrel are placed side by side; after having taken the bungs out, the tube is introduced into the full barrel, then filled by suction, and quickly brought into the bunghole of the empty barrel. The wine now flows from one barrel into the other until it has reached the same level in both; the emptying of the barrel is then completed by lifting the partly filled barrel onto the horse. This method can be used advantageously in the "half-and-half" blending operations.

With siphons it is also possible to transfer the wine by the aid of cans and jugs, from which the wine is poured into the empty barrels; but this method is less rapid and has the objection of making the wines flat—particularly the fine wines.

To sum up what we have said, the best methods for racking are those which preserve the wine in the most effective way from contact with the air. Such is the Bordeaux method, which is used in some parts of Burgundy as well as in Bordeaux.

The same remarks can be applied to the process of simply transferring wine from one barrel to another, and for the same reasons the transfers by means of the pump, or the half siphon, or the compressed air pump, or the rotary pump, for casks of great dimensions and perhaps in poor condition, are preferable.

Sulphurous Acid Gas; its Nature; Properties; Use in the Treatment of Wines—Sulphur Wicks; their Manufacture, etc.—Sulphurous acid gas is the product of the combustion of sulphur; it is nothing but the smoke of this combustion; composed of one part of sulphur and two parts of oxygen. The specific gravity of this gas is greater than that of the air. In the gaseous state, sulphurous acid gas is miscible with water. The latter can absorb several times its own volume of the gas. It neutralizes the oxygen of the air and possesses also the property of changing or destroying a great number of organic colors.

This acid can also be used for the conservation of food, be it vegetables or meats, by keeping these substances in hermetically sealed vessels, in which sulphur has been previously burned. The quantity of sulphur used should be proportional to the dimensions of the vessel; the combustion stops on its own account as soon as all of the oxygen is used up.

These properties of sulphurous acid have been utilized since time immemorial for the purposes of vinification and that of conserving barrels and casks. For the different uses to which it is applied, the

sulphur should be free from all admixtures. It is used for the following purposes:

(1) To prevent the must from fermenting, by which means are made what are called unfermented wines.

(2) To stop the first violent fermentation, when it has already begun, or to prevent and stop the alcoholic after-fermentation.

(3) To prevent the wines from becoming acid, moldy, or flattish, through contact with air, when the barrels are not quite full.

(4) To preserve in a good state the empty barrels, and to prevent the moldiness and acidity which are liable to develop in the interior of the casks.

(5) Lastly, to redden and make more flexible the wicker which is used for the hoops.

In the various operations which we are going to describe, wicks impregnated with sulphur are used. These wicks are strips of linen which have been dipped several times into molten sulphur, according to the thickness which it is intended to give to the coating. It is advisable to use wicks rather with a thick coating of sulphur than with a thin one, particularly for the purpose of treating wines, because the combustion and carbonization of too much linen may communicate a disagreeable taste.

If the wine maker resides far from the great manufacturing centers, he may easily manufacture the sulphur wicks; the operation is very simple: In a suitable dish the sulphur is fused on a slow fire, and strips of thin linen 12 inches long by 0.8 to 1.2 inches wide are steeped repeatedly in the melted mass, until a coating of sufficient thickness is obtained.

Nowadays flower of sulphur (purified sublimed sulphur) is to be found at all the druggists of wine-growing countries. By the use of this kind of sulphur better wicks will be obtained than those which are made with impure crystals. In order that the wicks may be of a fine yellow color, the sulphur should be fused on a very moderate fire and the temperature raised gradually. It fuses at 228 degrees Fahrenheit. For this operation a large and flat stewpan is more convenient than a deep vessel. A partition perforated with holes or open at the bottom is soldered in the middle of the pan, thus forming two compartments. The flower of sulphur is placed in one of them, and the fused sulphur runs into the other. As soon as the sulphur is fused, the strips of linen are soaked in it, and turned from one side to the other by holding them at one end with pinchers. The wick is now allowed to drain for a few minutes by holding it vertically above the pan, and then it is placed horizontally on a large board near the stove. The wicks cool off very suddenly, and thus the board is covered with them. Afterwards the first wick is taken and soaked again in the sulphur, and so on, until a layer of sulphur of the desired thickness is obtained.

In order that these wicks should burn easily in the barrels, they are suspended by an instrument which consists of a wire whose one end is bended to the shape of a hook, and whose other end is fitted into a cylindro-conical wooden handle which closes the bunghole hermetically. (Figs. 33–4–5.)

Practical Method of Stopping the Fermentation of the Must.—This operation is most frequently performed with the musts from white grapes a short time after they have been pressed. The grapes are gathered with care, stemmed, and crushed in the ordinary way. Then the must is separated from the bulk of the lees. This is done by pouring the must from the press into a vat or pipe. The must becomes clear on standing, but it is important to draw it off before the fermentation begins. The starting of the latter is indicated by numerous bubbles of carbonic acid which rise to the surface. It is necessary to wait eight or twelve hours to obtain a clear must. Sometimes even the must has to be watched during the night if it is considered important that it should be clear; for as soon as the fermentation starts the must becomes turbid.

Unfermented wines, or preserved musts, are used to communicate sweetness to the new wines which show a deficiency in this respect; for making concentrated must, if it is not possible to carry out the concentration on the spot; or for the preparation of certain sweet wines. To make unfermented wine in the right way, the must should be previously freed from the fragments of skins, of the seeds, etc., which it contains. For this purpose a peculiar wicker basket, with very small meshes, is placed below the opening of the press, and thus a part of the impurities remains in the basket. The same end is attained by using an ordinary basket, whose bottom and walls are covered with several layers of intertwisted straw. The casks which are destined to hold unfermented wines are previously rinsed with boiling water, then with cold water, and carefully drained.

The fermentation of the must can be prevented in two ways. The following is one of them: In an empty barrel two squares of sulphur wick, more or less, according to the thickness of the layer of sulphur, are burned, but always enough to use up all the oxygen present. Then the must is rapidly filled into the barrel, so as to make it half full; the barrel is now bunged as firmly as possible, and rolled and moved in all directions, to allow the sulphurous acid gas to become well absorbed by the must. This must is then transferred (protecting it all the time from contact with the air) into another barrel, which has been sulphured in the same manner, and which is bunged, rolled, and moved in its turn just as was the first one. During this time sulphur is burned again in the first barrel, which has been emptied and the must transferred back to it again; the barrel is again moved about and rolled, and its contents transferred into another sulphured barrel, which is bunged and treated in the same manner as the other barrels. This must has been therefore treated four times with sulphurous acid gas. The barrel is now completely filled with other must, which has been treated in the same manner, and solidly bunged.

In performing these operations, contact with the air should be avoided as much as possible.

Another method of preventing the fermentation of the must is given in the following: A square of sulphur wick, representing about one and a half ounces of sulphur, is burned in an empty barrel; then five gallons of must are poured into the barrel, which is hermetically bunged and rolled; after some time the bunghole is opened, and an attempt is made to burn a second wick, but if the oxygen of the air has been used up by the combustion of the first wick, it is necessary to renew the air in the barrel, which may be done with the help of a pair of ordinary kitchen bellows. When the second wick is burned, five more gallons of must are added, the barrel bunged, and again rolled and shaken. This same operation is repeated until only five gallons more of must are required

to fill the barrel. These last five gallons are treated separately with sulphurous acid in another barrel, and then poured into the cask to fill it completely; after that the barrel is definitely bunged.

Classification of the Preserved Musts—How to Treat Them.—They should be filled into strong barrels, which are solidly hooped with iron and firmly bunged. The barrels should always be placed with the bunghole upward, and in air-tight cellars whose temperature is constant. They should be kept well filled by making up the loss from evaporation every five days with preserved must; these musts should be also frequently racked, in order to free them from sediments and from the ferments which they contain. In racking, avoid contact with the air as much as possible, and use barrels which have been thoroughly sulphured. A complete clearing is obtained by introducing in the must before treatment with sulphurous acid about three quarters of an ounce of tannin per barrel (alcoholic tannin solution is mostly used), and by pouring into the barrel, before filling completely, a cold solution of two tablets of gelatine in one pint of water. The treatment with sulphurous acid partly discolors the musts. To prevent the fermentation of the must, some chemists have proposed to use, instead of sulphurous acid gas, sulphite of lime, sulphuric acid, carbonate of iron, evaporation in vacuum pans, etc.; but these different processes are generally more expensive than the use of sulphur, or possess the objection of imparting a foreign taste to the musts. Up to the present there has not been found an easy and economical method for the above, the use of which does not impart a foreign taste to the wines, and which could profitably replace sulphurous acid gas. Here I must remark that musts can be also preserved, without fermentation, by fortifying them to an alcoholic strength of 15 per cent of alcohol.

Method of Stopping the First Violent Fermentation.—To stop the violent fermentation of white wines, they should be racked and poured into barrels which are more or less sulphured, according to the degree of violence which the fermentation has reached. As far as the red wines are concerned, great cautiousness should be exercised in using sulphur, if it is either desired to prevent the after-fermentation or the access of the air during racking, for the sulphurous acid precipitates a part of the coloring matter, particularly in the case of ordinary wines which are low in alcohol and tannin. Only when the fermentation is very violent is it advisable to thoroughly sulphur the empty barrels destined to hold them; under ordinary circumstances, it is sufficient to burn a small quantity of sulphur, particularly when the wine is in its first year; a still smaller quantity will answer when it is in its second year.

Partly Filled Barrels.—In order to prevent the wine from becoming sour and moldy when the barrels are only partly filled, it is sufficient to burn a piece of sulphur wick in the barrel and to bung hermetically. This operation is repeated every time the bung is taken out, and at least every fortnight, if the barrel has to remain bunged for a long time. It is advisable to avoid as much as possible leaving the barrels partly filled, because in the end the sulphurous acid communicates to the wines a disagreeable taste, which disappears only after a long time. It is possible to sulphur a partly filled barrel without taking out the bung. For this purpose it is sufficient to bore a gimlet hole in the upper part of the bottom, and to hold at this opening a sulphur wick every time when the wine is drawn off by the stopcock. The air, in rushing in through the gimlet hole, draws in the sulphur vapor; afterwards a plug is introduced in the gimlet hole.

Keeping the Empty Barrels.—In order to preserve the empty barrels in good condition, it is necessary to rinse them with plenty of water when they are dirty, and to burn some sulphur in them, and let them drain for some hours; they should be, also, solidly hooped and bunged. By burning in the barrel (after a first treatment with sulphurous acid and a complete draining) three squares of sulphurous wick, and by bunging hermetically afterwards, moldiness, acidity, etc., are avoided. It is possible to burn the sulphur without using a hook, simply by cutting the sulphur wick into long strips and removing the sulphur from one of the ends, by which it is suspended from the bunghole by bunging the barrel after having lighted the other end.

Making the Wicker Flexible.—To redden the wicker and to make it flexible, it is sufficient, after having moistened and drained it, to expose it to the sulphur vapors in a barrel whose bottom has been taken out, and which is covered carefully in order that the vapors should not escape.

CHAPTER II.

CLARIFYING WINES.

Preliminary remarks. Various finings; their application. Finings which exercise a mechanical action; filtration. Alkaline finings. Albuminous finings; fresh white of egg. Albuminous substances which are not entirely coagulated; fresh or dried blood. Gelatinous substances; gelatin. Various other substances which are used for purposes of fining. Decoction of animal sinews. Recapitulation; the best finings.

Preliminary Remarks.—Wines become turbid and lose their brightness owing to several causes, chief of which are: 1. The after-fermentation or the "working," which impairs the brightness of the wine by keeping in suspension the insoluble matters which, on settling, gradually form the lees. This latter is composed of different salts, ferments, mucilaginous substances, and of the insoluble coloring matter. 2. The expansion which is produced by the rising of temperature. 3. The motion which the wine undergoes during transportation. 4. The blending together of several wines, which renders insoluble and precipitates a part of the coloring matter, and often produces salts equally insoluble. 5. The deficiency in vegetable albumen and tannin, which should be present in order that the matters which become insoluble should be precipitated with the lees.

The fining of wines can be performed in various manners, either by allowing Nature to do the work, or, artificially, by the different methods of fining, the details of which are given below.

The wine becomes clear simply on standing and on being racked from time to time, if the grapes from which it was made were ripe, if the vinification was effected under favorable conditions, if the young wine was carefully treated after the first rackings, and last, not least, if the cellar in which it was stored answered its purpose. Under such conditions, perfectly bright wines can ordinarily be obtained without the help of artificial means.

Before discussing the different methods of fining, we will say that, though it is very important to fine turbid wines on account of the coloring matter, the ferments and the salts which they keep in suspension and which impart to them a common taste and make them liable to undergo an after-fermentation, it is also desirable to avoid the too often use of artificial methods of fining. For by these operations not only the insoluble matters which are in suspension are precipitated, but also the different preserving elements of the wine, which otherwise would not become insoluble, excepting after a very long time. These latter substances are tannin, the various mucilaginous substances, and the pectine, which impart to the wine the mellow and fruity taste and the oily consistency. The repeated treatments with finings affect these qualities and destroy them in the end; they make the wine dry, and thus remove that which imparts, particularly to the first-class wines, their principal value. To prove this assertion we can state that we have always noticed that well made and properly treated wines which cleared perfectly after standing some time—judicious racking only having been applied, but no artificial fining—are superior in every respect to those which have repeatedly undergone an artificial treatment; they possess also more fruity taste, are more oily, and show more color.

It is, therefore, not advisable to apply finings, particularly in the case of first-class wines, excepting when a perfectly bright condition cannot be obtained by natural means. It is never advisable to apply artificial means, unless it is absolutely necessary; and it is important to find among them substances which are able to clear the wine perfectly without altering the color and the taste; these substances should likewise possess the property of not leaving in the liquid any soluble residue, and they should exercise their action by rendering insoluble as little matter as possible.

The substances commonly used in fining wines can be divided into six classes, according to the difference in their action; this action can be purely mechanical, or may give rise to some chemical reaction; it may be the coagulation by alcohol or tannin, or the neutralization of the tartaric and acetic acids, etc.; it may also consist in a partial solution of certain substances in the wine.

1. Substances which exercise but a simple mechanical action without leaving in the wine a soluble residue: unsized gray paper, reduced to a pulp, fine and siliceous sand, filtration through a strainer, etc.

2. Alkaline substances which exercise a mechanical and chemical action by neutralizing a part of the acids contained in the wine, and by forming with them soluble salts, calcined and pulverized pebbles, calcined oyster shells, pulverized marble, pulverized chalk, calcined magnesia, etc.

3. Albuminous substances which exercise a chemical and a mechanical action, and which are mainly coagulated by alcohol and in a less degree by tannin, without leaving in the wine a soluble residue: pure albumen (fresh white of eggs).

4. Gelatinous substances which exercise a chemical and a mechanical action; they are precipitated chiefly by the tannin which is contained in the wine, and do not leave soluble residues, as gelatine, isinglass.

5. Albuminous substances which are not entirely coagulated by alcohol, and a part of which remains dissolved in the wine: fresh or dried blood, milk.

6. Various gelatinous, viscid, or gummy substances, which are not entirely coagulated and precipitated by tannin and alcohol, and a portion of which remain dissolved in the wine: a decoction of animal sinews, gum arabic, starch, rock candy, a decoction of rice, etc.

PRACTICAL USE OF THE ABOVE MENTIONED SUBSTANCES.

Whatever the substances may be which are employed for fining wine, the mode of operation is as follows: After the material has been previously prepared, according to its special character, the bung is taken out of the cask and about two and one half gallons are drawn off by means of a siphon or other appliance; then the finings are introduced in the cask through the bunghole and the wine well stirred, either by a specially constructed instrument or by a stick which has been split into four parts at one end. When the substance is thus well mixed with the liquid, the wine, which had been first drawn off to facilitate this operation, is poured back into the cask. Nothing remains now to be done but to fill the cask accurately, bung it up, and let it rest.

It is not possible to state the precise length of time which is necessary to obtain a perfect clearing; this depends from the finings that have been used, their quantity, the quality of the wine which was subjected to the treatment, the greater or less uniformity of the temperature of the cellar, etc. In most instances, particularly if it is possible to maintain a uniform temperature in the cellar, it is advisable to allow the wine to rest for a fortnight or month before drawing it off. This length of time is most favorable to effect the clearing. For it has been noticed that if the wine is left a longer time in contact with the finings, there is danger that it may become turbid again and acquire a foreign taste, particularly if the lees should rise again owing to after-fermentation, or to expansion of the liquid. Besides, a prolonged contact of the lees with the clear wine can impart to it a disagreeable taste from mere contact, often without any turbidity having been noticed; this experience has been had with wines that had remained in contact with the finings for six months. If there is some hurry about sending off the wine, the process of fining should be watched from day to day, so as to rack the wine as soon as it has perfectly cleared. If the wines under treatment are in a cellar which does not have a constant temperature, particularly during very warm weather, the same precautions should be taken; also the temperature of the cellar should be lowered by the various means which we have mentioned in the first chapter. As soon as the wine has cleared it should be drawn off from the lees.

FININGS WHICH EXERCISE A MECHANICAL ACTION—FILTRATION.

As these substances (gray paper, fine siliceous sand) are neither dissolved, attacked, nor coagulated by any of the constituents of the wine, they effect its clearing by a kind of filtration; in passing through the liquid they carry down a part of the insoluble matters which they meet on their way; but it is seldom that by their use a perfectly bright condition of the wine is obtained. They should be used, therefore, only where other methods cannot be applied.

As far as the filtration through strainers is concerned, this method makes it possible to obtain perfectly clear wines. There is, however,

the drawback that, owing to the prolonged contact with the air, the wine becomes flat, loses some of its bouquet and flavor, particularly its fruity taste and oily consistency, and decreases also in alcoholic strength. Apart from these deteriorations, the filtration requires, in order to be carried on in a satisfactory manner, more manual labor than any other method of fining. It is, therefore, employed only in exceptional cases when it is impossible to use other methods. On board ship, for instance, where the pitching and rolling make all other methods impossible, filtration can be very useful. The same may also be the case when it is desired to send off the wine bottled as quick as possible; in this latter case the access of the air should be particularly avoided, and the whole work should be done rapidly.

Gray Paper Converted into Pulp—Preparation.—From five to ten leaves of paper are taken, torn to pieces, and soaked in half a gallon of wine, and afterwards converted to a pulp, first with the hands and afterwards with a pestle or a piece of wood; when the whole has acquired the desired degree of fineness, it is poured into the cask which is under treatment.

Fine and Siliceous Sand.—White and very fine sand is chosen, washed, and freed of any foreign matter it may contain. It is used in quantities of from one to two fifths of a gallon per barrel.

Filtration through Strainers.—For the purposes of filtering, strainers are used, made of different materials, such as wool, felt, unbleached cotton, etc. Woolen strainers should be chosen when large quantities have to be filtered; their form is conical and similar to that of a conic sugar loaf. (Fig. 128.) They are fixed by means of strings either below the tap or somewhere else, but always in such a way that it should be possible to place below them the vessels which are destined to hold the filtered liquid; they are kept open by adjusting a hoop to their orifice by means of strings. If the material of the strainer is easily permeable, it is necessary, in order to make the straining complete, to use gray or white unsized paper (filter paper) which has undergone the following treatment: Take two sheets of the paper and reduce them with some water to a pulp; mix this pulp very thoroughly with, say, two and one half gallons of wine in a jug. Pour, quickly, the turbid wine on the strainer, and introduce the pulp only when the filter is almost full. The first liquid which runs through the strainer is always turbid; filter it again until it is perfectly transparent. Take care to keep the filter always full to the same level, so that the pulp which sticks to its sides should not be displaced.

By means of a specially constructed wooden or tinned copper filter the operation may be carried on more protected from the access of the air, and also more rapidly. In this case the shape of the strainers is not the same—they form an oblong oval whose one end is tied to the lower end of a tube, and the produce of the filtration drops into a closed receiver. The whole operation becomes thus, with the help of the funnel which fits in the upper end of the tube, much easier, more effective, and more rapid. These filters, of which a drawing is given in Fig. 130, can be made, according to their diameter, with one, three, and even twelve tubes. In order to use them they are provided with strainers, which are tied to the tubes; the tubes are closed with cork stoppers inside the funnels. After the paper has been prepared and mixed with several gallons of the wine which has to be filtered, the funnel is filtered, and then the tube is opened. The turbid liquid fills and inflates a strainer; now the chief stopcock, is opened in order to pour back the turbid liquid; then several gallons of the wine containing the paper are rapidly emptied, and the shredded paper does not fail to cover the interior of the strainer; the liquid is repeatedly poured back into the funnel until it is perfectly transparent. When this stage is reached, it suffices to add new liquid in the strainer, and when the latter has become too dirty another tube is opened and a second strainer is started exactly in the same way and without any necessity of displacing or changing anything.

ALKALINE FININGS.

Calcined and Powdered Pebbles, Calcined Oyster Shells, Powdered Marble, Chalk, Alabaster, Wood Ashes.—These alkaline materials combine with the acetic acid, the tartaric acid, etc., which are contained in the wine, and form thus salts (acetates and tartrates of potash or lime), a part of which remains in the liquid in suspension, producing turbidity and making the wine less wholesome.

The particles of these alkaline substances which are not attacked by the acids of the wine, exercise a mechanical action, which is analogous to that produced by sand; they sink gradually to the bottom of the cask, and carry down with them in their course a part of the impurities that are contained in the wine. The quantity of these materials that should be used is one quart per barrel.

These substances have been sometimes used, mixed with gelatine, for fining wines which do not contain tannin. In this case only one third of the usual quantity is used. A simple addition of tannin is much preferable.

It is evident from what we have said already that this method should be rather avoided. We shall have, in speaking of faulty wines, an opportunity to discuss more fully the effect of alkaline substances on musts and wines.

ALBUMINOUS FININGS.

Fresh White of Egg.—Albumen is an organic matter which is contained in the white of eggs, in the blood of animals, and in milk. Its constitutents are (in parts by weight): Carbon, 53.33; oxygen, 23.70; hydrogen, 15.50. Thus it differs from gelatine only by the relative proportion of the constituents. This substance, which is fluid, is soluble in cold water. It coagulates at a temperature below 122 degrees Fahrenheit. It is *coagulated also in the cold* by alcohol and tannin. These properties are utilized in the process of fining dry and sweet wines, cordials, and syrups. To fine liquids which stand easily a higher temperature (as, for instance, the syrups), albumen is dissolved in the liquid cold; then the whole is gradually heated; the heat coagulates and unites the molecules of albumen which are suspended in the liquid, expands them, and makes them specifically lighter; they rise to the surface of the liquid, and carry with them the impurities which they meet.

If the albumen is dissolved in cold alcoholic liquids, it is coagulated by the alcohol and tannin which are present. It forms a kind of network, which has a higher specific gravity than the wine, and sinks by its own gravity to the bottom of the cask, carrying down all matters in suspension.

Pure albumen is contained in the white of egg. According to M.

Payen, there are 12½ to 30 per cent of albumen in the white of egg. This albumen is liquid and inclosed in very thin-walled cells. This kind of tissue imparts to the albumen a gelatinous consistency. By suspending the white of egg in water, and beating the liquid, the walls of the cells are destroyed, and a clear solution is obtained.

For one barrel of wine the whites of six to eight eggs, on the average, should be used. These are beaten with about half a pint of the wine under treatment, and afterwards filled into the barrel.

The soundness of the eggs should be always ascertained by holding them to the light before breaking them. This precaution is very important, for it becomes evident that one rotten egg is more than sufficient to impart a disgusting taste to a barrel of wine.

If the wine under treatment is not of high quality, is young, very turbid, and does not clear easily, the white of eggs should be dissolved and beaten in one pint of water, in which a handful of common salt has been dissolved. The object of this addition of salt is to give more weight to the albumen, also to increase its density, and to precipitate it quicker to the bottom. We do not, however, advise the use of salt water, except for ordinary and very turbid wines. To experiment with it on first-class and old wines, should the alcohol-percentage of the wine be very low, an addition of one or two quarts of brandy to the barrel will promote the coagulation of the albumen.

ALBUMINOUS SUBSTANCES WHICH ARE NOT ENTIRELY COAGULATED.

Fresh or Dried Blood.—According to Riffault, the blood contains usually three parts of serum and one of cruor. The serum does not contain gelatine, but a great deal of albumen. The cruor contains insoluble fibrine and a soluble coloring matter. The blood can therefore be used for fining instead of albumen, as it contains a good deal of albumen; but the blood of the ox, of the cow, or of the sheep, has a smell and a taste which is not agreeable. The blood of the hog is the best for this purpose. It is important that the blood should be odorless and tasteless, because it is only partly coagulated by the alcohol contained in the wine. Thus its aqueous part remains mixed with the wine, and is liable to impart to it a disagreeable taste and smell, which disappears only after a long time. For these reasons the use of blood for purifying old and fine wines should be avoided. The quantity which is usually employed is one quart per barrel, well mixed with one quart of wine or of salt water.

Milk.—Cow's milk contains, according to M. Payen, in one hundred parts by weight: water, 86.50 parts; nitrogenous matter (caseine albumine matter, soluble in alcohol), 4.30 parts; lactose (milk sugar), 5.20 parts; butter (or fatty matter), 3.70 parts; insoluble salts, 0.20 parts; soluble salts, 0.10 parts. One can see from this enumeration that the milk cannot be completely coagulated by the alcohol which is contained in the wine. The whey, or the watery part, remains in solution, and the milk sugar may give rise to an undesirable after-fermentation. The use of milk should be, therefore, avoided in the treatment of fine wines. The milk also exercises a discoloring action, and can be used for bleaching russet white wines. The quantity to be used is one quart per barrel, and it is poured in without mixing it previously, either with wine or with water.

The freshest milk should be used; for milk which is older than twenty-four hours can easily, particularly in summer, acquire acidity, which would be imparted to the wine. Milk has an alkaline reaction, and may thus be useful in diminishing the acidity of faulty wines, clarifying them at the same time (compare *Acidity*).

GELATINOUS SUBSTANCES.

Gelatine.—Gelatine is an organic substance which is chiefly contained in the sinews and in the hide of animals, in the bones and in certain parts of the body of fishes; it is extracted from these different materials by prolonged boiling with water. According to Gay-Lussac and Thénard, it contains (parts by weight): carbon, 47.881; oxygen, 27.207; hydrogen, 7.914, and nitrogen, 16.99.

Gelatine is susceptible of assuming, on cooling, an elastic consistency, and of becoming liquid again on heating; this is what distinguishes gelatine from albumen, which, on the contrary, is liquid in the cold and is coagulated by heat, without possessing the property of becoming liquid again on cooling.

Gelatine is soluble in water; it is precipitated by tannin, and on the other side tannin which is dissolved in a liquid is precipitated by gelatine; thus the two substances, by forming an insoluble compound, carry down with them the matters which are suspended in the liquid. On this quality the use of gelatine in the fining of wines is based. If tannin is present in the wine only in small quantities, the whole quantity of gelatine which was added will not be precipitated, and will thus remain in solution; in such a case it will be necessary to add some tannin to the wine in order to facilitate the precipitation of the gelatine (compare composition of the wines under the head of *Tannin*). It is possible, however, to precipitate the gelatine without the help of tannin by adding to the solution of gelatine just before using it alkaline substances, such as ashes, soda, lime, chalk; but these substances, though they increase the effectiveness of the gelatine, are objectionable, and we have already considered their action on wines.

Gelatine, of all the chemical finings, is the one which is most efficient if the wine contains sufficient tannin to precipitate it in full. But the loss of tannin is injurious to the keeping qualities of the wine (compare *Composition of wines*), and the gelatine which is used to fine red wines, precipitates, together with the tannin, a considerable part of the coloring matter with which the tannin is intimately combined. For this reason gelatine should be used in the treatment of red wines, only when it is desirable to diminish their harshness by removing the excess of their tannin and of their color; in one word, gelatine should be used when it is desired to age a wine. The utility of gelatine in the treatment of ordinary white wines cannot be denied. Should it now and then happen that a white wine does not clear on being treated with gelatine, one hundred and fifty to three hundred grains of tannin should be added to each barrel, so as to make the precipitation of the gelatine more complete. Nevertheless, we advise treatment of the finer white wines, of a mellow character, rather with pure albumen than with gelatine, in order to avoid an excess of precipitation, which would possibly carry down also the sweetish matters contained in the wine.

Preparation.—In commerce, the gelatine is found in tablets. One

tablet per barrel is used, and even two, if a very thorough clearing is desired. The gelatine is gradually warmed with one pint of water per tablet. Great care should be taken to stir continually, in order that the tablets should not stick to the bottom. The vessel is taken from the fire as soon as the gelatine is dissolved, which is done without the necessity of boiling. Boiling should be, on the contrary, avoided. Gelatine dissolves easier if it has been previously soaked in water for some hours.

Isinglass.—This isinglass is extracted from the air bladder of the sturgeon. It contains a large amount of gelatine, and, like the latter, is precipitated by tannin. It does not require, however, much tannin for its precipitation. It contains exceedingly tenuous membranes, which exercise a mechanical action, and are precipitated by their own weight. To prepare the fish glue for purposes of fining, the leaves of this material are beaten on a block and cut into as small pieces as possible. One and three quarters ounces for each barrel are soaked cold with half a pint of white wine during twelve hours. When the glue is thus almost dissolved, it is pressed repeatedly between the fingers, and a quarter of a pint more of white wine (per barrel), or in winter, water (warmed to 122 degrees), is added. After that the mixture is strongly beaten with a small broom, and the pieces of glue which have not dissolved completely are kneaded with the hands until they do so; then the whole is passed through a sieve. For further use it is diluted with one pint of white wine per barrel.

DIFFERENT OTHER SUBSTANCES WHICH ARE USED FOR PURPOSES OF FINING.

Decoction of Animal Sinews.—By boiling for twenty-four hours in water, sheep's or calves' feet, heads, etc., a liquid is obtained which, on cooling, solidifies to a jelly which contains a large quantity of gelatine, and which can be used for the same purposes as gelatine if, before being dissolved a second time, it is first dried in a warm place. Only fresh materials should be used, else there is danger of imparting a bad taste to the wine.

Glue.—Glue, which is prepared from the refuse of slaughter houses, imparts often to the wine a disagreeable taste, and should be used only when no other materials can be obtained. The quantity employed for each barrel is eight and three quarters ounces, which should be dissolved in one pint of hot water. This liquid is added to one quart of the wine, and then poured into the cask. This glue is, like gelatine, precipitated by tannin.

Gum Arabic, Powdered Rock Candy, Starch, Decoction of Rice.—Powdered gum arabic as well as rock candy are not rapidly and completely precipitated, and the amount which remains dissolved in the wine gives rise to after-fermentation. This is a very poor process. The quantity required is six ounces per barrel. Starch dissolved in hot water and a decoction of rice and of flour have been sometimes used as finings. Their use is based on the fact that starch and gluten are precipitated by tannin; but the precipitation is not a complete one, and these substances introduce into the wines harmful ferments. The quantity used is one quart of the decoction per barrel; this quantity is mixed with one quart of the wine and then poured into the cask.

RECAPITULATION.

The Best Finings.—The best finings are those which remove the suspended matter in the wine, without leaving a soluble residue, without imparting a bad taste to the wine, and without exercising any action on the chief constituents of the wine. All these conditions are fulfilled by pure albumen or fresh white of egg.

Pure gelatine and isinglass do not leave soluble residues in the wine, but they possess the disagreeable property of precipitating the tannin and a part of the color. For this reason they should not be used with red wines, unless the wine is a poor one, or economy is an object, the price of these materials being lower than that of fresh eggs. For ordinary white wines, whose alcohol-percentage is low, they are the best finings. With the help of tannin, which is added to the wine, a perfectly bright condition is obtained. But those white wines of highest quality, which have a high alcohol-percentage, should be rather treated with albumen, which does not take away so much of their flavor as gelatine does.

All we have said makes it evident how important it is to be posted on the action and nature of the finings which are generally used. It is consequently impossible for us to speak without being prejudicial to the vendors of the various compositions met with in commerce under different names, *and without designating the substances which enter their composition.* Besides, these substances are mostly composed of what we have described above.

It should be added that, when it is necessary to clarify *fine* and *high priced* wines, it is important that the foreman of the cellar—who is responsible for the work—or the proprietor, should know and select the substance according to the character of the wine which has to be fined. Under no circumstances whatever should he use substances with whose composition and action he is not perfectly familiar.

CHAPTER III.

SPECIAL TREATMENT OF VARIOUS KINDS OF WINES.

Treatment of young red wines. Treatment of old red wines. Treatment of white wines. Racking..

TREATMENT OF YOUNG RED WINES.

We have already spoken, in discussing the drawing off of the must from the pomace, of the inconveniences which result from performing this operation either too early or too late. Let us suppose, therefore, that the wine has been drawn off and filled into casks, an operation which may be performed in two ways: Either the casks are placed directly under the tank or the wine is drawn off into a tub and carried in buckets to the cellar. Here it is poured through funnels into the casks, care being taken to distribute each drawing in equal parts through the casks required to receive the contents of the several fermenting tanks, in order that a homogeneous wine should result. Before entering into details we desire to call attention to a widespread error as

to the amount of labor and attention which should be bestowed on the wine. Many wine makers and coopers think they have done all that can be done for the wines which are in their charge if they have filled up the casks and racked at periods which are fixed by tradition; but whosoever has experience in the business knows that it is impossible to state precisely the time when racking is necessary. Intelligent care, frequent and timely racking are required to preserve the wine from injurious alterations, which can be produced by various causes. Thus, even if a wine is racked at certain periods, this does not mean that everything required has been done for it; for perhaps the other precautions have been neglected, which its nature, its composition, the cellar in which it is placed, and the alterations which it may possibly undergo, make necessary.

Young wines, after having been pressed, have, as a rule, not completed their fermentation, and though they may not contain any quantity of sugar which is either appreciable to the taste or to the spindle, they continue to ferment in the barrel. Under such circumstances, a small quantity of alcohol is formed by the transformation of the small amount of the fruit sugar which remains in the wine; but this after-fermentation is not always a vinous one, particularly if the first fermentation has been well conducted. Sometimes the pricking taste which the wine retains some days after having been pressed, is mostly due to carbonic acid, which is gradually given off. The wine should be attentively watched at this time, and the casks should be bunged hermetically as soon as the after-fermentation is over—that is, when the wine has lost the pricking taste which is due to the presence of carbonic acid, and when no more of this gas escapes through the bunghole.

As soon as the casks are filled, they should be placed on racks, or on blocks of wood, and be bunged; then the bung is taken out again and some more wine added, so that the cask is filled up to the bunghole. When this is done, the bunghole is covered with a flat piece of wood, or with a new bung, which is placed loosely on the bunghole, with its thicker end downwards, or with vine leaves loaded down with sand; thus the casks are only loosely closed, so that the carbonic acid gas may easily escape. Every two days the casks are filled up to the bunghole with wine from the same vintage, to make good the loss by evaporation. There are also used for young wines, which are still fermenting, various other kinds of bungs, which allow the passage of the gas through a small aperture; but these bungs are objectionable, because they also give access to the air, and moldiness sets in as soon as the liberation of carbonic acid gas has ceased.

The wine should be tasted each time the filling is done; and as soon as it is found that the after-fermentation has stopped and no more carbonic acid is liberated, the casks should be solidly bunged with ordinary bungs. The best for this purpose are conic bungs made from oak and carefully turned. From now on the cask should be filled up at least every eight days.

The young wines are sometimes turbid on leaving the fermenting tank, particularly if they have been drawn off at other than the right time.

The filling up of the barrels is very simple. For this a vessel is employed specially prepared with a hooked nozzle, for casks filled up with this utensil so as to partly cover the bungs causes some loss of wine to take place, particularly in the hands of untrained workingmen, owing to the difficulty of seeing if the cask is full. These losses can be avoided by using the funnel shown in Fig. 16.

When the wines which have been made from perfectly sound and ripe grapes have been pressed, and when the violent fermentation is over, if the pressing has been done at the proper time, they are almost clear, though during the tumultuous generation of carbonic acid they were turbid. This first natural classification is due to the formation of insoluble compounds, consisting of organic albumen, tannin, pectine, etc., which are coagulated or precipitated by alcohol; but it is chiefly due to the cessation of the ascending movement of the bubbles of carbonic acid; the latter, by rising from the wort to the surface, carries up and leaves in suspension a number of foreign substances, such as particles of the skins, seeds, coloring matters, organic salts, and particularly a great deal of salts of tartar. When the violent evolution of carbonic acid ceases, a part of these matters sink to the bottom of the liquid, owing to their gravity, and thus a mechanical and chemical clearing results. The latter is due, as we have already remarked, to the chemical reactions which go on between the various components of the new wine.

As long as a visible fermentation goes on, and as long as carbonic acid is evolved, the lees, which are formed by the insoluble matters, do not settle to the bottom of the casks, but remain in suspension. This is the reason why the wines become turbid, and that often they are less clear several days after than immediately after having been pressed, but as soon as the fermentation is over a more or less complete precipitation of the first lees, called *bourres*, is effected. These lees contain a great deal of ferments, of tartrates, of insoluble coloring matters, and other salts.

As soon as the after-fermentation has ceased, and the wine has become clear, it is advisable to rack it off as soon as possible from the first lees, in order to preserve it from the action of the ferments, which are contained in the latter. This first racking cannot be done at any fixed time. The period depends upon the nature of the wine, the temperature of the atmosphere, etc. Generally, when a wine is well made, the fermentation ceases entirely during the month of November; it clears then, and can be racked for the first time in December.

We have repeatedly observed that wines which have been racked with care as soon as the fermentation has stopped, and as soon as the first lees have been deposited, are less liable to undergo an after-fermentation than those which have been allowed to remain on the lees until spring-time, and that they become perfectly clear with the least difficulty. This fact may be explained thus: By the end of November, and in December, the temperature sinks gradually, and exercises on the wine a contracting influence, thus facilitating clearing and precipitation of the insoluble matters. If, on the contrary, the first racking is done as late as March (the time when generally the first racking is done), the wines may experience a slight after-fermentation before the racking. This after-fermentation is due to the presence of ferments in the lees. At this time of the year, the gradual rise in the temperature expands the wines and disturbs the lees, of which the lightest particles mix with the wine and produce turbidity. Under such circumstances the wine is racked off in a turbid state, holding in suspension a quantity of ferments; then it becomes difficult to clarify the wine and to preserve it

from secondary fermentation. Sometimes, even, it assumes a disagreeable taste of lees. These accidents can be avoided by racking the first time in December, and by finishing the spring racking before the temperature has risen considerably—for instance, during the month of March.

The barrels containing the new wines should rest in the warehouse until the autumnal equinox which follows the vintage, *i. e.*, until September. They should be kept hermetically bunged and always full. They should be filled once every eight days in close cellars, and twice a week in ventilated cellars, in which the evaporation is considerable. At any rate, it should be ascertained if the wine is inclined to moldiness or not, because in this case it would be necessary to fill up more frequently. To prevent moldiness it is best to bung the casks very carefully. If the casks are piled in single tiers they are filled up by means of the ordinary filling-pot; but if they are stacked high care is taken to use long bungs in order to make it easier to take them out, and the filling up is done with the help of the pot and of a bended funnel in the shape of a Z. This funnel, which is called a Z funnel (see Fig. 16), is arranged in a manner such that near its end can be fixed a piece of candle, destined to light the bunghole. The linen which is used to wrap the bungs should be kept clean and renewed as soon as it becomes dirty or acquires an acid odor.

By smoothing and rounding out the bunghole well, and by using long bungs, which are carefully turned, it is possible to bung hermetically by hand without the necessity of wrapping the bung in linen.

After the first two rackings of December and of March, the wine is racked a third time in the month of June, and for the fourth and last time during the autumnal equinox. Afterwards the casks are permanently bunged and placed with the bung sidewise. From this time the wines should be treated as old wines.

These prescriptions apply to the wines which are stored in close cellars and to wines which do not "work;" and, indeed, some wines are liable to set in "working," even when the after-fermentation is over, notwithstanding they may have been repeatedly racked. This happens particularly with wines which have been moved, shifted, transported without having been racked at all, and also with those which are stored in cellars whose temperature is not constant. In the first case, the after-fermentation should be prevented by timely racking; the condition of the wine should be also ascertained by frequent tasting.

In summing up, the treatment which should be bestowed on new wines consists:

1. In placing in well-hooped casks, with loose or open bung, in close cellars, and by filling them up constantly and regularly with wines of the same character.

2. In racking the new wine from the first deposit of lees as soon as the after-fermentation is over and as soon as it has cleared; that is, toward the month of December, and in racking again before the spring equinox, again toward the summer solstice, and during the autumnal equinox.

3. In preventing after-fermentations by racking each time when it is found on tasting that the wine begins to "work."

If the wine is clear the use of finings should be avoided, in order not to diminish the fruity taste; but if it remains turbid after the second racking it should be treated with white of egg after the third racking, and the wine should remain the shortest time possible in contact with the finings.

By such a treatment, clear wines without tendency to working can be obtained, which, if they are wines of the highest quality, will keep their fruity taste. On the contrary, if the young wines are allowed to "work" after their after-fermentation is over, they lose their fruity taste, their mellowness, and become dry. To avoid this dryness, which is produced by the working and which decreases considerably the value of the wines, particularly of the fine wines, the casks with wines which date from hot years should not be placed with the bunghole sideways after the June racking, for at this time of the year the expansion resulting from the rise of temperature may set the wines to fermenting.

For the same reasons the wines which have to be sent off before the regular time of the first racking should be racked from the first deposit of lees as soon as they have become clear, because if the lees mix again with the wine the latter becomes disposed to undergo after-fermentations, and thus loses its mellow taste.

During the first year the wines lose by evaporation twice as much as they lose when they are old, and the amount of labor they require is three times as great. Even if they are placed in cellars which are very well protected from the access of the air, the losses which are occasioned by evaporation, filling up, and racking may reach the 8 per cent provided for by the law.

In filling up the casks which are stacked up, by means of the Z nozzle or funnel, it happens frequently that a few drops run out of the bunghole. The small losses which occur every time when the barrel is filled up increase the total waste considerably by the end of the year.

In the cellars of northern France—as, for instance, in Paris—the barrels with the young wine are not kept full. As soon as they arrive they are stacked up in tiers just as if they were old wines. Not infrequently the bung is left undisturbed, and perhaps on the side; and in order that the casks should not be bursted by the working, a gimlet hole for vent is bored in the upper part of the bulge and left open. This method is an extremely poor one, because the contact with the air changes the wine, makes it flat, and produces after-fermentation.

TREATMENT OF OLD RED WINES.

One-year old wines are treated, after the autumnal racking, like old wines.

If their taste is frank, if they are clear and not "working," the casks are completely filled, bunged, and placed with the bunghole sideways in the cellar (see *Cellars*).

If they are faulty, turbid, or if they are "working," the faults with which they are affected should be first treated in an appropriate manner (compare *Faulty wines* and *Clarification*). But if the wines have been treated with care as long as they were young they are rarely faulty, unless the cellar in which they have been placed subjects them to sudden changes of temperature.

In perfectly air-tight cellars the old red wines which have a frank taste, which are clear and not "working," and which are preserved in strong casks carefully hooped with iron, require only two rackings a year; the one in March before the spring equinox, and the other in September

at the time of the autumnal equinox; unless, from whatever reason it may be, they lose their bright condition by again beginning to "work;" this can be ascertained by tasting them from time to time. In this case it would be necessary to rack them immediately, and to use finings. We should avoid leaving an empty space in the casks with old wine, either by taking samples frequently or by tasting too often. Thus, as soon as there is an empty space in a cask, owing either to one of the above reasons or to a leak, even if the deficiency amounts to not more than half a gallon, the wine should be drawn off immediately in order to avoid the pernicious influence of prolonged contact of the air with its surface. The rackings should be more frequent in cellars which are not close, and where the evaporation is greater, in order to prevent the wine from becoming flat or acid, or liable to undergo after-fermentation.

If all these prescriptions are carefully observed, the wines will improve and develop all the qualities they are able to acquire, according to their nature. The greater or less excellency which the wines acquire by aging under favorable conditions, is due to two chief reasons. The first is the separating out of the coloring matters, and of the various salts which are dissolved in the young wines, and which become afterwards insoluble by the formation of new compounds, which, in their turn, are removed at each racking with the lees. The second reason is the transformation of the tannin, which gives a certain harshness to the wine, into gallic acid. It is then precipitated through the formation of insoluble compounds with certain substances that are contained in the wine and in the finings. The result is that the old wine loses some of its original color and soluble salts, and a large quantity of tannin; its taste becomes, therefore, finer; its flavor, which was hidden by these substances, comes into greater prominence, and the bouquet, which chiefly consists of ethers, begins to develop; the mellow taste is also more decided. These observations apply chiefly to wines of the highest quality, because many of the ordinary wines lose the fruity taste which they had when they were young before the end of the first year. This is due to the fact that the mucilaginous substances and the pectine, which impart the mellow taste, are precipitated with the lees or destroyed by the after-fermentation.

Generally these wines are lacking in strength, body, and tannin, and many among them show besides a great tendency to lose their color. The time required for a wine to reach the highest degree of excellency which it is able to attain in the barrel, is not the same for all; thus, certain strong and harsh wines require much more time than the delicate wines. On the average, those Medoc wines which are the lightest in body attain the completion of the natural clarification towards the end of the second year. If they are kept longer in the barrels they lose their mellow taste. The wines from the same region, which, on the contrary, are strong and full-bodied, should remain one year longer in the barrels, in order to reach perfect maturity. Certain wines, with a very large amount of tannin, take a long time to develop perfectly, but they keep, also, much longer.

When the wines have reached their full maturity, and when no more lees are separating out, they should be bottled, else they lose their good qualities. In the bottles they complete their maturing; they acquire bouquet and preserve at the same time their mellow taste, while in the casks they lose in the end their fruity and velvety taste and become hard and dry.

One should be a connoisseur in wines and have a certain knowledge of the wines which are under treatment in order to fix the time which is best suited for bottling. We shall mention the details of this matter in the chapter on the *bottling of wines.*

What we have said of old wines may be summarized as follows:

1. They should be stored in perfectly close cellars, and before they are placed with the bunghole sidewise it should be ascertained that they are perfectly bright and free from defects.

2. The lees which separate out should be removed by careful racking every half year; the casks should be always kept full, and after-fermentations should be prevented by attentively watching the wine, and racking when necessary.

3. The loss by evaporation should be reduced to the smallest possible amount, by keeping the wine close in cellars and in strong, iron-hooped casks.

4. The wine should be bottled before it has lost its fruity taste, and as soon as the lees have completely settled down. By following these prescriptions, it will be possible to make a wine acquire, in due time, all of the qualities possible.

But if the cellars are not tight, if the evaporation is considerable, and if empty spaces are left in the casks by taking samples too often, or if racking is not done frequently enough, the wine is liable to set in working, and become hard, to lose its mellow taste, and to undergo a slight change, which is due to the presence of acetic acid, formed by contact of the wine with the air.

TREATMENT OF WHITE WINES.

As the fermentation of the white wines is going on in the barrels, their treatment begins as soon as the must is in the barrels, in which they are filled without any preparatory operations as soon as they have left the press. In each barrel a more or less violent fermentation sets in, according to the quantity of grape sugar present, and to the temperature of the must and of the surrounding atmosphere, etc.

We know that there exists three kinds of white wines; the differences between them are produced by the greater or less amount of sugar in the must, by the different methods of vinification, by the variety of grapes used, etc.—there are the dry white wines, the mellow white wines, and the sweet white wines.

There are besides, *sparkling* wines, which are made from red and white grapes; but we are going to speak of them in a special chapter. The care which should be bestowed on the white wines begins, as we have already said, as soon as the must has left the press and has been transferred to the barrels.

The barrels are filled only up to two inches from the bunghole, in order to leave room enough for the expansion which is produced by the bubbles of carbonic acid, generated as soon as fermentation has started. If this precaution is taken all loss of must is avoided.

The violent fermentation begins after the first twenty-four hours. As soon as it has started in violently the foam which rises to the surface of the liquid is made to run down the walls of the keg by filling up every

day with must of the same character; the bungholes are left open from the start. The method which consists in making the foam flow out of the barrel in proportion as it rises to the surface of the wine—a method which is different from that of fermenting in tanks or in partly empty barrels, when the lees remain in the wine—is used in the fermentation of the high quality wines of the Gironde, such as Barsac, Sauternes, etc. The method is based on the principle that the removal of this foam, which consists partly of ferments, produces a kind of a purification by carrying out of the barrel with it some of the injurious matters.

The result is that the lees are less voluminous and that the fermentation lasts a longer time. The wines which are made according to this rule retain the mellow taste better than those (the specific gravity of the must being the same) which have been fermented in partially filled kegs. The explanation of this is that in the former case a small quantity of mucilaginous substance escapes the action of ferments, while in the other case the fermentation is more energetic, all of the sugar is transformed into alcohol, and such wines are therefore dry and less agreeable to the taste.

Therefore, the first violent fermentation of white wines which are destined for further use without previous blending or any other operation, should be conducted in completely filled kegs. As far as the white wines are concerned, which are destined for concentration by heat or for blending, these fermentations should be conducted in partially filled barrels or in covered tanks, so that the foam and ferment should remain in the wine until the fermentation is over, in order to give increased activity to the latter, and to insure the complete transformation of all the sugar present into alcohol.

As soon as the fermentation of the white wines becomes less violent, and no more foam is produced, the bungholes are covered loosely with a piece of wood, so as to give an outlet to the carbonic acid gas, and the barrels are filled up every two days. At last, when the evolution of carbonic acid has stopped, the barrels are hermetically bunged, and once or twice a week filled up according to the greater or less rate of evaporation. The wine should be racked as soon as the lees have settled and its condition has become bright; in this respect no time can be fixed, because the duration of the fermentation of the white wines depends chiefly upon the specific gravity of the must and upon the temperature of the atmosphere; at any rate, it lasts much longer than that of the red wines. It often happens that the fermentation is not over before the month of February, particularly that of wines which are very rich in sugar, such as the Sauternes, and particularly if the end of the autumn is cold; while the wines which come from the same vineyard, and which are made under the same conditions, but which contain less sugar, will be through with their fermentation in December. Moving the white wines in the course of fermentation should be avoided, particularly when the lees begin to settle, because, by mixing them again with the wine, the fermentation is rendered more active, and the mucilaginous substances are destroyed, by transformation into alcohol. Consequently, the mellow taste, which gives to the white wines their value, is lost. Such are the precautions which should be exercised during fermentation; the latter, it must be added, can be stopped, delayed, or prevented at liberty, by the use of sulphurous acid gas, according to which kind of wines are desired—sweet or dry ones (compare Manufacture of preserved musts). If the sweet white wines have less than 15 per cent of alcohol, they are liable to undergo fermentation.

It is possible, by treating the white wines with sulphurous acid, to maintain them sweet from one vintage to the other, even if they are made from rather weak musts; but it is not possible to obtain this result with such musts, unless they are repeatedly treated with sulphurous acid, and protected from the access of the air; and in such a case the wine is liable to acquire the taste and smell of the sulphurous acid; besides, when strict watch is not kept over them they begin to ferment. In order that white wines which are treated in the usual way should preserve their sweetness, it is necessary either that the musts should be very rich in sugar (16 per cent to 20 per cent) or that they should be fortified so as to contain 15 per cent to 18 per cent of alcohol after their fermentation is over. But this method of fortification is only used in making the sweet wines. We shall speak of it more explicitly in the chapter on *Sweet wines.*

The white wines which are destined to be used when they are still sweet are transported either in form of must, which has been lately pressed, or during their most violent fermentation. If the must has been sent off without the fermentation having started, the latter begins on the way, and becomes violent, owing to the motion of transportation, particularly if the temperature is high, if the voyage lasts several days, and if no sulphurous acid or artificial finings have been used. Even the treatment with finings alone, without the help of sulphurous acid, makes the fermentation of a must less violent. (Compare Classification of unfermented wines.)

In order to prevent the bursting of the bottom of the casks through the generation of carbonic acid and the expansion of the liquid, a small hole, which affords an outlet to the gas, is bored near the bunghole. Now, in order to avoid the wines flowing out in rolling the cask, a tin button is introduced in this opening which is retained in the stave by a stem of the same metal. This stem is bent on the inside of the stave so as to allow the button to rise a little and give an outlet to the gas. Instead of this button with metallic stem, three or four straws with their ears yet on, may be introduced in this opening; the ears remain outside of the stave and do the same service as the button.

Notwithstanding these precautions, there is great loss connected with this manner of transporting white wines, particularly if the men in charge do not watch carefully to see that the fermentation goes on freely in each barrel, and that the latter should be always placed with the bunghole right side up.

Care should be taken not to transport white wines of high quality, and generally, all the sweet or simply mellow wines which retain a part of their sugar in aging, as long as they ferment. There are two reasons for that: the first is that the fermentation, stimulated by the ferments and the first lees which have already settled and now rise again, is liable to become too violent (particularly if the wines had less than 15 per cent of alcohol), and that thus the mucilaginous substances are transformed into alcohol, making the wines dry and difficult to clarify; the second is the great amount of losses which result from the transportation of the wine in this condition.

Racking.—After the first violent fermentation of white wines is entirely

over, and as soon as they have become bright, they should be racked, particularly if the temperature is rising. It should be mentioned here that the less grape sugar a must contains the sooner the wine becomes bright, for the fermentation of the musts which contain little sugar is more rapid than that of musts which are rich in this ingredient.

The most favorable time for the first racking is the month of February, before the rise of the temperature makes the wines expand and which raises the lees.

In racking it is strictly necessary to avoid contact with the air and to fill the wine into strongly sulphured kegs.

The care which should be bestowed on a white wine after its first racking varies according to the quality of the wine.

If we have to deal with ordinary dry wines, that is, with wines whose sugar has been entirely destroyed by fermentation and changed into alcohol, they should be treated in the same way as new red wines.

But the mellow white wines, that is, those which retain still some sugar after the first violent fermentation is through, require (particularly if they don't contain fully 15 per cent of alcohol) minute watching in order to preserve their mellow taste in aging, for if they are left to themselves they undergo a second fermentation and become dry.

In order to age without losing their mellow taste, these wines *should be protected from any after-fermentation*, and should be classified and freed from their ferments by the use of as little as possible of *finings or filtration. Both of them diminish the mellow taste.* To attain this object, the following conditions should be fulfilled: The wine should be—

(1) Placed in perfectly close cellars of uniform temperature, and the kegs should be strong and hooped with iron.

(2) The barrels should be hermetically bunged, and always filled up to the bung with bright wines of the same quality and of the same temperature.

(3) Cleared, preserved from after-fermenation, and freed from the ferments, which they still contain, by racking during the first year in proportion as the lees settle. Finings should be used only in cases when it is impossible to obtain perfect clearing by racking at the proper time.

(4) When the wines have reached, in barrels, their third or fourth year, in case they are not bottled, they should be racked and preserved in *tuns*, and treated in the same way as if they had remained in barrels. These tuns should have been previously used for white wines of the same character.

(5) The wine should be constantly watched, and it should be ascertained by frequent tastings if no fermentation has set in; in the latter case the wine should be immediately racked. If the wine remains quiet after the first violent fermentation is over, it should be racked every year three times, be it an old or a new wine. The first racking is done in March, before the spring equinox; the second at the time of the bloom of the vine in June, before midsummer, and the third and last at the time of the maturing of the grapes in September, before the autumnal equinox.

It is worth while remembering that the less alcohol white wines contain, that is, those which remain mellow after their first violent fermentation, the more liable are they to undergo an after-fermentation and to thus lose their mellow character. If the white wines on hand are sweet and contain less than 15 per cent of alcohol, it is necessary to fine them completely in order to free them from their ferments. Certain ordinary white wines are difficult to fine. It is possible to obtain perfect clearing only by the simultaneous employment of the racking treatment with sulphurous acid and of gelatine in conjunction with tannin. This tendency to ferment is quite natural for wines which are poor in alcohol; and the mellow wines which contain less than 15 per cent of alcohol are not through with their natural violent fermentation; stopped either by the use of sulphurous acid or by frequent rackings or by other means. This stopped fermentation sets in easily again as soon as the wine is left to itself and as soon as the needful watchfulness is relaxed. A rise in the temperature or the wine being transported produces the same result.

In the wines, on the contrary, which attain the highest alcoholic percentage due to fermentation (between 15 and 16 per cent), no new alcohol is formed at the expense of the sugar, unless the liquid becomes weaker through evaporation. These wines are consequently less liable to undergo fermentation, other conditions being equal. If it is necessary to send to a great distance, or even only to preserve sweetish, mellow, but ordinary wines, whose alcohol-percentage is low, they should be slightly fortified with a very strong and pure alcohol, so as to contain 15 to 20 per cent of this ingredient. This only after having become perfectly bright. It will thus be possible to preserve them under ordinary conditions and to transport them easily; it is not advisable, however, to make use of this extreme means excepting in the case of wines which are sweet but which possess an ordinary flavor.

CHAPTER IV.

BOTTLING.

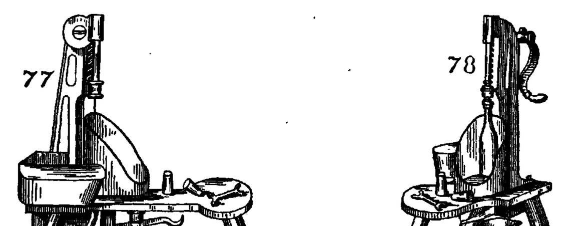
Choice of Wines to be Bottled.—Only wines which date from a satisfactory vintage, which possess a fruity taste, and which are susceptible of acquiring and developing flavor and bouquet on aging, should be put aside for purposes of bottling and aging. Wines which date from an indifferent vintage, or which were made from an ordinary variety of grapes and which are faulty, thin, tart, rough, etc., should not be bottled and stored in cellars, because they are not susceptible of improving in quality on aging, and because consequently it would mean the loss of the interest on a capital which has been invested in bottles, fixtures, and labor.

The wines which are destined to be bottled should fulfill the following conditions:

1. They should be perfectly bright.
2. Their natural clearing should be completely finished, *i. e.*, they should be entirely free from excess of color, of ferments, and of salts, which they keep in suspension during the first years, and which settle on standing and on treatment with finings.
3. They should also be completely through with the after-fermentations.

Should the wines be bottled without fulfilling these conditions—that is, should they be too young or turbid, two grave inconveniences would be the result.

Should the wine be bottled when it is yet too young, the after-fermentation, the separating out and settling of the lees, would continue in the bottles; the wine would acquire a taste of lees and a disagreeable bitterness, and even the bottles would burst should the fermentation be too strong owing to the generation of carbonic acid gas. Anyhow, voluminous sediments would form in the bottles; they would even necessitate the emptying of the bottles into barrels—slow and expensive operations, which are injurious to the quality of fine wines.



CORKING MACHINES.

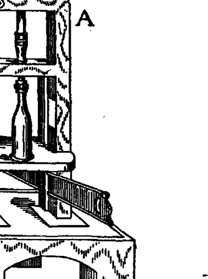
77, 78. Machine for corking bottles (system, Gerrais). This machine is a modification of the ancient machine (drawing No. 79). The corking and movement of the needle is done automatically; the hand-lever is replaced by a treadle (foot-board), and a basin is present to receive the liquid produced by breakage.

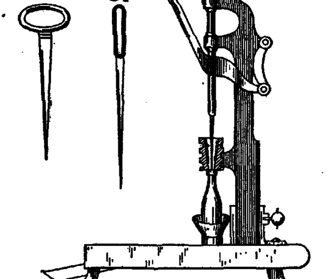
It is not possible to state precisely the age which mellow wines should possess in order to be bottled in good condition. In this respect it is only possible to go on general principles. It depends equally upon the more or less favorable conditions of the vintage as upon the variety of the wine, of the crop, of the stock, of the processes of vinification that were used, of the labor and attention which have been bestowed on the wine, etc. As a rule, the delicate wines which are low in alcohol and deficient in color, or those which date from the years when the grapes did not fully mature, are the most advanced, while the strong, full-bodied wines with a deep color, dating from warm years, are the slowest to deposit the solid matters in the barrel; it is self-evident that such wines keep much longer in bottles, while on the contrary wines which age rapidly in barrels do not last a long time.

The most precocious wines of the Gironde are fit to be bottled towards the end of their second year. The Medoc wines, as a rule, which date from hot years, reach this stage only in their third year. If they remain longer in the barrel, they are apt to lose their mellow taste. Exceptionally, however, certain very full-bodied wines require four years.

If a wine possesses a high alcohol-percentage, together with a rich color and much tannin, a long time is required for it to develop in the barrel. The first crops of Saint Emilion, and particularly the first Queyries, belong to this category. We have seen Queyries of pure *Petit Verdot*, of the year 1851, which, after having been for six years in barrels, were hardly sufficiently mature to be bottled; but this is only an exceptional case, which is due to the stock, for in the same country the wines which are made from *Vidure*, *Malbec*, *Merlot*, etc., are fit to be bottled from the beginning of their third year, and even often towards the end of their second year; but they do not last so long.

The indications that a wine fulfills the necessary conditions in order to be bottled are: that it should be well freed from the lees so that there should be hardly any sediments at the times of the half-yearly rackings; that its color should be brilliant, and that it should have lost the roughness and harshness of the first years, but that it should retain at the same time its mellow taste. It should not be expected that the fine wines will develop their bouquet in the barrel. In olden times the latter method was followed. The wine was allowed to remain in the cask until it almost began to degenerate, and only then was it bottled. The use of this method makes the wine not only lose a part of its velvety, mellow taste, but it has also been proved by experience that wines which have been treated in such a manner do not last so long as those which are bottled *before the bouquet has developed and while they have their fruity taste.* In this case the only drawback is that the possibility exists of obtaining earlier and more voluminous sediments in the bottles unless the greatest precautions have been exercised to bottle the wine only when it has perfectly cleared.





79. Corking machine, ancient model—description of its working see text. A hook is adapted to *a* in order to withdraw the needle from the neck of the bottle.
80. Needle for corking (ancient model) with ring and hinge.
81. Needle specially designed for use in the machine Savinean.
82. Corking machine of Savinean—see description of its working given in the text.

PRELIMINARY PREPARATION OF THE WINE IN BARRELS.—Even if the wine which is destined for bottling appears bright, it should be first racked and fined, as a matter of precaution, in order to precipitate completely all the insoluble matters which may be in suspension.

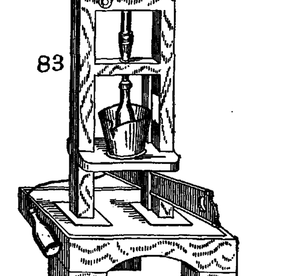
The kind of finings most preferable is albumen; the white of six to eight eggs. As soon as the wine has become perfectly bright during the month which follows the treatment with finings, it should be racked; the

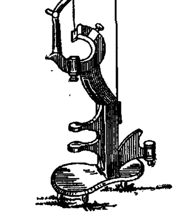
barrel should be also slightly sulphured; the wine is now allowed to remain in the barrel at least three weeks before bottling it. We should avoid bottling wines which contain finings, for the lees, which may have been disturbed by the moving of the barrel, rise frequently to the stopcock and make the liquid turbid.

If, however, the wine which is destined to be bottled is perfectly bright, and if it is very delicate and mellow, it is admissible to dispense with the treatment with finings in order not to diminish the body and to destroy to no purpose the fruity taste. In this case it is sufficient to rack the wine and allow it afterwards to rest.

It should not be forgotten, however, that a bright condition of the wine is essential; if this detail is neglected there is sure to form in the bottles a voluminous sediment. If it is absolutely necessary to bottle wines which are too young, they should be repeatedly fined, in order to avoid a too early formation of sediments. These repeated finings, it is true, bring down the insoluble matters, but they also make the wines harsh, because they precipitate as well the matters which impart the oily and mellow taste.

RINSING THE BOTTLES.—The bottles are washed and rinsed, as a rule, in the glassworks, or in the store-houses, unless they are destined for a long voyage, or unless an agreement to the contrary has been made. These are afterwards placed in draining baskets. These baskets are used for their transportation; for the same purpose pigeon-holes are sometimes used. If wines dating from an extra good vintage have to be bottled, the bottles should be sorted, and those which possess too prominent unevenness in the glass and whose apertures and bottoms are irregular shaped, as well as those which possess any other blemishes, should be put aside. After sorting, the bottles should be thoroughly washed, and drained in the baskets.





83. Corking machine (system of Kehrig). This is the machine used in Bordeaux. It resembles Fig. 79, to which is added a reservoir destined to receive the liquid produced by breakage.
84. Small corking machine. These small machines, of which many patterns exist, are used only in a small way.

This precaution is necessary, for in the glass manufactories great quantities of bottles are rinsed in the same water, and consequently the degree of cleanliness attained is a doubtful one. In order to rinse easily, one should have either two tubs, which may be made from a barrel, or a hogshead, sawed into halves; or two basins in the form of a lozenge, three feet long and two feet high, which are covered inside with tin or zinc, or are made of beton. In winter the water may be easily warmed by means of a stove covered by a hermetically closed boiler, which communicates with the water of the basin. This arrangement is useful only in cases where a great number of bottles have to be rinsed every day. In a cellar of the ordinary size the two tubs are mounted on a stool.

The bottles should be drained in the basket for one or several hours before being filled; but they should not be left in this condition during several days, particularly in moist cellars, for the humidity might possibly develop mold on their inner surface, which would impart to the wine a bad taste. In this case they should be rinsed again before being used.

The bottles, after having been rinsed and drained, are filled, as a rule, without any other preparatory measure. If, however, the wine which is being bottled has a low alcohol-percentage, and not much body, and is deprived of its preserving elements by excessive age, its keeping qualities can be increased by pouring a little old brandy into each bottle before filling.

This brandy is transferred from one bottle to another without allowing them to drain too long. *It would be an excellent method to rinse the bottles with wine of the same character as the one which is destined to be bottled, particularly in the case of the extra fine wines.*

The only drawback to this method, which is a very good one, is that it requires one more workman and the expense of a couple of bottles of wine, which becomes turbid and weak after having been used for rinsing.

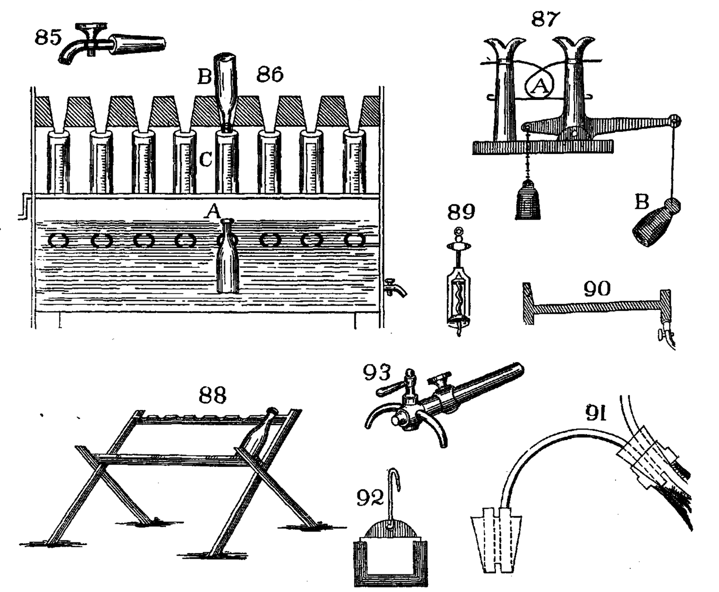
THE BOTTLING PROPER.—The bottling is generally performed with the help of a copper faucet of the usual pattern.

This work could be hastened by using a system of special faucets which allow us to fill several bottles at the same time without losing any wine, and which regulate perfectly the level which the wine should attain in the necks of the bottles. (See Fig. 94.) This system could be very profitably applied to the drawing off of wines and liquors, particularly of those which are in barrels; but in cellars whose space is often very limited it does not offer much advantage in comparison with the simple faucet, *particularly with a skilled workingman;* on account of the delays which are occasioned by the lifting of the barrel, this cannot be effected conveniently with this apparatus.

The barrels whose contents are destined to be bottled should be placed in cellars which are well protected from access of the air. They can be piled up two and even four rows high; the barrels of the lowest row should be placed on benches which are sufficiently high to enable the pan to be easily placed under the barrels.

In order to draw off the wine from the barrels of the lowest row into bottles, a pan for holding the bottles and receiving the drainings is placed under the barrel. After it has been stably placed on blocks of wood, or on triangular blocks, the faucet is inserted; the socket should be first wrapped in a strip of linen and then driven in by gentle blows; care should be also taken to turn the nose of the faucet towards one side, in order that the wine should not fall perpendicularly in the bottles, and should thus produce as little foam as possible by gliding along the walls of the bottle. By operating in this way the wine is less affected by contact with the air.

The workingman, after having taken out the bung as gently as possible (with a gimlet, if the bung is cut off, never with the bung-starter or mallet, for the violent shock is apt to make the wine turbid, by dis-



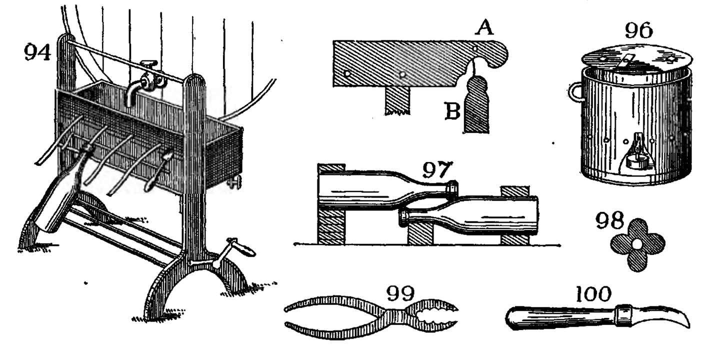
BOTTLING.

85. Stopcock used for bottling in Bordeaux.
86. Apparatus employed for decanting bottles (system of M. Vinean, of Bordeaux); *c*, zinc tube with graduated glass-scale; *b*, a bottle which is being decanted, placed on the funnel over a tube; the crank shown in the cut is used for emptying the water from the tubes into the basin; the leather arrangement can be replaced by stopcocks at the bottom of each tube if desired.
87. Machine for putting on capsules (system of Blanchard). This machine, which is a very simple one, is fixed to a table. In *a*, the neck of a bottle with its capsule is introduced; by pressing the footboard at *b*, the strings which surround the neck at *a*, contract. It is but necessary to impart a rotatory movement to the bottle and to push it at the same time forward in order to fix the capsule on the neck.
88. Bottle rack.
89. Corkscrew.
90. Extension tube and cock for filling the bottles from casks which are piled up in the fourth or fifth row.
91. Decanting corks, described in the text.
92. Rack into which a card may be placed designating the wine, when racked, etc.
93. Faucet of the pattern used in the Champagne; it has two nozzles and a double stopcock, the advantages of which are plainly apparent.

turbing the lees), sits down on a box or on a stool before the basin; he has within his reach a basket with empty bottles, which is slightly inclined towards the barrel to be drawn off; he lets a small quantity of the wine run into the first bottle in order to clear the faucet of the impurities which it may contain; he then puts this first bottle aside and begins the drawing off by placing separately each bottle under the faucet, which he opens. As soon as a bottle is full, he changes it rapidly without turning off the faucet, and regulates, at the same time, the filling of the bottles to the same level, which should be about one and one fourth inches distant from the aperture of the neck, if the bottles are corked with the "needle" machine, and two to two and one half inches for ordinary corking. In order to avoid the spilling of the wine into the basin, an inexperienced workman should open the faucet but little, and gradually he will acquire such proficiency as to enable him to leave it more and more open without spilling the wine. If the faucet is turned off every time after a bottle has been filled, not only the whole operation of bottling lasts much longer, but there is also imparted to the wine in the barrel an up and down movement which may cause the lees to rise.

In proportion as the bottles are filled, the workingman places them upright in a box which contains fifty pigeon-holes; this box should be within his reach or on the floor, which has been previously leveled and strewn with half an inch or an inch of sawdust or fine sand.

When the faucet ceases to run, the workingman has the barrel lifted by another workingman; this should be done very gently either by the hand, a screwjack, or by wooden wedges (compare the chapter on



BOTTLING.

94. Bottling machine (system, Farrow and Jackson). Described in the text.
95. Machine for putting capsules onto the bottles. This is a board of hard wood which is fixed to a table; it is cut out at *a*, in order to facilitate the introduction of the neck of the bottles. A string is introduced through a small hole in *a*, and fastened by a knot on the outside; the other end is connected with the footboard *b*. In order to adjust the capsule, the string is wound around the neck, the bottle is placed above *a*, and the footboard pressed down; then by turning the bottle and imparting to it a movement forward the capsule is fastened to the neck.
96. Stove for use in branding corks, model of Kepsig.
97. Bordeaux bottles, as shown in the cellar.
98. Trefoil. Instrument used in wiring sparkling wines.
99. Bottle forceps. This instrument is used to open bottles containing sparkling wine.
100. Book knife to assist in the preceding operation.

Description of Utensils). He should take the greatest care to see that the wine in the bottles, which are filled when the barrel is lifted, be always perfectly bright; if he finds that it is a little turbid in some, he should put these bottles aside to decant them when they shall have cleared.

In order to draw off the wine from the barrels which are piled up in the second and third rows, the basin is raised by placing it on empty boxes or barrels, but always in such a manner as to give the bottles an inclined position.

CORKS.

In former times very long and slightly conical corks were used for Bordeaux wines; in those days the corking was done by hand with a mallet. The great length of the corks was almost to no purpose, because on account of their conical form they did not fit perfectly in the neck of the bottle, excepting at the top near the ring; their lower end was scarcely pressed at all by the neck. To-day the practice of corking the bottles by machinery has become universal, and the shape, length, and the thickness of the corks have been modified. For the corking of extra fine wines shorter corks are used than in former times. (These corks are two inches long, are thicker, and have an almost cylindrical shape.) Their average diameter for small bottle necks is 0.8 inch.

These corks, which are forced into the bottles with the help of the piston of the corking machine, exercise on the neck a uniform pressure throughout their whole length; this pressure is also much stronger than that of the corks which are forced in with a mallet.

The conical corks, be they long or short, are used only in the absence of a machine and for corking wines destined for everyday use.

The various qualities of corks are the result of sorting. And, indeed, it is possible to find in the same piece of cork bark, portions which are more or less hard or porous. The cork manufacturers pick out the least porous and the most supple corks. This first picking over is followed by several others. The corks of the first picking are the soundest and the most supple; they form the quality which is styled *extra fine*. Notwithstanding these repeated sortings, rarely a perfect cork is found; that is, one which is free from visible pores.

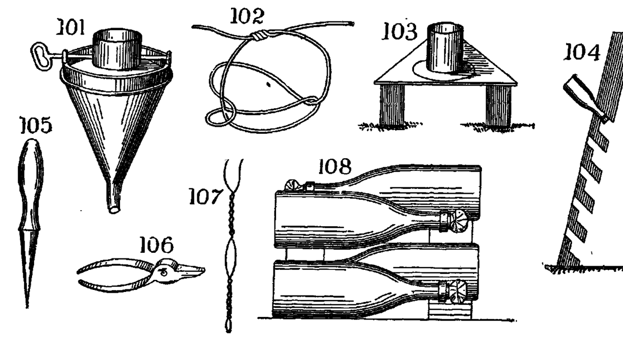
The ordinary non-assorted corks, and particularly those which have been rejected in sorting, are hard and very porous; they break more bottles than the supple corks, and if they are too porous the dust which they contain in their pores enters the wine, makes it turbid, and may also impart to the same a disagreeable taste. Aside from that, the ordinary corks sometimes allow the liquid to ooze out. For this reason they should not be used in the corking of fine wines, for, in the end, it would be more expensive to use them instead of extra fine corks, owing to the loss of wine, to the breakage, and to the bad taste which they might impart.

Preliminary Treatment of the Corks.—Before using the corks which are destined for corking by a machine, care should be taken to render them more flexible by soaking for several hours in water of ordinary temperature, or rather by allowing them to remain for two or three hours in boiling water; they are afterwards allowed to drain, and before being used they are again soaked, but this time in the wine which is to be bottled. If it is desired to give to the new corks the appearance and vinous color of the corks which have been used in corking old wines for several years, they should be soaked in boiling wine for four or five hours. Before using them they should be again soaked in wine.

Whatever the preliminary treatment of the corks may be, either with cold or with hot water, or with wine, their introduction into the neck of the bottles is facilitated by dipping them into brandy before using them. This treatment makes them more slippery.

Steaming the Corks.—Steam penetrates much easier than hot water into the pores of the corks. An apparatus for steaming corks can be rigged up without expense and very easily. The simplest and most convenient arrangement for steaming a small quantity of corks is given in the following:

An ordinary boiler of copper or of any other metal, which should be sufficiently deep, is fitted with a wooden cover; the wine or water is poured in, so as to reach a height of four inches, and above the surface of the liquid a wooden or metallic grate is placed; this grate rests on four legs, and is destined to prevent the immersion of the corks in the liquid, but to allow the steam to circulate freely; the corks are now placed on the grate, and the boiler covered and heated. As soon as the liquid begins to boil, the steam rises and enters the pores of the corks and softens them considerably; they are allowed to remain in the boiler from two to four hours.



101. Funnel according to M. Mosach.
102. Knot fastening in the cork of ordinary and sparkling wines.
103. Case prepared to hold the bottles while wiring corks.
104. Stand for storing bottles neck downwards—useful for sparkling wines.
105. Knife with double edge.
106. Pinchers for cutting and binding wire.
107. Wire twist and loops.
108. Manner in which the bottles are stored in the Champagne District.

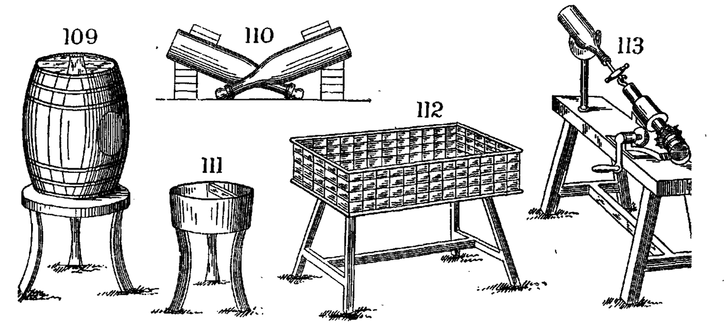
SEALING BOTTLES WITH WAX.

If bottled wines are destined to age in the cellar, or to be placed in pigeon-holes in buildings, which are free from humidity, and if they have not to remain there longer than one or two years, it is possible to dispense with the sealing. Thus an amount of extra labor is saved when they have to be sent off, because it is the rule to send off the bottles capsulated; it would be necessary to remove the wax before putting on the

capsule. But when the cellar is very moist, and when very costly wines have to be stored for several years, the sealing wax protects the corks from the influence of the humidity, which would make them rot rapidly; and also from the attacks of insects, which sometimes gives rise to loss by leaks.

To Prepare the Sealing Wax.—In order that the sealing should be effective, it is necessary that the wax or mastic which is used should be very adherent, fat, unctious, and not brittle. Most of the sealing waxes for bottles which are found in the trade are too dry and too brittle for this purpose. The best sealing wax is made from gallipot (a white, viscid resin). It is prepared by fusing the resin in a saucepan on a slow fire. This fusing should be watched attentively, for it is liable to foam and to rise over the rim of the pan unless it is incessantly stirred and taken from the fire at the right time. When the resin is well fused, the impurities which it contains are removed, such as fragments of cork and chips of pine wood. Then a little tallow is added in order to make it fatter; about three hundred grains of tallow to a pound of resin are used. This sealing wax is used without the addition of coloring matters. Its natural color is russet. It should be kept constantly hot, without, however, heating it to boiling during the operation, which consists in quickly dipping in the necks of the bottles, whose corks should be dry. It is unnecessary to cover much of the neck with the wax. As this operation is performed only to protect the corks, the wax should not go below the ring. Thus labor is saved when the wax has to be taken off in order to put on the capsules for sending them off. In case gallipot cannot be obtained, resin in the form of cakes, or the mastic tablets which are found in commerce, should be used. The cakes or tablets are broken before being put on the fire, and about three hundred grains to an ounce of tallow per pound of the resin are added.

Coloring the Sealing Wax.—If, in making the sealing wax, the tallow is replaced by unbleached wax, a mastic is obtained which is more brill-



109. Disgorging cask. The sediment being discharged into the hole shown in the side of the barrel.
110. Improved stack for bottles.
111. Tub for corks removed from bottles, provided inside with a wire net on which the corks fall and drain.
112. Basket for corks.
113. Apparatus for uncorking and emptying champagne bottles, the working of which is plainly shown in the figure.

iant and finer than that into whose composition tallow or stearine has entered. Various colors may be imparted to the wax according to necessity—red, yellow, black, blue, green, etc.; since the use of the capsules has become general colored wax is seldom used for sealing the bottles which have to be transported. The quantity of the colors used is on the average one ounce to every two pounds of sealing wax; the color is put in the hot wax, which, however, should not boil, and it is mixed in gradually, stirring the whole with a spoon of galvanized iron or with a wooden spatula. Wax is colored red (the color, by the way, which is most frequently used in commerce) with *cinnabar;* deep red is obtained by means of *red ochre;* the yellow with *orpiment* (sulphide of arsenic); deep yellow with *yellow ochre;* black with *animal charcoal;* blue with *Prussian blue;* green is produced by a mixture of equal proportions of the blue and yellow colors. The poisonous colors, such as cinnabar and orpiment, can be replaced by the ochres, which are perfectly harmless; their color, however, is never so brilliant.

TREATMENT OF THE BOTTLED WINES.

The bottled wines are liable to undergo various alterations. These are: 1. The acquiring of the "working" taste; 2. Voluminous deposits and loss of transparency; 3. Bitterness; 4. Roughness; 5. Sliminess; 6. Decomposition and putrefaction. Most of these defects can be ascribed to the fact that the condition of the wine which was bottled was bad, or, in other words, that the wine was too young; its after-fermentation was not over, and it was not perfectly bright. These defects are also caused by extreme variations of temperature, or, lastly, by too great age.

Taste of "Working."—The taste of "working" is due to the presence of carbonic acid in the wine. This acid is produced by an untimely fermentation which starts in wines still containing mucilaginous substances, ferments, and saccharine matters. The after-fermentation of wines which contain such matters is consequently not over, and is completed in the bottles. The same influences which start the fermentations of wine in wood, such as contact with the air, the rising of the temperature, etc., act on the bottled wine.

These alterations can be prevented by avoiding the bottling of wines which are too young, or not perfectly bright, and when they are bottled by protecting them absolutely from the access of the air, by corking the bottles hermetically, and by storing them in places which have a constant temperature.

The sweet and simply mellow wines which contain saccharine matters, whatever their nature may be, are liable to ferment in the bottle, particularly if they are submitted to a high temperature, and if their alcohol-percentage does not exceed 15 per cent.

The non-sparkling wines which ferment in bottles should be transferred back to the barrels, and afterwards treated in a special manner (compare *Treatment of Faulty Wines*). The fermentation may be partly stopped by placing the bottles upright in a cool place, and leaving them in this position for at least two days; afterwards, they are opened for an hour or so in order to give an outlet to the carbonic acid gas; but this operation is but palliative, and does not correct the evil. In the majority of cases these wines are turbid, and then it is advisable to put them back into wood.

Voluminous Deposits—Loss of Brilliancy.—After having remained for some time bottled, the wines form more or less sediment according to their quality, to their age, and to the brightness of their condition, possessed at the moment of their bottling. The character of the sediment varies also according to the variety and age of the wine. These sediments or lees consist mostly of coloring matters and organic and mineral salts, which, after having become insoluble, are precipitated by their own weight to the bottom of the liquid.

Sometimes the sediment adheres to the walls of the bottle. In certain wines it has a muddy consistency and does not adhere to the glass. Sometimes, also, the sediment appears like gravel, particularly if the wine contains a great deal of tartar (bitartrate of potash). Several things hasten and promote the formation of sediments. Sediments often reach a considerable volume after a few years in wines which were bottled too young, or in those which were blended with wines of a different character. In wines dating from good years which have not been

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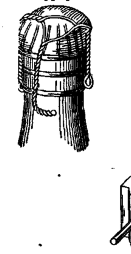

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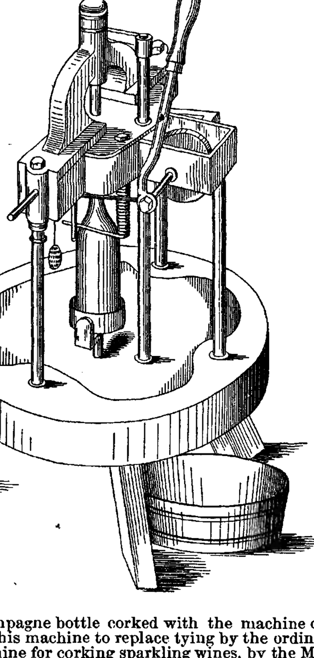

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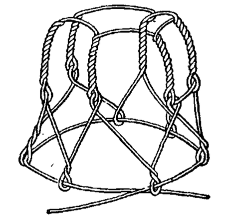

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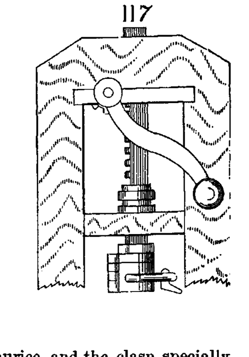


114. Champagne bottle corked with the machine of Maurice, and the clasp specially used with this machine to replace tying by the ordinary method.
115. Machine for corking sparkling wines, by the Maurice system.
116. Cowl for tying in the corks of bottles with sparkling wine, according to Adrien de Mestre, of Bordeaux. This system is used for corking champagne bottles.
117. Bordeaux machine with jointed tube—system of Mestre—for corking sparkling wines.

blended with other wines, made from a good variety of grapes, carefully treated, and bottled under normal conditions, a sediment is hardly deposited after two or three years from the date of the bottling. Frequent moving of the bottles, however, long voyages (particularly if the corking had not been done by means of the bottling machine), variations of temperature, and the decomposition of the wines which have become too old, increases the sediments by precipitating a portion of the color and of the salts in solution.

If the sediment is voluminous, it is apt, in the long run, to impart to the wine a bitter and harsh taste or the taste of the lees. It is therefore very important to separate this sediment from the liquid, particularly in the case of fine wines. This can be done by decantation. If there is not much of a sediment, and if the wine is of a high quality and has not acquired any bad taste, it should be avoided, for this operation causes the wine to lose some of its bouquet—particularly if done without the necessary precautions.

These observations apply to bottled wines which have deposited some sediment, but which nevertheless preserve their limpidness, the brilliancy of their color, and brightness. As for wines which become and remain turbid in the bottles, it is absolutely necessary to fine them; and as it would take too much time to perform this operation in the bottles, the wine has to be transferred back to the barrel.

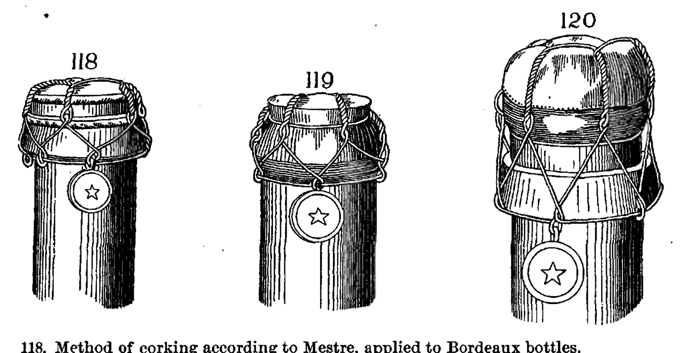
Bitterness—Roughness.—The most usual cause of these defects in bottled wines, if not due to the sediment, is the loss of their fruity and mellow taste; it is then a sign of a beginning decomposition. It is rarely that this defect does not increase with time. The only remedy, if the wine so affected is of high quality and has not lost its bouquet, is to blend it with younger wines which are mellow and perfectly clear.

Sliminess.—Sliminess is an alteration which develops in wines containing but little tannin. This defect occurs chiefly in white wines which have been bottled when not perfectly clear, and which contain nitrogenous matters in suspension. The slime in the bottled wines can be destroyed by the same means which we have indicated for wines in wood (compare *Treatment of Faulty Wines*). If the wine has lost much of its quality it is necessary to put it again into barrels and blend it with wines of the same character, but which are younger.

DECOMPOSITION—PUTREFACTION OF WINES.

Wines in bottles keep and improve in quality if they are suitably treated, that is, so long as their component parts remain united and soluble, but after a lapse of time, which varies according to their special character, they begin to lose in quality. This decomposition is indicated by many signs, appearing sometimes in advance, particularly in the case of wines of high quality. These signs are: loss of the oily and fruity taste, further bitterness, and sometimes roughness. After the lapse of several years, it may be observed that the bouquet loses its sweetness, and that the wine acquires a "*rancio*" taste, which covers its natural flavor. The wine also loses its color rapidly, and deposits a sediment which is much more bulky than that which is formed during the first years after bottling. Lastly, when the decomposition is rather advanced, the wine acquires a slightly putrid odor.

On the average the fine wines of the Gironde, which date from a good



118. Method of corking according to Mestre, applied to Bordeaux bottles.
119. The Mestre system applied to alcoholic liquids.
120. Champagne bottle provided with the clasp 116, and the capsule of Mestre.

year, improve in quality after the first two years after bottling; the wines which are deficient in body and are delicate, begin to deteriorate even before this length of time; the full-bodied wines, which take naturally a longer time to develop their qualities, keep a much longer time; there have been examples of such wines which have preserved their qualities in bottle as long as ten years; but as a rule, after having remained three years in the wood and the same length of time in bottles, they have attained the maximum quality they are able to acquire.

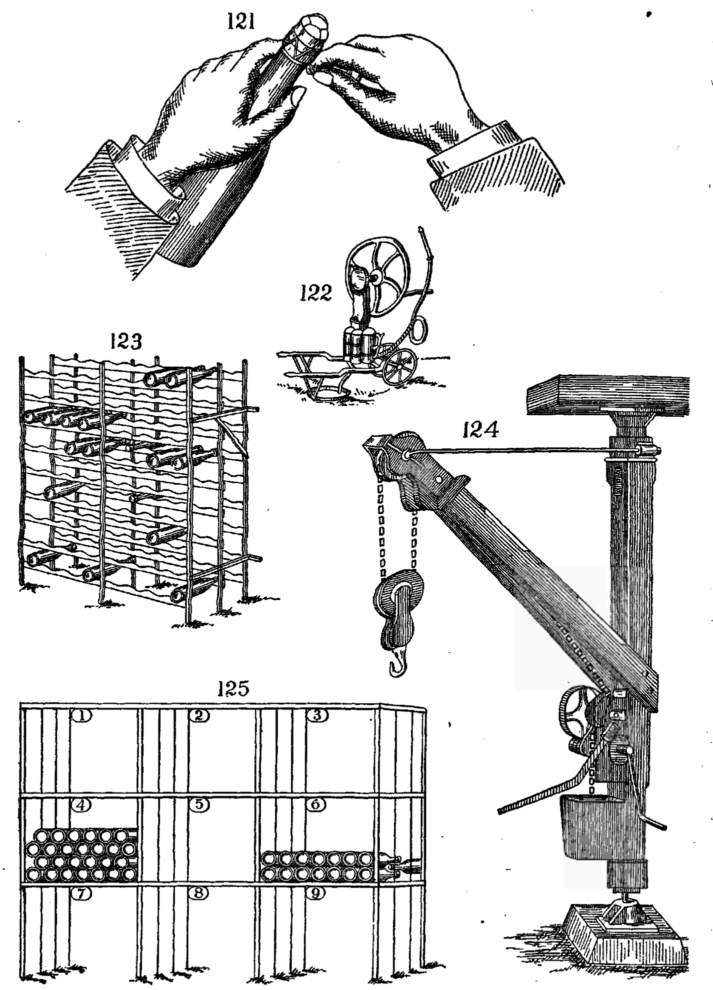
As soon as it can be noticed by the taste that a high-priced wine has attained its full development in the bottle, it should be cautiously decanted into bottles which have been rinsed with the same wine, and these bottles should be closed with *ground* glass stoppers.

Certain wines, such as those made from the first crop of *Petit Verdot des Queyries*, the first quality Saint Emilion, first quality Barsac, and Sauterne, keep a much longer time. The loss of color, together with the abundance of sediment, which is a constant sign of deterioration in the wines of the Gironde, should not be interpreted in the same sense for all kinds of wines.

Thus, the red wines of Spain or the sweet wines of Roussillon, which possess a very deep color as long as they are young, lose their color, almost entirely, after having been bottled three or four years; they assume a golden yellow color, without, however, deteriorating; but in these wines, whose alcohol-percentage exceeds fifteen, it has been observed that the sediment is not so considerable in proportion to the color which has been precipitated as in French wines, and that the coloring matter remains sticking in all directions to the inner sides of the bottles instead of sinking to the bottom.

The alcohol and tannin are the preserving principles of the wine; it follows from this that the more abundantly a wine is provided with these substances the longer it will keep.

The origin of the deterioration of wines is the dissolution of their component elements, which become thus insoluble and are precipitated. The loss of tannin, which is transformed in time into gallic acid, removes from the weak wines their most effective conserving element, and causes



121. Uncorking of bottles which have been corked according to the Mestre method.
122. Portable pump for transferring wine from one cask to another. System, A. Suc.
123. Pigeon-hole bottle rack of corrugated iron, each pigeon-hole receiving one bottle. These pigeon-holes offer the advantage of enabling one to take out one or more bottles without moving the rest. They, however, occupy much more room than the racks shown in Fig. 125.
124. Turning crane. System, A. Suc.
125. Spaced rack. These contain three hundred and twenty-five bottles, or a barrel of wine each. The bottles are stored away with the help of boards, which are placed between the layers; they are of the same length as the spaces partitioned off.

a precipitation of the coloring matter. In support of our assertions it has been observed in practical work that wines which contain tannin in large quantities have the advantage of keeping much longer than wines which have the same alcohol-percentage, but which are poor in tannin.

We have, therefore, good reason to believe that the transformation and loss of the tannin is one of the chief reasons why wines degenerate. What science has not explained up to this day, is the cause of putrefaction in the last period of the degeneration of bottled wines—wines which are too old or poor in alcohol; the cause of the transformation and decomposition of their alcohol without any contact with the air. True, it is a known fact that putrefaction starts in only in wines which are very poor in alcohol (below 8 per cent), and which have remained a long time in the bottles, and after the coloring matter and the salts which are contained in the wine have already begun to separate out; but what has not yet been explained is, as we have already said, the cause of the decomposition of the alcohol.

CONCLUDING REMARKS—GENERAL PRECAUTIONS.

In order to prevent the defects which bottled wines may acquire, the following precautions should be taken:

(1) Only those wines should be bottled whose after-fermentation and clearing have been completed.

(2) The moving of the bottled wines should be avoided as much as possible. They should also be protected from changes of temperature by storing them in specially constructed cellars.

(3) They should be freed from their sediments at the proper time by decantation, but this means should not be adopted unless the sediment is voluminous, or unless it has imparted to the wine a bad taste, as by this operation it loses unnecessarily a part of the bouquet and strength.

Decantation.—Decantation is an operation which has for its object the separation of the clear portion of the bottled wines from their sediments. In order to perform this work in the right manner, certain precautions should be used; contact with the air should be particularly avoided. Experience has shown that wines which are decanted when the air has access to them (we speak here of fine wines), have less bouquet, and are weaker in alcohol, than wines of the same character which have not undergone this operation.

The bottles should be taken out from the pigeon-holes without either changing their position or shaking them, in order not to disturb the sediment. To perform this operation easily, they are placed in a slightly inclined position in special baskets, which hold five to six bottles, so that we may uncork them without spilling the wine. These baskets have a partly open bottom, so that they may be placed on a frame or trestle; then with the help of a candle, which is placed below, the movement of the sediment may be followed. We are going later to describe these baskets more in *detail*. If such baskets cannot be procured, the bottles are moved just as they were laid down onto a rack.

After allowing them to rest a longer or shorter time, according to the consistency of the sediment, they are uncorked without shaking, by means of an *English* corkscrew, and the wine decanted slowly into clean bottles which have been previously rinsed with decanted wine. The bottles which have been emptied can be used again after having been rinsed with plenty of water, and after draining and rinsing them with wine which is similar to that decanted. If it is a wine which shows signs of beginning decomposition the bottles should be rinsed with old brandy. Decanting can be done by hand in the following manner: On the empty bottle a small funnel with a trellis is placed in order to avoid the introduction of impure matters; the bottle is then slightly inclined after having first wiped the orifice, and with the help of a lighted candle, which is held below, the movement of the sediment is followed. When the clear portion of the wine has run off, the bottle is filled completely with wine which has been already decanted, and immediately corked. The decanting should be done in the cellar, and never in work-rooms through which the air circulates freely.

CHAPTER V.

RATIONAL TREATMENT OF FAULTY WINES.

Faulty wines; general considerations. Natural defects. Earthy tastes; means of preventing this defect. Tartness; how to prevent and destroy the same. Harshness; its nature and causes; how to prevent an excess of harshness, bitterness, and the taste of stems. Acidity; hot taste; means of preventing acetic fermentation. Insufficient alcoholic strength. Lack of color; dull, leady, bluish color; taste of lees. Putrid decomposition. Faults or diseases of wines which have been contracted after the fermentation is over. Acidity; pricked wines; roughness; means of preventing acidity; treatment of pricked wines. Taste of the cask; moldy taste; bad taste produced by foreign matters; slime; bitterness; roughness; taste of "working" of the lees, etc. Degeneration; putrid fermentation of wines.

FAULTY WINES.

By this name are designated wines which possess some natural or acquired defect, or which show the beginning of an alteration. From the commercial point of view, by *defect* or *fault* are understood the changes which a wine has undergone after its fermentation, and which are mostly due either to the non-observance of necessary precautions concerning its preservation, or to the poor state of the casks.

The natural defects are not considered in the trade to be real defects.

We divide the different kinds of defects and diseases into two classes:

1. Defects which are due to the nature of the soil, to the fertilizers which were used, to a deficient maturity of the grapes, to unsuitable processes of vinification, to the prevalence of ordinary varieties. It is evident that the defects which belong to this class must be innate to the wines at the time of their leaving the fermenting vat; these defects are the following: Earthy taste, acidity, harshness, bitterness, taste of the stems, hot taste, low alcohol-percentage, lack of color, dull, leady, bluish color, taste of the lees, and tendency to putrid fermentation.

2. The defects contracted by the wine after its fermentation, the majority of which are due to carelessness, or to the bad condition of the casks, are: flatness, moldiness, acidity (pricked wine), taste of the cask, bad taste produced by accidental introduction of foreign soluble substances, slimy condition, bitterness, harshness, taste due to the "working" of the wine, decomposition, and putrid fermentation.

GENERAL CONSIDERATIONS.

Before indicating the means which should be applied in correcting, destroying, or diminishing the defects of wines, I would say, that a faulty wine, whatever its defect may be, particularly if a bad taste is very prominent, will never be equal to a wine of the same kind which was sound from the beginning, even after complete elimination of the defect. It is, therefore, more prudent and wise to prevent the diseases of wine than to wait until the wine becomes faulty and then attempt to cure the defect. It is to the interest of the wine maker to use all the means which are in his power to remedy the natural defects of the wines which he produces.

As far as the wine merchants and consumers are concerned, they should refuse to buy faulty wines, particularly if they make a purchase without having immediate use for it; not only because these wines, notwithstanding their low price, cost more than they are really worth, but also because they lose in quality on aging instead of improving. Thus, by keeping them in the cellar one is exposed to the danger of losing, not only the interest, but also a part of the capital which he has invested in their purchase. Besides, if a wine has a too prominent defect it is only seldom that it is possible to use it alone; either because it is too poor in alcohol and in color, or because it is no longer possible to entirely eradicate the defect. Besides, it would be an error to believe it possible to hide the bad taste by distributing the faulty wine through a large number of barrels of sound wine. The way to do is to destroy or to diminish, first, the defect, by treating each cask separately by a suitable method, and then by blending the wine with the most ordinary brands which are at hand.

In speaking of each kind of defect in particular, we are going to describe its nature, its origin, and the means which should be employed to prevent, diminish, or destroy it. Everybody can ascertain the action of the remedies which we propose by experimenting on a small scale, say with a quart or a fraction of a quart of the faulty wine; the sample should then be well corked and kept in a cool place for at least two days in ordinary cases, and for eight days if it has been previously treated with finings. The quantities of the different correctives which we advise are for one barrel containing fifty gallons. As the quantities which have to be used on fractions of a quart are very small, they can be weighed out accurately only with the aid of a small laboratory balance.

NATURAL DEFECTS.

Earthy Taste.—This natural defect is a bad taste which the pulp and the skins of the grapes acquire before fermentation; it is met with in wines which are made from grapes grown on moist, swampy soils, and particularly if such soils have been fertilized too strongly, or if substances have been used as fertilizers which are liable to impart their character to the sap.

Proper Means for Preventing the Earthy Taste.—The crops from young vines which are growing in moist soils have a stronger earthy taste than those of old vines which grow in the same soil, and this taste is generally more prominent in prolific and ordinary varieties than in nobler varieties. Sometimes it is possible to destroy or diminish this defect by proper drainage; by allotting more space to the vines; by artificially cleansing the soil, and by avoiding the planting of trees in the neighborhood. If it has been found that this taste is due to a too abundant use of manures, a smaller quantity of these substances should be used, and less wood should be left on the vine. Lastly, a great deal of attention should be paid to the drawing off of the young wine. The murk should be drawn off as soon as the fermentation has gone through, for a long contact of the liquid with the stems and skins only increases the bad taste.

How to Destroy or Diminish the Earthy Taste.—The treatment of wines with earthy taste differs according to their prominence, their character, and their possible future; but the condition necessary for all of them is that the insoluble substances should separate out rapidly, and that the wine should never be allowed to remain long in contact with the lees. These wines should be drawn off as soon as they have become clear, and they should be also frequently racked to avoid the formation of voluminous deposits.

The red wines which, notwithstanding this defect, promise to develop good qualities in the future, should be racked the first time in the beginning of the winter, again in the first days of March, and should be then fined (after this second racking) with the white of about eight eggs; they should be racked again after a contact of a fortnight with the finings.

If we have ordinary red wines possessing this defect, which are of little promise, whose color is dull and deficient in depth, and which are lacking also in alcohol, they should be treated in the same manner; but before adding the white of eggs, they should be fortified with alcohol of 60–90 degrees, in proportion of one quart per barrel, in order to facilitate the coagulation of the albumen.

If the wines made from marshy, low lands are strong and rich in body and color, and have to be treated for the same defect, an excellent result will be obtained by an energetic fining with two ounces (about two tablets) of gelatine per barrel.

White wines with an earthy taste should, before being racked, be entirely through with their fermentation, and should also have received an addition of seven tenths of an ounce of alcoholic tannin solution per barrel, or an equivalent of white wine which has been treated with tannin. After the first racking, they should be treated with two ounces of gelatine. This racking and fining precipitates the insoluble matters and a portion of the coloring matter, which is strongly contaminated with the earthy taste. Thus this taste is sensibly decreased. If the earthy taste is not very strong, it disappears gradually after each racking. Should the earthy taste be very strong, it is advisable to beat the wine with one pint of olive oil per barrel. After having stirred the mixture well, the barrel should be filled up completely and the oil removed; the latter, by its contact with the wine, takes up a portion of the essential oil which is the cause of the bad taste. After this treatment the wine should be fined in the same way as has been described above.

Tartness, Its Nature and Origin.—The tartness of wines is due to the presence of an excess of tartaric acid. This acid imparts to the wines a sourish, harsh taste. The wines which are affected with this

defect contain also another organic acid, but in smaller quantities—malic acid. In tasting such a wine these acids produce in the palate a disagreeable sensation, and like unripe fruits they set the teeth on edge.

The origin of this tartness is to be found in the imperfect maturity of the grapes. It is well known that tartaric acid abounds in most unripe fruits and that it disappears only at the period of maturity, when it becomes transformed into glucose (fruit sugar) under the influences of solar heat.

Thus, a tart wine is an imperfect wine which, besides this defect, has generally some other defects; such a wine is often poor in alcohol and body, and defective in flavor, bouquet, and color. This is because the grapes, which are not completely ripe, contain much tartaric and malic acids, little fruit sugar and mucilaginous substances, and because the substances which are destined to color the skins, as well as the aromatic compounds, have not been completely formed.

Means of Preventing Tartness.—We refer the reader to the article on "Vintages in Cold and Rainy Years," in which we have indicated the different means which should be used to counteract the inclemencies of the seasons. Then we have detailed how to avoid the making of tart wines, *without using sugar or other substances foreign to the grapes, and without using alkaline materials to neutralize the tartaric acid in the must.*

The artificial means of improving the must are indicated in the article on *artificial wines*, in which we have made the reader acquainted with their various uses and inconveniences (compare the first volume of this work, *Vinification*).

How to Diminish or Destroy Tartness.—The treatment of tart wines differs according to the quantity of tartaric acid it contains. If the tartness is not unbearable, the wine can be improved by adding one or two quarts of old brandy to each barrel.

The wine contains more tartaric acid after leaving the fermenting vat than after the second slow fermentation in the barrel is through; this can be explained by the fact that the free tartaric acid combines with the tartrate of potash which is contained in the wine, and forms with the latter a new salt, the bitartrate of potash (cream of tartar), which settles down with the lees or adheres to the walls of the cask. The result is that the wine is less tart after the first racking than when it is new; but if the tartness of the wine has attained a very high degree, it will be retained even when the after-fermentation is over. This acid can be neutralized by adding to the wine a convenient quantity of tartrate of potash. This salt will combine with a part of the tartaric acid, and form cream of tartar (bitartrate of potash), and after a few days of rest the wine will be less tart. The quantity which should be used is half a pound to a pound per barrel. In order to apply it, some gallons of the wine are drawn off, and the tartrate of potash, a handful at a time, is thrown into the barrel; the whole should be well stirred, exactly in the same manner as when the wine is fined.

This process is not a new one. It was proposed in 1826 by M. A. Julien, who saw it in use in the neighborhood of Paris. In cold and rainy years certain wines are so tart that it becomes impossible to destroy their tartness by blending them with well matured wines; for if a wine is too tart, and if in order to improve it it is blended with well matured wines, it appears indeed as if the acid had been partially destroyed as soon as the blending has been done; but after a few days the superabundance of the tartaric acid ends by attacking the good wines, which have been thus sacrificed to improve the poor ones.

It is, therefore, more advisable to neutralize the acid by tartrate of potash. It should be added, however, that the practical application of this method has not yielded such good results as one would expect considering the theory only. I have often experimented on very tart wines and have used as much as thirty to forty-five grains of tartrate per quart, but did not succeed in diminishing their extreme acidity appreciably. We insist, therefore, that the wine maker should do his utmost to prevent this defect. As far as the wine dealer is concerned, he should avoid buying wines which are too tart and which have no future.

The tartaric acid could be also neutralized by alkaline substances, such as the bicarbonates of lime, soda, or potash. By following this method it would be easier to discover the excess of acid, than in any other way; but by neutralizing the acid soluble salts are formed, which remain in the wine, and which may have a bad influence on its hygienic properties. We won't speak, therefore, of this kind of treatment.

HARSHNESS.

Its Nature and Causes.—The harsh taste is due to the astringent nature of the tannin. If an excess of the latter is contained in the wine, it imparts a harsh taste to it. Tannin is useful in preserving and fining wines; wines which contain much tannin keep longer without degenerating, and endure transportation better than those which have none, provided their alcohol-percentage is the same. From medical science we learn that wine which contains tannin is more wholesome than wine which does not contain any, for tannin strengthens and tones up the digestive organs. That portion of the grapes which contain most tannin are the seeds, the skins, and the stems. Harshness is not a defect; it is rather an excess of good quality, particularly if such wines have no after-taste of stems, no earthy taste, no bitterness, nor acidity; if their alcoholic strength is considerable, if they have a good fruity taste, and good color; such are, for instance, the first wines of Palus, Queyries, Bassens, etc., which are made from the grapes of pure Verdot. These wines are harsh on account of the excess of tannin, but valuable in aging, preserving, and blending wines which are deficient in body and too weak to keep a long time without degenerating. Wines which contain much tannin keep a long time; they are, however, afflicted with the drawback of developing very slowly. The harshness decreases with time, because the tannin is gradually transformed into gallic acid. The continuous motion during a long voyage hastens this transformation. Aside from that, the tannin is precipitated by several substances which are contained in the wine, and by certain finings; thus, by its separating out of the wine, the tannin hastens its clearing.

Means of Preventing an Excess of Harshness.—We should never attempt to destroy the harshness of wines which are mellow, weak, and low in alcohol, because, if once the tannin is removed from them, not only their keeping qualities would diminish, but they would also

require a much longer time to clear; in the end they would also have less color. An excess of harshness is prevented in strong and richly colored wines by stemming the grapes which are used, and by drawing the wine from the pomace at a suitable time; if the young wine is allowed to remain too long a time on the pomace, its harshness is liable to increase.

How to Destroy the Harshness.—As soon as the wine is in the barrels, its harshness begins to increase, owing to the tannin which is contained in the oak wood of the staves (if the barrels are new); but when the after-fermentation is over, and when the first and most voluminous portion of the lees has subsided, it becomes less harsh, because a portion of the tannin has been precipitated by the vegetable albumen, and by other substances which are contained in new wines. If the quantity of tannin is great, the harshness continues for several years.

If the wines are full-bodied and possess a fine color, their excessive harshness can be destroyed *by precipitating a part of the tannin;* for this purpose it is sufficient to add a good dose of gelatine (two ounces, or approximately two tablets).

It should not be forgotten that when tannin is precipitated, at the same time a portion of the color is also destroyed; this method should be therefore avoided in dealing with pale red wines, and should be only applied to wines which are rich in color and very harsh, and which would require too long a time to develop in the natural way.

BITTERNESS AND TASTE OF STEMS.

Bitterness is a disagreeable taste, which is produced in the new wines by the solution of a bitter substance which is contained in the grape bunches. This substance has nothing whatever to do with tannin. Sometimes this bitterness is due to the cortical portion of the seeds of certain varieties of grapes.

This bitterness decreases in the wine in the proportion as the settling of the lees progresses. The bitterness is prevented by allowing the grapes to mature completely, and particularly by stemming them with care, and not letting them remain too long in the fermenting vat. In order to overcome bitterness the wine must undergo the same treatment as in the case when it is desirable to destroy the earthy taste; afterwards, to each barrel one quart of old brandy should be added.

We now speak only of the bitterness of new wines. The bitterness of old wines is due to an entirely different cause, and requires other measures. We are going to speak of it later.

The Taste of Stems, which is often associated with bitterness, is due to a prolonged immersion of the grape bunches in the murk. It is presumed that this defect is due to an aromatic substance in the stems. It can be prevented by stemming the berries. Like the natural bitterness, it decreases with time. The remaining of the murk on the pomace in the fermenting tanks beyond a reasonable length of time is one of the chief reasons for the taste of stems and bitterness.

Acidity—Hot Taste.—This defect is due to the presence of acetic acid in the wine. Every wine, even the most mellow, the best made, and the best cared for, contains acetic acid, but in such small quantities that it is not appreciable to the taste.

The acetic acid is formed in the wines during and after vinification in open vats. Its formation is owing to the contact of the air with the cap. The cap is formed by the ascension of a portion of the skins and stems, which the bubbles of carbonic acid carry to the surface of the must. The alcoholic fermentation ceases very soon in this cap when it has once come in contact with the air, and the alcohol soon becomes transformed into acetic acid by means of certain ferments. This change proceeds so rapidly that in cases when the must is allowed to remain in the fermenting vat too long a time, and the temperature is high, the acid condition of the cap passes into putrid.

So long as the first violent fermentation is going on, carbonic acid is evolved; the bubbles of the latter raise the cap to the surface of the must; but as soon as the heat of fermentation has subsided, the cap sinks down into the wine and imparts to it the acidity which it had acquired from contact with the air.

Means of Preventing Acetic Fermentation.—Acetic fermentation can be prevented by various means:

1. By fermenting the must in covered tanks, so as to prevent the access of the air and to compress the carbonic acid; also, by avoiding the formation of the cap by means of a frame.

2. Should the fermentation be conducted in open tanks, it will be advisable to have them only three quarters full, so that a layer of carbonic acid, which is heavier than air, protects the cap from all contact with the air; the cap is also sometimes covered with a layer of straw as soon as it begins to form.

3. By watching the contents of the fermenting tanks, and by pressing the murk as soon as the fermentation has ceased.

Treatment of Wines Which Have Become Pricked During Fermentation.—It should not be expected that such wines may improve with time. It is possible to make them palatable, but still their future is lost. This is the reason why it is the direct interest of the producer to prevent this defect by all possible means.

These wines should be racked off as soon as possible from the first lees; that is, as soon as the generation of carbonic acid has ceased. If they are still turbid, their clarification should be hastened by an energetic treatment with finings, and they should be left in contact with the finings only the necessary space of time. Then they should be racked. The object of this preparatory treatment is to free them from a portion of the acetous ferment which they contain.

Insufficient Alcoholic Strength.—This defect is due to the watery nature of certain kinds of grapes, and to the small amount of sugar which they contain. It is peculiar to wines which are made from grapes which come from young vines, for it is an established fact that young vines which grow in fertile soils, or long pruned ordinary varieties, produce an abundance of watery grapes with large seeds. When the wines whose alcohol-percentage is low are not well supplied with tannin and coloring matter, they degenerate quickly. This may happen even in their first year, before the lees have time to settle completely.

The deficiency in alcohol is prevented by planting in rich soils varieties only which are well supplied with sugar and tannin, such as the two varieties of Verdot, and the two Vidures. These produce full-bodied, strong wines, which possess good keeping qualities, and improve regularly with time.

The treatment of weak wines consists chiefly in freeing them as quickly as possible from the ferments which they contain, in order to prevent further acetic and putrid fermentation, which they are extremely liable to undergo. This result can be obtained by racking as soon as the lees have settled. If the wine should still remain turbid after the second racking, it should be treated with the white of six eggs per barrel. The coagulation of the albumen may be facilitated by adding to the wine, before the fining, from a pint to three quarts of alcohol (90 degrees) per barrel, and to the white of eggs add a handful of common salt in a glass of water. As such wines are not of much promise for the future, it is necessary to blend them with strong wines which are rich in body and color. The practice of fortifying with alcohol is not advisable in this respect. It is true the spirits which are added increase the alcoholic strength of the wines, but they remain dry and without a fruity taste; whereas, if blended with strong and fruity tasting wines of the same character, they acquire alcohol and a mellow taste at the same time.

LACK OF COLOR.

The color of the grapes in most instances arises from the skins of the berries. These colors are yellow and blue in the red grapes, and merely yellow in white grapes.

The natural color of the skins of the red grapes is, as we have said before, a mixture of yellow and blue. The acids have the property of changing the blue vegetable colors into red, such as litmus, orchilla, etc. The blue color of the grapes undergoes materially this chemical change by contact with the organic acids in the pulp, which dissolve in the must during fermentation (tartaric, malic, and acetic acids).

The pulp of most red grapes is colorless. If the red grapes are pressed, and the must is allowed to ferment without the skins, white wine is obtained. This is proof that the color is ordinarily seated in the skins.

The coloring matter is formed in the berries only when they are perfectly ripe. This explains why tart wines, which date from vintages when the grapes had not attained perfect maturity, have so little color. Overripeness has the disadvantage that it makes the skins rot, and thus diminishes the color.

The mode of fermentation also influences, more or less, the depth of the color. Thus, the wines which have been fermented in a manner such that the cap is always kept submerged by grated frames, show more color than wines which have been fermented after the ordinary fashion, in open tanks. This is explained by the fact that the cap, which consists mostly of skins, remains when grated frames are used the whole time submerged in the must, while otherwise it floats on the top.

It follows that the deficiency in color is due: (1) To the incomplete ripeness of the grapes, or overripeness, which causes rotting of the skins. (2) To the small proportion of skins compared with the pulp and the water of vegetation (watery berries with large seeds). (3) To the fact that the skins are not sufficiently immersed in the must during fermentation.

Wines which are too poor in color may be improved in this respect by the following means: (1) By picking the grapes, if possible, only when perfectly ripe. (2) By planting varieties with small berries, so as to have a greater proportion of skins. (3) By the use of grated frames and foulage. The treatment of wines which are deficient in color should consist, besides the ordinary precautions, in avoiding everything that facilitates the precipitation of coloring matter. For this reason they should be fined as little as possible. Gelatine should not be employed at all for this purpose, but albumen in the proportions as we have given for wines whose alcohol-percentage is low.

It is quite natural that blending wines which are very rich in color with wines which are deficient in this respect, increases the color of the latter; but in order not to alter the natural flavor, the blending should be done with wines of the same character and from the same locality.

The use of vegetable matters, or of fruit juices, for the purpose of imparting color to the wine, should be rejected; some of these substances are, besides, *unwholesome*. In the chapter on *Sophistications* we shall give a detailed account of these substances and the means of recognizing them.

DULL, LEADY, BLUISH COLOR—TASTE OF LEES.

Some wines remain turbid and retain a dull, leady color, even when the after-fermentation is over. There are several causes for such behavior, and it is necessary to look for them and to study them before deciding upon any treatment. Sometimes, even often, the new wines remain turbid because they have undergone an after-fermentation which has disturbed the lees, which had already settled. Such an after-fermentation is due, as we have already explained, to untimely racking, or to the imperfect arrangements of the cellar. New wines also remain turbid if they have been moved without having been previously racked.

In this case the wine should be placed in a cellar whose temperature is constant, and allowed to rest a fortnight. When this time has passed, it should be ascertained if the lees have settled. If the wine has still a dull color, it should be fined by using the methods best suited to its nature.

If the wine is turbid owing to an untimely fermentation, the first thing to be done is to stop this fermentation by means such as are generally applied under such circumstances. If, notwithstanding all precautions, such a wine remains dull, even if all fermentation has stopped, the reason of this defect must be ascribed to the lack of alcohol or of tannin. It is known, indeed, that the coloring matter of wines which are deprived of alcohol or tannin, either settles to the bottom or remains in suspension.

If it is found that alcohol is lacking, the treatment consists in fortifying the wine with one or two quarts of alcohol (70 to 90 degrees) per barrel, or with one fifth or one tenth part of the whole of strong, full-bodied wine of the same flavor, and afterward in fining with the white of a few eggs.

If the wines which remain dull possess a sufficient alcoholic strength, and a satisfactory color to each barrel, an alcoholic solution of about

300 grains of tannin should be added; afterward the wine should be treated with an ounce or two of gelatine. A bluish violet color and a taste of lees is only rarely met with among the wines of the Gironde. This defect is rather met with among certain southern wines, and is due to an excess of coloring matter and to the absence of tartaric acid in the wine. If such wines have much color and more than 9 per cent of alcohol, it is easy to change this color into red by blending them with one sixth to one fourth of a tart wine, which contains, as it is known, an excess of tartaric acid; after that they are treated with 300 grains of tannin, so as to enable them to preserve their color and to undergo the fining processes. If a tart wine cannot be had, crystallized tartaric acid could be used. This acid is soluble in wines. Before using it on a large scale, the quantity which is needed to turn the wine red should be determined by experimenting on a sample; for it should not be forgotten that this acid makes a wine less wholesome.

If the alcoholic strength of a wine is low, if its color is inadequate and blue and dull, it will possess a great tendency to undergo putrid fermentation. In such a case the blue color is indeed nothing but the beginning of decomposition. It is due to a chemical reaction which transforms a part of the potassium tartrate into carbonate of potash. These wines possess a slightly alkaline taste, and if they are left to themselves they spoil rapidly if the air has access to them, but they do not acidify completely. This is the worst kind of a wine. It is possible, however, to prevent this kind of decomposition, which is very rare, even among common wines, by using good processes of vinification, and by making the wine more full-bodied and stronger by the choice of good varieties.

As to the treatment of these wines, several experts have proposed the use of tartaric acid for their improvement. This acid will indeed change their color into red, but it will not prevent the putrid decomposition which threatens them. We prefer to use for this purpose about one sixth part of tart wine, which contains, as we know, a good deal of free tartaric acid, and to fortify afterwards by blending these wines, in convenient proportions, with wines which are full-bodied and possess a high alcoholic strength.

PUTRID DECOMPOSITION—CAUSES OF THE SAME.

Wines undergo a putrid decomposition owing to a great lack of alcohol and tannin. This defect is due to the deficiency in sugar and to the watery nature of the grapes. It is therefore possible to recognize when wine is predisposed to putrid fermentation by its showing a lack of alcohol and of tannin. These wines soon lose their color, and fail to become bright and clear; they remain turbid after the settling of the lees, which, besides, is never complete, and is going on all the time.

The tendency to decomposition is announced by a change in the color they assume—a brick-red, dull hue. Thus wines, though they may be quite young, acquire the appearance of old turbid wines; their red color becomes in the greatest part precipitated, and they retain only a yellowish color. If, in such a stage, they are not immediately fortified, they assume a nauseous, rotten taste, become more and more turbid, and decompose without going through the acetous fermentation.

How to Prevent Decomposition.—The tendency toward putrid decomposition (a rare defect, by the way) can be prevented by using all the necessary means to increase the sugar in the must in a natural way, and thus by a proper choice of varieties raising the percentage of alcohol.

TREATMENT OF WINES WHICH ARE PREDISPOSED TO PUTRID FERMENTATION.—Putrid fermentation can be delayed by the use of the following means:

1. By raising the percentage of the alcohol of the wine by adding tannin, and by blending with a suitable quantity of wine which is full-bodied, has a high alcoholic strength, and is harsh.

2. Should there be no such wine at hand, brandy or alcohol can be used for the same purpose; or, still better, a solution of tannin in alcohol (of which we will give the composition in speaking of the component parts of the wine), thus raising their alcohol-percentage to about ten.

3. By avoiding as much as possible the use of artificial finings, particularly of such substances as precipitate the coloring matter; for instance, gelatine; albumen should be used instead.

4. Do not permit such wines to undergo shaking and motion of long voyages. Avoid the use of sucking pumps, for strong motion accelerates the precipitation of coloring matters. These various precautions may delay the putrid decomposition, but they do not stop it, and these wines can never bear a long voyage unless strongly fortified before shipment.

WINES WHICH POSSESS SEVERAL DEFECTS.—It happens frequently that certain common wines have several defects at a time. In such a case the defect should be treated which is the most prominent.

FAULTS OR DISEASES OF WINES CONTRACTED AFTER FERMENTATION—FLATTISH, MOLDY WINES.

NATURE AND ORIGIN OF MOLDINESS.—The moldiness of wine is nothing else but a crust of microscopical fungi which the botanists call *Mycoderma vini* and *Mycoderma aceti*, and which develop on the surface of wines which are in contact with the air. These growths communicate to the wine a disagreeable odor and taste, as well as light acidity, which is known under the names of *flatness, flattish odor or taste.*

The principal reasons for the growth of these parasites is the direct contact of the wine with the air, which favors their growth; further, the evaporation of a portion of the alcohol on the surface of the wine which is in contact with the air, and the incipient oxidation of the alcohol which remains in the liquid.

The result of all this is, that the surface of the wine becomes very low in alcohol, and having thus lost its preserving principle, it becomes moldy. Moldiness consists, as is commonly known, in the development of a large number of small fungi. This mold has a bad taste, and is impregnated with an acidity which is due to the action of the oxygen of the air on the alcohol, it being thereby transformed into acetic acid.

These changes are more or less rapidly effected according to the alcoholic percentage of the wine and to the temperature of the storage cellar. The weak and ordinary wines which contain from 7 to 8½ per cent of alcohol are first attacked. They begin to mold three or four days after having been exposed to the air. Stronger wines which contain 10 to 11 per cent can resist the mold twice as long as the weak wines. Lastly,

the wines which have more than 15 per cent of alcohol do not mold. During summer the changes are much more rapid.

HOW TO PREVENT THE FLATTISH TASTE.—The flattish taste can be prevented by protecting the wines from contact with the air. To do that they should be kept in casks which are always full or in hermetically sealed and horizontally placed bottles. (Compare *General Treatment of Wines.*)

If we cannot avoid having the casks partly filled, the air which remains in the cask should be neutralized by burning a piece of sulphur wick and by afterwards bunging hermetically. (Compare *Sulphurous Acid, its Uses, etc.*)

TREATMENT OF FLATTISH WINES.—Sometimes it happens that new wines have been neglected by not filling up the casks in which they were stored for eight days or more, and it is only the surface of the wine which has become so altered. By filling up the cask, it is possible in such a case to withdraw the mold which has been already formed, through the bunghole; afterwards, the cask should be bunged hermetically, and, lastly, care should be taken to fill up frequently, because a new formation of mold would not only impart a flattish taste to the wine, but would also make it turbid and introduce acid ferments, causing it to sour in the end. (Compare *Treatment of New Wines.*)

A barrel containing wine that is considerably moldy, and which has acquired a distinct, flattish taste, without, however, being rankly acid, should be filled up with fresh wine. The mold is allowed to escape through the bunghole, and then the wine is racked off into a barrel which has been sufficiently sulphured. This barrel should be completely filled. After the racking, one or two quarts of old brandy per barrel should be added to the flattish wine, or the same amount of a strong wine possessing the same flavor as the one to which it is added. Afterwards, the wine should be well fined by using, preferably, egg-albumen (the white of eight eggs and a handful of salt, dissolved in a glass of water), and should be racked again as soon as it has cleared. The object of this treatment is to remove from the wine, by means of racking, the mold which imparts the bad taste; to increase, afterwards, the alcohol, in order to replace that which has been lost by evaporation; lastly, by the use of finings, to precipitate the acid ferments which were produced by the mold. It must be remarked, however, that the wines which have become decidedly flattish can never be cured completely, and if they possessed a fine and delicate flavor, they lose a considerable part of their value. We insist, therefore, that the foreman of the cellar should be careful to prevent this disease, which produces acidity, for often the neglected wines are at the same time *flat* and *sour*.

ACIDITY—PRICKED WINES—ROUGHNESS.

The acidity is due to the fact that the alcohol which is contained in the wine is partly transformed into acetic acid under the influence of the oxygen of the air. (Compare *General Treatment of Wines; Influence of the Contact with the Air.*) All unfortified wines are subject to this change *if they remain exposed and in contact with the air.* If they are fortified so as to contain 18 per cent of alcohol, whether containing sugar or not, they undergo no change except that the alcohol decreases through evaporation.

MEANS OF PREVENTING ACIDITY.—Acidity is prevented by treating the wines according to their character, by storing them in convenient cellars (compare *Treatment of Wines*), and by using the precautions indicated in speaking of the flattish and moldy wines; that is, by avoiding all kinds of prolonged contact with the air. Mold is, as we have just said, the forerunner of acidity. However, the wines do not always become moldy before getting sour, particularly if the temperature is high, and if their alcohol-percentage is a high one. Generally the wines turn sour without becoming moldy if they are exposed to the air at a temperature of 77 degrees to 104 degrees; under these conditions acidity is produced very rapidly; this is the reason why the precautions should be doubled during hot weather, and why it should be remembered that this fault is due either to the negligence of the foreman in permitting the access of air, or to the casks being in poor condition and the imperfect construction of the cellar.

TREATMENT OF PRICKED WINES.—The acetic acid which is contained in pricked wines can be neutralized to a great extent by the reaction of several alkaline matters, but in this case there remain dissolved in the wine salts (acetates and tartrates) which are formed by the combination of acetic and tartaric acids, with a part of the alkaline substances which were introduced.

The alkaline matters neutralize by this combination, not only the *acetic acid* but *all* the organic acids which are contained in the wine. These neutral salts are not perfectly wholesome; they are to some extent *purgatives*. Aside from that, it is not possible to neutralize completely the acetic acid which is contained in the wines by using caustic alkalies (potash, soda, quicklime), for by their introduction they decompose the wine, they effect the precipitation of the coloring matters, and impart besides an unpalatable, bitter taste. It is therefore necessary to select for the treatment of pricked wines alkaline substances which are best fit to neutralize the excess of acetic acid without changing the composition of the wine, without altering the color, and which produce by their combinations with the acids the least soluble and the least unwholesome salts.

The alkaline substances which should be chiefly used are: Carbonate of magnesia, tartrate of potash, and lime water.

The following substances should be used only in cases when it is impossible to obtain those just mentioned: Wood ashes (preferably the ashes of grapevines, which contain a great deal of potash); chalk, or pulverized marble; solution of bicarbonate of soda, and of bicarbonate of potash.

HOW TO APPLY THESE SUBSTANCES.—It is advisable to try first on a small sample, say one quart, of the pricked wine the effect of the substances which it is intended to apply. Care should also be taken to use quantities which are proportional to the degree of alteration of the wine. Thus, to one quart of pricked wine there should be added in small portions, shaking the bottle all the time, 15 or 30 grains of magnesium carbonate. In case the wine is considerably pricked, the quicklime should be slaked in water in convenient quantity; the mixture should be shaken and then allowed to subside until the supernatant water becomes clear; 1.2 cubic inches of this lime water should be added to the wine which has already been treated with magnesium carbonate; after that 0.6 cubic inches of brandy are added, and lastly an albuminous fining, preferably fresh milk, in a dose of 0.6 to 1.2 cubic inches, is added; the bottle is then corked, shaken, and allowed to rest. At the end of three or four days it will be possible to judge the improvement which has been produced by the treatment, by comparing the pricked wine with the treated sample.

This treatment varies according to the kind of wine in which the acid taste is found. If the wine is not only pricked, but also tart, fifteen grains of tartrate of potash, besides magnesia, should be added; if the wine has a dull color after the milk has been added, a small quantity of gelatine solution is also used; lastly, if the wines are turbid and difficult to clarify, there should be added before pouring in the milk and the gelatine solution a small quantity of tannin.

It is hardly necessary to mention that the quantity of each substance to be used should be adequate to the condition of the sample, and that the same proportions should be used on a large scale.

If carbonate of magnesia cannot be obtained, the quantity of lime water should be doubled; and lastly, in case lime is not at hand, marble or powdered chalk could be used, but very cautiously; also the ashes of the shoots of vines, but in smaller quantity, or solutions of bicarbonate of soda or potash. The last mentioned substances require much precaution in their use. We should avoid employing them in cases where the wine is only slightly pricked. As far as my own work is concerned, I prefer the carbonate of magnesia to all other alkalies, because it does not act so strongly on the color and does not impart to the wine the bitterness and unwholesome properties which potash, lime, and soda salts do. (It is a well known fact that the carbonate of magnesia is used in medicine as an antidote for the acidity of the stomach.)

To these wines brandy is added in order to replace the alcohol which was destroyed by the formation of the acid. As far as the fining is concerned, the preference given to the milk in this case is due to the fact that milk has an alkaline reaction. It helps, therefore, to neutralize the acid taste of the wine, and clarifies it at the same time; but milk is alkaline only when it is fresh; the skimmed milk of the day before is acid—it should not be used. Lastly, the tartrate of potash and carbonate of potash are used in the treatment of pricked or tart wines. Gelatine and tannin neutralize the tartaric acid, and facilitate the clarification and precipitation of acid ferments.

Wines whose acid has been neutralized should be fined and racked as soon as they have completely cleared. This result can be obtained by following the method above indicated. The more acid the wines are, the less alcohol they contain, because the acid has been formed at the expense of the latter; therefore, it becomes necessary to fortify them, either by adding alcohol, or, if the change is not a deep one, to blend them with strong, but ordinary wines. Should this change, on the contrary, be very great, and consequently their alcohol-percentage very low, it will be more profitable to convert them into vinegar.

TASTE OF THE CASK.

The taste of the cask should not be confounded with the taste of the wood, as this taste, when imparted to the wine, is due to the aromatic substances contained in the oak. The wines acquire it generally in new casks. The taste of the cask is a bad one, due to a disagreeable essence of taste and smell, produced by a peculiar change in the wood of one or of several staves, or of the bottom of the casks. This defect is very rare. It is impossible for the cooper to prevent it, and reject the staves which impart the bad taste, because there is no sign by which they may be recognized.

The treatment of wines which have contracted a bad taste of the cask consists in transferring the same as soon as possible into good and sulphured barrels, in order to remove them from the contact with the wood which has imparted to them the bad taste. This bad taste may be diminished by agitating the wine for five minutes or more with a quart of olive oil. This should be afterwards taken out by means of a pipette. *After that,* a good dose of fining—white of eggs, or gelatine—should be applied, suitable to the wine. Following this, after a week or fortnight, the wine should be racked. The object of this treatment is to secure, by means of a non-volatile oil, the volatile essential oil which seems to be the reason of the bad taste. And, indeed, the olive oil which is used for this purpose, acquires a decided taste of the cask. It is possible, by treating the wine in this manner, to attenuate the taste of the cask; but it is seldom that it can be completely eradicated.

MOLDY TASTE—BAD TASTE PRODUCED BY FOREIGN MATTERS, ETC.

The wine acquires a moldy taste by remaining in casks whose staves are moldy on the inside. The presence of mold is due to carelessness and negligence, which, in this case, consists in leaving casks empty without sulphuring and bunging them hermetically. (Compare the article on *Empty Casks.*) The mold of the empty cask is a whitish moss, which consists of microscopical fungi; it develops under the influence of humidity and darkness; its disagreeable taste seems to be due to the presence of a certain essential oil.

This defect is prevented by carefully inspecting the casks before filling them, and by avoiding the use of those whose odor indicates moldiness.

Wines which have accidentally acquired a foreign taste, either by having been kept in casks which had originally held "liqueurs" with a very decided taste and flavor, such as anisette, absinthe, rum, etc., or by their contact with odoriferous substances, owe this taste to the solution in the wine of a portion of the essential oil which is contained in these substances, and should be treated in the same manner as the wines which have acquired the taste of the cask. First of all, they should be removed from the infection as soon as possible by drawing them off in other casks.

SLIME.—Under this head a property and alteration are indicated: a property, if the mellow, oily, and fruity taste of certain wines is understood; an alteration, if a certain fermentation is meant which makes the wines ropy, like oil. This alteration, which is really nothing but a certain kind of fermentation, is peculiar to white wines, which hold in suspension nitrogenous matters which contain only a small quantity of

tannin. This is not a serious defect and is easy to remedy. It is sufficient to add to a barrel of such a wine several gallons of wine in which tannin has been dissolved or a solution of about three hundred grains of tannin in alcohol. The whole should be well mixed and shaken as in the case of the application of ordinary finings. (Compare *Tannin.*)

The tannin which is mixed with the wine precipitates the slimy matter by combining with it. Thus a real fining is effected by the chemical action of the tannin. These wines should be racked a fortnight after the treatment with tannin.

BITTERNESS.—Bitterness, which is often a natural defect (we have already spoken of it), becomes an accidental defect if it develops in old wines which before had a frank taste. In this case it is almost always the beginning of decomposition. This bitter taste is chiefly due to the compounds which are formed by the decomposition of color, and by the precipitation of mucilaginous matters which give to the wine the mellow, fruity taste; and, indeed, it has been noticed that the wines acquire bitterness in the same proportion as they lose their fruity taste. It is possible to diminish this bitterness by fortifying. We may regenerate the bitter wines only by blending them with wines of the same character, young and strong ones which have not reached their full maturity. The blend should be fined with albumen and racked after a fortnight. Thus these wines can be improved; but at the end of several months the bitterness reappears. These wines should be, therefore, consumed as soon as possible.

ROUGHNESS.—The rough taste which certain wines acquire in aging is a sign of decomposition. We have some reason to believe that this defect is due to the presence of acetic acid and to the precipitation of the mucilaginous substance which gives to the wine the mellow taste; indeed, this defect is most frequently observed in the case of old wines.

The proper treatment to diminish the roughness consists in destroying the acetic acid, by using sixty to one hundred and twenty grains of magnesium carbonate per gallon (compare *Pricked Wines*); or, if the roughness is not very prominent, to blend such wines with young and strong ones which have a frank taste; after blending, the wine should be fined, in order to make the mixture more complete. As fining the white of egg should be used with preference.

TASTE OF "WORKING" OF THE LEES, ETC.—The taste of "working" is due to the presence of carbonic acid gas, which is given off from the wines as soon as they undergo an after-fermentation, either owing to the sugar which they still contain, or to mucilaginous substances. The principal reasons for the "working" are the presence of sugar and of mucilaginous substances, together with the ferments. Under the influence of a higher temperature, the "working" begins. The taste of lees is due to the rising of the lees and of the sediments. The taste of "working" wine and that of the lees can be prevented by conducting the vinification under favorable conditions; by keeping the wines at a constant temperature, and by separating them from the lees by timely racking.

The "working" can be stopped by racking the wine in other barrels, which have been previously sulphured. During the racking the wine should not be allowed to come in contact with the air. After racking, the barrels should be placed in a cellar whose temperature is low and constant. Should it happen that the wine be turbid, it should be fined with the substances which suit its character best; the wine should remain in contact with the fining only during the time which is strictly necessary to effect its clarification. The details of these operations have been mentioned in the paragraphs on sulphurous acid, finings, and special treatment of each kind of wine.

DEGENERATION—PUTRID FERMENTATION OF WINES.—The degeneration announces itself in the wine by many signs a long time before it really sets in. These signs are loss of the fruity taste, bitterness, roughness, etc., but the true symptoms of degeneration in old wines are the more abundant precipitation of their blue coloring matter, their turbid condition, and their slightly putrid taste. The chief causes of this alteration are the same as those which we have mentioned in opening, of the tendency of the new wines to putrid decomposition; namely, a low alcohol-percentage, together with a lack of tannin. It is known that with time the tannin is transformed into gallic acid, also the alcohol decreases through slow evaporation, and thus it happens that wines which are too old have lost a portion of their preserving elements—alcohol and tannin.

How long wines may keep is very difficult to say; like animated beings, they show a great diversity in their character. Very weak wines begin to decompose the first year, while others, which are stronger, improve during four, six, ten years, and perhaps longer. As soon as it is apparent by the aspect and by the taste of a wine that it has begun to degenerate, it is important to stop, as soon as possible, the beginning of the decomposition. This can be effected by the use of a solution of tannin in alcohol (compare *Tendency Towards Putrid Decomposition* in the paragraph on *Natural Defects*); but it is more advisable to blend such wines with young, strong wines of the same character. (Compare *Diseases of Bottled Wines.*)

CHAPTER VI.

THE LEES OF WINE.

Composition of lees. Wines extracted from the lees. Methods of extraction. How to avoid the bad taste and to press the lees economically. Presses. Use of the dry lees. Pearlashes. Crude tartar.

The lees should not be neglected, for, in the absence of timely precautions, the wines which are extracted from them acquire a bad taste, due to the fact that they have remained too long a time in contact with the sediments.

To prevent this alteration, which would deprive the liquid of all its value, the lees should be treated with very particular attention, and should be kept in cellars which are perfectly protected from changes of temperature.

Before being separated the lees contain from 30 to 90 per cent of wine. The lees of wines on which finings have been used contain about 70 per cent of wine, not comprising that which can be extracted by pressure.

The dry portion of the lees contains a large quantity of insoluble matters, of tartar, several other organic and inorganic salts, various compounds, ferments, mucilage, residues of animal or vegetable matters, albuminous or gelatinous, which have been used as finings.

M. Bracounot, a distinguished chemist, who has analyzed the dried lees, has proved in them the presence of the following substances: bitartrate of potash, tartrate of lime, tartrate of magnesia, phosphate of lime, sulphate and phosphate of potash, organic nitrogenous matter, fatty matter, coloring matter, gum, tannin.

This composition of the dry lees varies according to their age and the nature and variety of the wine from which they have been deposited; but in all of them the salt which is met with in great abundance is the bitartrate of potash (tartar). The lees of mellow wines contain mucilaginous substances, and in the lees of sweet wines great quantities of sweet matter are found which can be utilized. We are going to speak later of the various uses of dried lees.

If intelligent care has been exercised, it is not only possible to draw off all the liquid above the lees, but also this wine will have no bad taste.

PRACTICAL TREATMENT OF THE LEES.—The empty barrels which are destined to hold lees should be washed and rinsed just as if they were destined to contain bright wines. In these barrels a piece of sulphur wick should be burned. In proportion as the racking of the wine is carried on the lees are emptied in a pail and *immediately poured* into the barrel which is destined to hold them. (Care should be taken when the lees are emptied in the pail, not to introduce into the latter earth, mold, etc. If the circumference of the bunghole is dirty, it should be brushed before taking out the bung.) As soon as the barrel is filled with lees, it should be placed like wine with the bunghole upward, in a close cellar.

If the barrels cannot be filled completely the same day, they should be bunged hermetically after having burned in them a new piece of sulphur wick. This operation of sulphuring should be repeated every time that new lees are poured into the barrel, the barrel having remained several days only partly full. This constant sulphuring is not only to prevent the access of the air which would acidify the wine, but also to prevent a renewed fermentation which could be possibly started by the ferments contained in the lees. In a word, the barrels which contain lees, without being quite full, should always be well bunged, sulphured, and protected from variations of temperature.

After the barrels with the lees have been placed in a cellar which has an even temperature, they should be filled up regularly every week with clear wines; after fifteen days of rest the clear liquid should be drawn off for the first time; this operation should be repeated every month; thus, by simple racking, the whole clear portion of the liquid can be drawn off, if using the precautions which we are going to describe later. By following this method any after-fermentation is avoided, to which the lees are very subject, particularly in summer; also, the disagreeable taste of lees is avoided, and harshness and bitterness, which the wines that have remained a long time in contact with the sediments may acquire.

Faulty wines, whatever their defect may be, also those which have been recovered from breakage, from leaks which have sprung up unexpectedly in the casks, or those which have been collected from the floor, should never be poured in with the good lees, for they would spoil them. Wines belonging to this class should be poured into separate barrels and treated each according to the fault which it has.

Separation of the Lees from the Wine by means of Glass Siphons, etc.—The lees which have not been separated from the wine, and which are kept under the conditions we have described above, on standing, get rid of a large portion of the foreign substances which they contain, for these are insoluble and specifically heavier than the wine.

The separation of the wine from the lees can be effected in two ways—either with the help of a glass siphon, or of a stopcock. For the first separations transparent siphons made of glass are preferred. The siphon is introduced through the bunghole into the barrel to a depth of about eight inches; two empty well rinsed and well drained pails are placed under the longer leg; then the liquid is sucked in, holding the siphon up so that it should not sink too deep into the barrel; with the help of a candle which is placed above the siphon, it is possible to ascertain if the wine which runs out is almost clear; as long as it remains clear the siphon is gradually immersed until the level of the turbid wine is reached. As soon as the first pail is full the second must be placed under the leg of the siphon, without stopping the outflow of the liquid. In order to apply this method, the presence of two men is necessary (unless one has great experience), of whom one watches and holds the siphon, and the other pours the clear wine into a rinsed and sulphured barrel. As soon as the liquid begins to show turbidity the outflow is stopped, and the same operation is performed with other barrels.

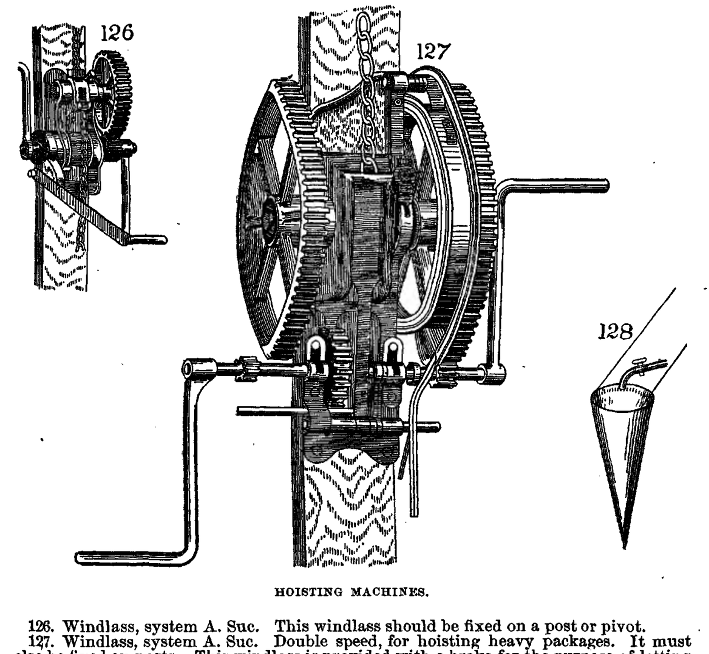
When the lees and wine in all the barrels are separated, the lees are collected in a barrel which already contains the greatest quantity of them. Before filling the barrel it is important to burn in the same a double square of sulphur wick, in order to prevent an after-fermentation. In order to collect the lees in an easy manner, they are emptied into great pails, if there are not more than ten gallons in each barrel; but if there is a greater quantity of them, the barrels are raised on other barrels, and the lees emptied by means of a stopcock, if they are not too thick; otherwise through the bunghole. In this latter case, the bunghole should be cleaned from time to time with a small stick, to facilitate the outflow.

The use of a stopcock is preferable to that of a siphon if the lees are thick and if the barrels which hold them are placed on the floor. By separating the lees from the wine with a stopcock, it is possible, at least for the first separation, to avoid the piercing of several holes in the bottoms of the barrels. It is the deterioration of the bottoms produced by these holes which often makes the siphon preferable to the stopcock. By piercing the end or head, the bottom is not spoiled, and besides the advantage is there that it is possible to extract with the stopcock a greater quantity of wine than with the siphon; but this wine is generally less bright than that which is drawn off cautiously with the help of a siphon. This system allows one man to perform all the necessary operations without further help.

Before beginning the separation of the lees and wine with the stopcock, it should be ascertained by means of some gimlet holes, or of a long glass tube, where the clear wine begins; then a hole for the stopcock is bored just above the surface of the lees. If, as we have already

said above, the barrels have not *yet* been used for the lees, and if the latter are separated for the first time from the wine, the hole for the stopcock may be bored instead in the middle piece of the head on the same level in one of the side pieces a little farther than one inch from the cross groove. Thus the bottoms are not spoiled.

The wine which has been drawn off from the lees should be immediately poured into rinsed and sulphured barrels, and should not be allowed to stand exposed to the air.



HOISTING MACHINES.

126. Windlass, system A. Suc. This windlass should be fixed on a post or pivot.
127. Windlass, system A. Suc. Double speed, for hoisting heavy packages. It must also be fixed on posts. This windlass is provided with a brake for the purpose of letting down freight, and a ratchet for holding the lifted weight when necessary.
128. Conic filter, made from woolen cloth or felt. This filter is fixed to a hoop of iron, which can be suspended wherever necessary.

The lees should be collected in the same way as we have already described. Care should be exercised in collecting the lees from which the wine has been already extracted several times, and which have yielded a small quantity of wine, not to fill the barrels with them except after thorough sulphuring. Then we must not move these barrels, because the movement would disturb the sediments and would impart a bad taste to the wine which is still on the lees, and even give rise to putrid fermentation, particularly if the lees contain large quantities of albumen and gelatine which were used as finings. It is hardly necessary to add that the barrels used for lees should, as soon as they have been emptied, be thoroughly rinsed, drained, and sulphured; otherwise the lees would adhere to the staves, where they would dry.

Classification of the Wines Extracted from Lees.—The wines which have been extracted from the lees are often wanting in clearness; it is generally more difficult to clarify them completely by using the ordinary methods than the wines of the same character from which they originate; it has also been observed that these wines have considerably less color and show a lower percentage of alcohol than ordinary wines of the same origin.

The difficulty met with in obtaining their complete clarification consists in the presence of large quantities of insoluble matters which are held in suspension, and in the relative weakness of these wines in alcohol and tannin. The decrease of the color is due to the mechanical action of the insoluble matters contained in the lees. These matters settle and carry down with them a portion of the coloring matter which is in solution. It follows, therefore, that the older the lees are the less intense is the color of the wines which are extracted from them.

If the wine extracted from the lees is a red wine, and if it is desired to clarify the same completely, it should be treated with a strong dose of albumen (the white of ten eggs per barrel), which has been well beaten in half a pint of salt water. If the alcohol-percentage of such a wine was below nine, to each barrel there should be added one or two quarts of brandy, or of alcohol, before applying the finings. Gelatine should never be used for fining red wines of this kind, as the color would suffer too much.

The white wines extracted from the lees can be treated with albumen, if their alcohol-percentage is high. The weak white wines should be treated with a strong dose of gelatine; but before applying the gelatine it is necessary to add some tannin, either in the form of a couple of gallons of wine which has been treated with tannin, or in the form of three hundred grains of tannin dissolved in alcohol.

The wines which have been extracted from the lees should remain in contact with the finings so long as is strictly necessary to precipitate the finings used (about ten days). After this time they should be carefully racked. When reaching perfect brightness these wines should be treated, according to their character, in the same manner as those from which they have been extracted.

Pressing the Lees.—After having drawn the wine from the lees three or four times, it is possible by pressing to recover a still further quantity, as the lees contain, on the average, not less than 50 per cent of liquid.

Economical Arrangement of a Press for the Lees.—The pressing of the lees is done in small sacks, which are approximately one and one half feet long. The material of these sacks should be *cotton cloth*, because the sacks which are made from hemp impart to the wine (even if they have been used several times) a disagreeable taste; this sack taste is very injurious to the quality of the wine. Cotton, which does not impart any bad taste, should always be chosen.

The lees from one vineyard, or from one cellar, can be pressed without any other expenses than the purchase of a sufficient number of sacks. The cloth should be fine, and have regular and tight meshes.

In order to arrange a cheap press for the lees, an empty barrel is taken, and its bottom staved in; this bottom is now fastened together by two crossbeams; when this is done, a little less than half an inch of wood is

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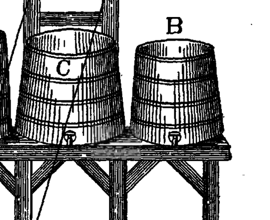

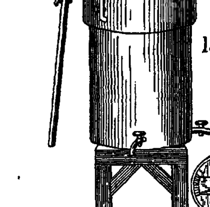

129. Press tanks and frames for lees. For description of its working see text. *A*, fulcrum for the lever; when it cannot be fastened to the wall, bars are placed in front or behind *B B*, for a similar purpose; the lever may then be used by the aid of blocks of wood in proportion as the contents of the sacks are compressed. When the apparatus is permanently established, a pulley is placed above the weight on the end of the lever, in order to hoist it when necessary; it is then sufficient to place new blocks of wood under the lever in order to reëstablish the pressure.

130. Closed wine filter. Closed filter lined with copper on the inside. This kind of filter has one, three, or five sacks, according to the diameter. These sacks are made of wool and sometimes of special tissues, according to the liquid to be filtered. They can be filled without the liquid coming in contact with the air, by means of an india-rubber tube with a stopcock at its end; this stopcock is attached to the filling-cock. A glass gauge is attached to the outside to indicate the contents.

taken off from the periphery of the bottom, so that it will easily go into the barrel, and thus answer for a cover. Afterwards, in one of the staves of the barrel, a gimlet hole is bored about half an inch above the bottom which remains, in a manner that this hole just touches the bottom in the interior of the barrel. Lastly, a stopcock is introduced into the gimlet hole. This barrel, which is destined to hold the sacks, is now placed alongside a wall on two barrels, which are covered with a board; if necessary, the barrel is raised to a sufficient height so that below the stopcock an empty barrel, destined to receive the pressed wine, can be placed.

In order to empty the lees into the sacks rapidly and easily, the full barrels are raised on a scaffolding, and emptied into the sacks. During this operation the sacks are held open by means of a piece of twisted wood; as soon as a sack is full, it is solidly tied up with a knot easy to undo again. In this way one sack after another is filled into the barrel until full.

During all this time the stopcock remains open, and the wine runs off in proportion as it is filtered into the empty barrel, which has been previously rinsed and sulphured.

When the barrel is filled with the sacks the cover is placed on top of them, and very gradually charged with weights; afterwards, the pressure is continued with a lever. The pressing of the lees should be carried on very gradually; thus, the lever should be used only after the sacks have been drained during several hours without the application of pressure; the lever should be also charged with weights after several hours; better still on the following day.

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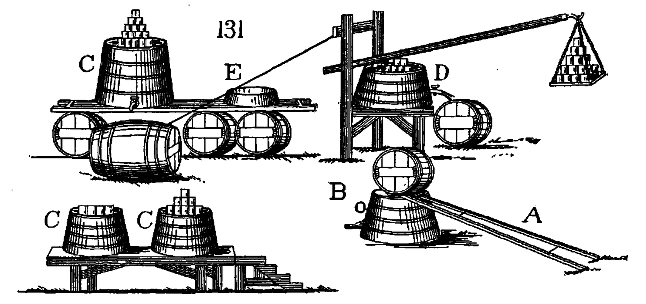

131. Filter presses; *a*, a bridge used for emptying the first lees in the tub *b*; in *c* is a utensil hooked to the pail—a kind of tin basin with double bottom of rectangular form—which possesses one or several iron rings which have the diameters of the sacks; *c*, *c*, *c*, these are small vats, which have an inner diameter of three and one third feet, and are about two to two and one half feet high; the first one contains about ninety gallons, and those which are two and one half feet high contain about one hundred and forty gallons; *d*, press for the lees with long lever; *e*, pail which is used for putting in the sacks, or to press them.

When there is no more liquid in the bags, which may be recognized when, notwithstanding the use of the lever, no more wine drops from the stopcock, the sacks are taken out of the barrel.

When the lees are not very compact there remains little masses of solid substance in the bottom of the sacks; in this case they may be filled again without taking out the solid residue and pressed a second time. After that they should be thoroughly rinsed. Lye should be never used for this latter purpose.

This simple arrangement, which does not imply any other outlay than the purchase of sacks, is sufficient for the small wine maker who wants to utilize the lees of his wines without incurring unnecessary expenses.

FILTERS.—It has been tried to filter the lees by using strainers of various patterns; some manufacturers of filters announce, in advertisements, that they extract by means of these filters *all the clear wine which is contained in the lees*. This is nonsense. All practical men know by experience that if a liquid is filtered which contains too much sediment, the filters are the more dirtied, and the more turbid and thick the liquid is; it follows that if the filters can be used to clarify the lees of old wines, these lees are practically nothing but *turbid wines*. But the real thick lees—lees from new wines and from those which have been treated with finings—are much more economically treated by the processes we have described above; if an attempt is made to filter such lees there remains on the strainers a kind of mud which contains still, on the average, 40 per cent of wine, which it would have been possible to extract by applying pressure.

DRY LEES.—The dry lees possess some value; they can be sold to the manufacturers of tartar, if they are made from the first lees; otherwise, they can be dried completely in the sun and sold to the manufacturers of pearlashes. But as the quality of these lees is rarely sufficiently

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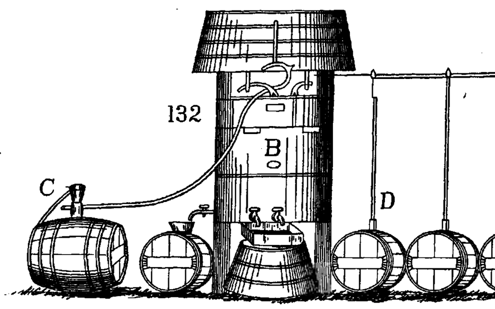

132. Automatic filter arrangement. The liquid is poured into the closed vat above, either by a stopcock above or from below, with the help of the forcing apparatus *c*; a gauge indicates the height of the liquid in the vat; regulating stopcocks slacken or stop the outflow of the liquid, according to the yield of the filters, which are located in *c*. The clear liquid flows out at *d*, and bungs of a special design distribute the liquid equally between several barrels which are placed on the same level; the liquid which runs off at the beginning of the filtration escapes through the stopcocks in front; if necessary, it is again forced into the apparatus by means of the airpump *c*.

high for this purpose, their sale would not cover the expenses of shipping, unless the manufactories are very near.

Pearlashes are nothing else but the ashes resulting from the combustion of the dry lees, which is effected in specially constructed furnaces. The lees of higher quality which have been dried completely, yield approximately one thirtieth of their weight of this alkali, which has a gray-greenish color. In case of necessity it is possible to manufacture pearlashes on a small scale without any special furnaces, simply with the help of a stove possessing a very large firegrate. In this case it is important to modify the stove in a manner such that the combustion of the dry lees, which is effected with difficulty under the ordinary circumstances, can be carried on with ease. This can be done by regulating the air supply, and by stimulating combustion through the addition of highly inflammable substances. If there is no market in the neighborhood for the ashes or for the lees, the latter can be used as a fuel by mixing them with coal. Dried in the sun and afterwards pulverized, the lees make also a powerful fertilizer, which is excellently adapted for meadows and all kinds of crops.

The dry lees which contain gelatinous matters, owing to the use of finings, burn only with difficulty in ordinary furnaces, because the gelatine has the property of becoming liquid as soon as the lees are heated, and thus the fire is extinguished. The lees which contain albumen do not show the same disagreeable quality, for albumen solidifies when heated. Anyhow, dry lees which consist partly of finings are less rich in pearlashes and tartar than the lees from wines which have not been treated with finings.

Pressed lees, and particularly the first lees from the sweet wines, contain considerable quantities of sugar, which is possible to utilize by fermenting and distilling. This operation can be profitably carried on only when their value as crude tartar is equal to zero.

TARTAR.—This substance can be extracted from the first lees after they have been dried. For this purpose the dry lees must be mixed with water. The process of extraction, however, requires manipulations, the details of which do not enter the scope of this work; we will only say that the tartar is much more soluble in boiling water than in cold water; this property is made use of to extract the tartar from the lees and to refine the crude tartar which is contained in the pressed lees, and which thus becomes *cream of tartar;* but the processes of extraction and of refining require a special plant, which costs a good deal of money; therefore, the wine makers generally sell the crude tartar to the refiners, who extract the cream of tartar.

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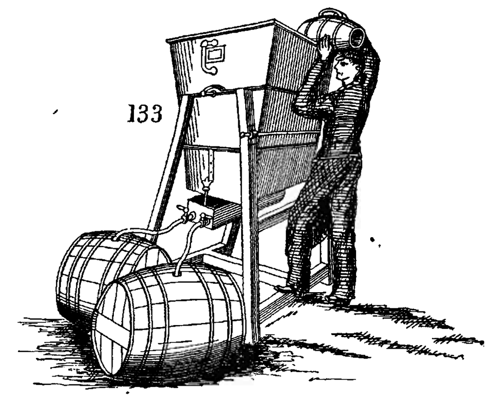

133. Filtering apparatus with frames. System of L. Mesot.

After the lees have been well mixed with water, the mixture is heated until the tartaric acid has been dissolved; often when the lees have remained slightly moist they contain still a small quantity of alcohol, which could be recovered by passing the first vapors which rise from the boiler through a worm, cooled by water. When the tartar is dissolved the liquid is filtered; on cooling, the tartar crystallizes out.

In order to accelerate the work, the water which has already given a crop of tartar is used again to leach out the lees. According to Batileat, who first tried to utilize the salts which are contained in the lees, the tartaric acid of the tartar can be obtained by transforming the latter into tartrate of lime. For this purpose it suffices to saturate with lime the liquids which contain tartar; thus a precipitate of tartrate of lime is formed. To sum up, it is possible to utilize in the following manner, and to extract from the lees according to their nature and consistence, the following substances: (1) clear wine by racking; (2) wine by pressing the lees; (3) alcohol by distilling the lees which have not been pressed; (4) pearlashes; (5) tartar; (6) manure; (7) fuel.

CHAPTER VII.

BLENDING AND THE BOUQUET OF WINES.

General remarks on the blending of wines. Flavor and natural bouquet. Artificial bouquet. Nature and composition of the bouquet.

GENERAL REMARKS ON THE BLENDING OF WINES.

The object of blending is:

1. To impart a uniform flavor to wines which possess the same character, which come from the same locality and sometimes from the same vineyard, but which have been fermented at different times.
2. To improve the wines by mixing those which possess opposite qualities and faults, *i. e.*, to give to a wine a quality which it does not possess, by mixing it with another that has an excess of this quality.
3. To compose good tasting wines from brands, each of which, if tasted separately, show some defect.

Blending which is done solely in view of saving money, without regard to the respective qualities of the wines which enter the blend, is not worth while speaking of. In most instances it will only prove harmful to the keeping qualities of the blend.

It is difficult to define precisely the kind of blending which a wine requires without first having tasted it, and without knowing for what use it is destined. Blending is mainly a practical business, which requires good judgment, and which should not be done haphazard.

BLENDING FINE WINES.—Great wrong is done to a fine wine which shows good promise for the future, and which dates from a good year, by blending it with other wines of a different character, particularly if the wine has not yet reached its maturity, and if its bouquet and flavor are not yet well developed. Experience has proved that such a wine, even if blended with old wines of good quality, never reaches the degree of perfection which it would have attained had it been left alone. It has been found that such a blend loses its fruity taste more rapidly, and is more apt to deposit sediments in the bottles. Nevertheless, it sometimes happens that such blending becomes necessary. This is the case when a wine has been kept too long in the barrel and has deteriorated by losing its fruity taste, thereby becoming harsh and dry. Blending also becomes necessary when the wine comes from an indifferent vintage, and when it is too poor in body or too tart or too weak to keep a long time without deteriorating. If the wine has deteriorated by having been too long in the barrel, it will be necessary to blend it with wines of the same kind, which, if possible, should come from the same vineyard. They should be also at least one to two years, and at most three years old, and should be very mellow. As to the quantity of the wine which has to be used, it should vary according to the degree of the deterioration of the old wine, and the time which it is intended to keep the blend without using it.

When wines which are low in body and in alcohol have to be treated, their keeping quality being doubtful, they should be blended with young and strong wines which are rich in body, and those which, if possible, possess the same flavor.

What we have just said applies only to weak, delicate wines which possess flavor and bouquet, but not a very decided tartness. As far as the weak and tart wines are concerned, wines which promise well should not be sacrificed to fortify such wines, for the excess of tartaric acid which the tart wines contain would entirely destroy the mellowness of the wine used for blending.

Before blending the wines which are too tart with other wines, it is advisable to neutralize their excess of tartaric acid in the manner already described in the chapter on the *Treatment of Faulty Wines*.

In blending wines of a high quality we should observe the following:

1. Do not leave them in prolonged contact with the air during racking.
2. Do not blend them with wines which are yet "working," which taste sweetish, or are somewhat faulty.
3. Do not leave them to themselves if they are not perfectly bright.
4. Avoid using large quantities of finings on wines which are low in alcohol and tannin. After having been blended with stronger wines, these weak wines should be well stirred, in order that the mixture should become a complete one; they should be always clarified with albumen; the whites of not more than five or six eggs should be used.

Blending Ordinary Wines.—We have said already that the object of blending is to improve the wines. We must, therefore, by means of blending, try to impart to ordinary wines the qualities which are prized in wines of high quality. It is known that these latter differ from ordinary wines by the suavity of their bouquet and their flavor—by their mellowness and the fruity taste which they retain when aging. The ordinary wines (we don't speak here of wines which are faulty, but of indifferent brands, which are met with in many wine-growing districts), which contain sufficient alcohol to prevent them from spoiling, but which do not possess either bouquet or any decided flavor, have seldom a fruity taste. It happens sometimes that they are mellow when new, but rapidly lose this quality, and become dry in their second year.

It is therefore desirable to impart to them, by the aid of convenient wines of the same age, bouquet, flavor, and mellowness, or at least to deprive them of their dryness, which process is a difficult one. It is, however, possible to reach the desired aim approximately, by blending such dry wines with wines from the same vineyard which possess a decided bouquet and flavor. All these operations are of a very delicate nature, and it is impossible to give any definite rules, on account of the great variety of wines.

Artificial Bouquets.—Artificial bouquets are made by the addition of aromatic substances of essential oils, from which the aroma is extracted by means of alcohol. The extraction of the aromatic principle can be either by digestion, distillation, or by means of non-volatile oils, which are afterwards dissolved in alcohol, etc. After all, these processes differ according to the peculiar character of the aromatic substances which are employed.

The aromatic substances which are mostly used to impart an artificial bouquet to dry wines are, if we begin with the most common and most powerful ones: iris root, raspberry, vine blossom, clove, reseda, muscat nut, bitter almond, sassafras, etc. The last mentioned substances are rarely employed alone, and play only a secondary part. They are

usually mixed with iris or with raspberry, the aromas of which are quite distinct.

Iris.—There are two varieties of iris. Only the roots are used, which are white, and have a diameter of at least three quarters of an inch. They possess very irregular and distorted forms, and occur in the trade in pieces, about two inches long, which are now freed from the rootlets. They are particularly used in perfumery.

The Florentine iris root, which grows in Italy and the south of France, has a distinct odor of violets. The German iris is often sold under the same name; a variety which grows in the north of France, Germany, etc. The form of the roots is approximately the same, but the connoisseur has no difficulty in distinguishing the German from the Florentine iris; the latter possessing a less glossy and fatty texture, a greater number of rootlets, and particularly a much more penetrating odor.

The aroma of iris can be extracted only with difficulty and incompletely by distillation. It is also obtained by infusing the roots in alcohol, after having reduced them to a pulp by means of a rasp. This operation is very tedious, but indispensable. Iris can also be obtained in commerce in the form of a powder, but when the roots have been powdered long since, they have generally lost a part of their aroma; sometimes, also, the powder of the iris is adulterated with foreign substances.

Tincture of iris is prepared according to the following prescription: Spirits of wine (85 degrees), two and one fifth gallons; Florentine iris, two and one fifth pounds. The vessel containing the mixture should be corked, then shaken for some minutes, and placed in a spot where the temperature is not below 68 degrees and not above 95 degrees. The liquid should be shaken from time to time during a fortnight; then the residue is filtered and pressed. This tincture has a distinct odor of violets, and a harsh and bitter aftertaste.

In order to impart a bouquet to the wine, the tincture of iris can be used alone in very small quantities; rarely more than one tenth of a pint to twenty-two gallons of wine are used. Very often some few drops of essential oil of cloves, or of some other aroma, are added.

Raspberries.—The preparation of alcohol with the flavor of raspberries is very simple. Ripe raspberries are chosen, picked over, stemmed, and introduced into a barrel with a large bunghole. Twenty-two pounds of the berries are mixed with two and a half gallons of spirits of wine (85 degrees); they are macerated for twenty days, then the liquid is drawn off and filtered. Thus obtained the liquid possesses a very agreeable aroma and a rosy color. Now the berries are crushed, a new quantity of brandy (strength 50 degrees) is added, and the maceration continued for a month; after that the residue is pressed. This second extract has an odor and taste less delicate than those of the first extract; it is also deeper colored. This liquid should be filtered, or, even better, distilled on the water bath; thus the essence of raspberry is obtained. The first extract is preferable in all respects. This aroma is generally used alone; a good deal of it is used in the manufacture of sparkling wines. Sometimes other aromas are mixed with the essence of raspberries. The quantities of raspberry essence which are used to impart an artificial bouquet vary, according to the flavor of the infusion, from one twenty-fifth to one fifth of a pint to twenty-two gallons of the wine.

Essence of Cloves.—The essential oil of cloves can be extracted either by pressure, maceration, or by distillation. In commerce, this oil occurs under the name of *essence of cloves.* To produce the bouquet this essence or concentrated spirits of cloves are used. To obtain the latter, crushed cloves are distilled with alcohol of 85 degrees. The proportions are ten ounces of cloves to one gallon of alcohol. In default of a still, the aroma can be extracted by infusion, macerating three ounces of crushed cloves in one quart of alcohol of 85 degrees. The mixture should be stirred and filtered at the end of eight days.

Essence of cloves alone is seldom used. By adding a very small quantity of this aroma to the iris extract, a good result is obtained, and the perfume mixes better with the wine, because the essence of cloves is heavier than water.

It must be said, however, that it is never desirable to have the aroma of cloves the prevailing one.

Vine Blossoms.—This perfume is collected while the vines are in bloom. The blossoms are extracted with alcohol of 85 degrees; three ounces of blossoms to one gallon of alcohol are used. After eight days the liquid should be filtered or distilled on the water bath. This essence, which is very volatile, is used in the proportion of one tenth of a pint to twenty-two gallons of wine.

Reseda.—It is difficult to obtain the essence of reseda; the flowers should be picked off the stems and put on cotton or pieces of wool, which have been impregnated with oil. This oil should not be allowed to become rancid (ben-oil is chiefly used for this purpose); the flowers are renewed at the end of four days until the cotton or wool is very fragrant. It is pressed afterwards and the oil shaken with alcohol of 85 degrees. The essential oil dissolves in the alcohol, which is afterwards separated from the ben-oil. Thus a reseda extract is obtained which is used in quantities of one tenth of a pint to twenty-two gallons of wine. Most frequently it is *mixed with other perfumes.*

Muscat Nut.—Muscat nut is used, either in the form of the essence, which is obtained by distilling over a fire, in quantities of half a pound in two and one fifth gallons alcohol; or in the form of extract made in the same proportions.

Bitter Almonds.—The aroma of the bitter almonds is due to one of the most violent poisons (hydrocyanic acid). It is extracted by different methods. The essence occurs in commerce. It should be used in infinitely small quantities.

Sassafras.—The wood and bark of sassafras, rasped or in shavings, come from the sassafras tree, which grows in America. They possess a sweet odor, and contain an essential oil, which is extracted by distillation, and which is also met with in the trade.

We have tried to use other aromas; but they are only useful as auxiliaries of the three first mentioned—iris, raspberry, and clove—because their odors differ considerably from the natural bouquet of mellow wines.

All these preparations only give to the wine a bouquet and an aroma which is peculiar to the substances used. They can never impart the real bouquet which characterizes our fine wines; it is impossible to imitate this bouquet, and one may only succeed in flattering the sense of smell. The artificial aromas are very volatile, and it is even not necessary to be a connoisseur in wines to recognize them. Nervous persons are even inconvenienced by them, particularly if the aroma is very strong.

When an artificial bouquet has been added to a wine, it will still retain its peculiar taste; the odor is changed; but taste the wine without smelling it and you will recognize its peculiar flavor. The artificial bouquets do not keep as well as the natural ones, and they even decrease gradually in strength. In the course of time they volatilize, contrary to the advertisements sometimes published by interested parties who sell them.

The trade journals abound with advertisements of persons who pretend to be wine experts, chemists, etc., and who manufacture bouquets bearing the pompous names: Flavor of Medoc, Bouquet of Bordeaux, of Pomard, Extract of Bordeaux, etc. All these products of charlatanry are advertised as imparting to the most common wines the true flavor of Medoc, as improving and strengthening the wines, etc.

In the wholesale and retail trade of France, irisated wines are rarely met with. It is true, some merchants and wine makers use the iris to improve their poor wines; but a poor wine will always remain a poor wine, because it has no flavor and strength, and because, notwithstanding the advertisements, the *flavor of Medoc* has given them no flavor; this is, by the way, very fortunate for the vineyardists of the Medoc; for nothing else would be left to them, but to burn their vineyards if it were possible to impart the flavor of the Medoc to wines of the poorest class.

Upon the whole, the use of artificial bouquets is a process of improvement which does not come up to the practice of blending with wines which possess a good deal of bouquet and flavor—among these latter certain old white wines occupy the first rank. Among the artificial aromas, the alcoholic infusion of raspberries is the one which modifies the taste of the wines in their first years most successfully.

CHAPTER VIII.

THE SOPHISTICATION OF WINES.

General observations. Means of detecting sophistications. Artificial coloring of wines.

What has not been written on "the adulteration of wines in the trade!" The wine merchants of the great consuming centers, particularly those of Paris, have been accused of the most culpable frauds, as for instance of manufacturing wine without grapes, fermenting solutions of sugar and tartaric acid and coloring these liquids by extracts of logwood. It has also been said that the harshness imparted to the mixtures by artificial coloring matter was neutralized by the addition of litharge.

These accusations seem false and exaggerated. The authors, who say those things without weighing their words, ought, before making such statements, to consult the official tasters of wines and the chemists—whose duty it is to analyse the seized wines—and the decisions of the Courts. They could also satisfy themselves by an experiment that such a mixture does not possess the taste of wine, and that they can thus form nothing but a disgusting beverage and a violent poison. It is besides an easy matter to detect such fraud, in that it is sufficient to pour a few drops of sulphuretted hydrogen-water into a wine which contains litharge in order to obtain a black precipitate, or at least to impart to the liquid a brownish color.

There are undoubtedly sold in Paris wines of very poor character and wines which are very weak. There may be found in the records of the Courts many judgments against merchants who were guilty of having sold wines which contained a greater or smaller admixture of water. It is seldom that the chemical analysis of the wines seized reveals in them unwholesome matters. There have been, however, effected seizures from the stock of ignorant merchants who had no idea of the composition and of the treatment of wines, and who had therefore used, to impart color to their wine, mixtures of alum or other substances; but, truly speaking, they did not know the properties of these substances.

On the whole, those having in charge the ordinary wines retailed by the great firms in Paris, know that no wholesome substance can ameliorate a wine, nor even conceal its defects. More than three fourths of the sentences for adulterations are based on the admixture of water to the wines.

We can positively state that in the viticultural centers of the Gironde and in the neighboring wine-producing countries, the wine producers and merchants are too much interested in finding the best possible means of producing good wines, to spoil them by sophistication with unwholesome substances, the use of which does not even conceal their defects. There are found, however, in certain places, wines with a very low percentage of alcohol, which possess a too *smooth* taste. These wines are often diluted by an admixture of very weak wines or "piquettes," sometimes of water; but this kind of adulteration is to be met with only among very common wines which are destined for the provincial retail trade. Producers of good brands know by experience that such dealings would close the markets for their wines, instead of bringing them a profit. This accounts for the fact that in the markets of Bordeaux and of the south of France, sophisticated or simply watered wines are so seldom met with; but notwithstanding this, we are going to point out the most practical methods of detecting these frauds. We must first state, however, that all these methods are of little use to the men who are themselves in the business, for by tasting, by distilling the wine in small stills, and particularly by comparing the samples with faultless typical wines, they can guess the nature of the fraud, though they cannot determine exactly the quantity of the admixture. The adulterated wines met with most frequently, particularly those which are found in countries where wines are rare and high priced, are: 1, wines which have been diluted with water; 2, artificially colored wines; 3, natural wines mixed with fermented liquids, which are made from sugar, glucose, brandy, cider, etc.

One must have a great deal of experience in tasting in order to be able to define exactly the kind of admixture. This is particularly difficult in cases where the quantity of the admixture is small, or when the sophisticated wine has been made a long time ago and since fined. In such a case the mixture has become more intimate and a good part of the insoluble matter precipitated.

Diluted Wines.—It is possible to recognize a diluted wine on tasting, if one has an experienced palate. This kind of wine is thinner, and the more water added the less bitartrate of potash and other organic salts they contain in proportion. In Paris the tasters, who are commissioned by the police department to inspect the liquor trade, enjoy a

somewhat discretionary power, so far as the provisional seizure of wines is concerned. They have the right to seize every wine which they think is diluted with water, whatever its alcoholic strength may be; otherwise, many of the retailers would think it feasible to dilute wines which contain from 12 per cent to 14 per cent of alcohol, to an average strength of 9 per cent to 9½ per cent, and would consider themselves safe from legal process, under the pretext that the wines of the central provinces of France do not contain much alcohol; but the administration justly punishes the fraud whenever it detects the presence of water, even if the alcoholic percentage of the diluted wine is higher than in the ordinary wines. A warning to the perpetrators of frauds!

It is possible to ascertain exactly the quantity of water with which a wine is diluted, by evaporating a portion of the same to dryness. In the residue will be found (together with the organic salts which each wine contains) the lime salts which were in the water that was added. If the chemical composition of the water is known, it is an easy thing to calculate, from the weight of the lime salts present, the quantity of the water of dilution. If the water was added recently the analysis gives positive results; but in case it has been added long ago, so that a portion of the salts has had time to be precipitated, the results of an analysis are less trustworthy. At any rate, it is a delicate operation, which can be done only by an experienced chemist. If the water which has been used does not contain any lime salts, but the same salts which are peculiar to the wine, the tasting and the chemical analysis can give but certain results.

There are certain countries, far distant from wine-growing centers, where much diluted wine is met with in the trade. Particularly in the colonies, a great many wines from the south of France are sold, which are diluted with water and artificially flavored. These wines are sold under the name of "*petit Bordeaux*" (little Bordeaux).

If distilled water has been used for the purposes of dilution, it is, unfortunately, very difficult to detect the fraud.

Artificial Coloring of Wines.—In the vineyards of southern France no artificial substances have been used for imparting color to the wines, because the "black" wines, *i. e.*, those which are deeply colored, abound. In certain regions of central France and of foreign countries, colored infusions are made use of. Such infusions are made from elderberries, etc., sometimes with water and sometimes with alcohol. The manufacturers add to these infusions a strong dose of alum in order to revive and to preserve the color, which otherwise would soon become insoluble. Such infusions or "lakes" become very unwholesome through this addition.

Besides fruit juices as coloring matters, there have been used extracts of beet roots, of litmus, of cochenille, of tincture of orchil in paste, of cudbear (coloring matter extracted from orchil), of the leaves of the red marsh-mallow—and besides a great number of blue vegetable colors which are turned red by tartaric acid: ammoniacal cochenille, specially prepared caramels, called "colorine of aniline," etc.

These various organic or mineral colors cannot preserve, in most instances, their red tint as long as the natural color from the skins of the grapes. In the wines, they are rapidly precipitated with the lees, and are always injurious to the frankness of the taste. Many of these artificial colors require an addition of alum, and the result is that they become unwholesome. Sometimes foreign wines are met with, and imitations of sweet wines, which are colored with the help of ordinary caramel. This substance has the inconvenience of imparting to the wines a taste which is not very agreeable, and sets them to fermenting if they do not contain enough alcohol. Still it is not unwholesome.

On the whole, as we have already said, white wines which are artificially colored cannot become red wines if they lack in tannin; they neither possess the taste nor the composition of red wines, and a trained eye and palate recognize easily either their artificial color or their characteristic taste of white wine. Certain unwholesome colors, in the composition of which arsenic enters through fuchsine, do not differ in their tint from the new wines, and do not leave a bad taste on the palate; but they separate out very rapidly, and besides, it is very dangerous to use them.

M. Fauré, the able chemist, who has analyzed the principal wines of the Gironde, gives a simple and easy method of ascertaining the presence of artificial colors. According to this authority, it is only necessary to add a little tannin to the suspected wine, and to treat it with a big dose of gelatine. If the color of the wine is natural, this treatment will decrease its intensity, while organic colors which do not have their origin in the skins of the grapes, are not affected. Unfortunately, in the majority of cases, the sophisticators use the artificial colors as an auxiliary, in order to increase the natural color of the blends made from various wines; the addition of a small quantity of foreign matter is in such a case very hard to detect.

The considerable difference which exists in the values of ordinary white wines and of red wines with a fine color (sometimes the latter commands double the price of the former), keeps a great number of wine makers busy looking for artificial colors to change the white wines into red ones; and it can be said that this is the sophistication which is most commonly met with, particularly if the prices of the wine are high and the vintage was a poor one. The trade should be on the lookout, and not only refuse to handle the wine, the genuineness of whose color is suspected, but should also cause analyses to be made of all questionable samples. We have already given one method of testing. Mr. Schrader has also given, at a conference which took place in Bordeaux, in February, 1874, a process for the detection of artificially added colors in the wine. It is remarkable for its simplicity, and is based on the fact that most of the artificially added colors, instead of combining with the wine, mix only, more or less intimately with the same, and remain quasi suspended in the liquid; so that by changing the density of the latter very gradually, they separate out.

This is the way the experiment is conducted: A small flask is filled with the suspected wine and suspended as straight as possible by the neck with the help of a string, then it is slowly lowered into a great flat-bottomed glass three quarters full of water. Care should be taken not to shake the water; also, the height of the latter should cover the open neck of the flask. Owing to the fact that it is specifically lighter, the wine rises slowly to the surface, where it forms a distinct layer. If the red wine is pure, the water at the bottom of the glass remains colorless; if it is artificially colored, the color diffuses, on the contrary, throughout the liquid, and the water at the bottom of the glass appears colored.

In order that the experiment should succeed perfectly, the density of the wine should be taken into account. Its specific gravity must be less than that of the water, as is generally the case with ordinary wines; but for sweet wines, which are heavier than water, this test cannot be applied in the same way. In this case it would be necessary to immerse the flask with the neck downwards to the bottom of the glass; the wine would sink to the bottom, and if the color were artificial, the diffusion of the same would take place from the bottom to the top.

Certain wines, which have a very deep natural color, give doubtful results, if they are very new, even though they may be pure. This is due to their specific gravity, which does not differ much, and sometimes not at all, from that of the water. More trustworthy results will be attained by clarifying and fortifying the samples of wines which are too young.

The different coloring matters which are introduced into the wine possess different tints, and may be recognized by various reagents. In the following is described the peculiarities of artificial coloring matters commonly used in our day:

Red Caramel, or Colorine.—This substance has the consistency of a thick syrup. Before adding to it the wine it may be dissolved either in water, white wine, or in alcohol. Its tint is not changed. The liquid may be neutral, as ordinary water, or strongly acid. The coloring power of this substance is very great; three pints of it are sufficient to impart a deep color to a barrel holding fifty gallons. The tint which is obtained by the use of this substance does not show, even to the best trained eye, any difference from the natural color of a fine new wine. It is a frank wine—red, wherein no violet tint predominates. So far as the taste is concerned this substance does not possess either that of the ordinary caramel or any other appreciable taste. The samples which came under my observation were sent from a manufactory in the department of the Seine-Inferiéure.

The white wines which are colored with this substance show a peculiar behavior. They are tolerably clear, if the artificial color has not been introduced too long ago; but on being mixed with red wines of natural and light color, they become turbid, and by the process of fining a large portion of the color is precipitated. It can be easily recognized in the lees, which have a slimy appearance.

The chemical analysis of this substance has been made officially on the occasion of a lawsuit before the Court of Libourne. The case originated under the following circumstances: Several soldiers in the garrison of Libourne showed symptoms of an indisposition which puzzled the medical men. These latter investigated the reasons of this indisposition, and came to the conclusion that it was due to the partaking of an excess of unwholesome wine. Samples of wine were taken from the places the soldiers used to frequent, and it was found that the wine was colored artificially. Analysis demonstrated the presence of fuchsine and of arsenic in the substance. The retailer had bought these wines from a wholesale house which had used this substance believing it to be harmless, as advertised and commended by numerous medals which the manufacturer had obtained for the preparation at different exhibitions.

This substance has been investigated by several chemists—among them M. Carles, apothecary in Bordeaux, who characterizes it in the following terms:

"On calcination this coloring matter yields a little ashes, which are neutral, and consist almost exclusively of oxide of iron and sulphate of lime. The color of the preparation becomes yellow by the addition of alkalies (potash, ammonia), or of mineral acids (sulphuric, chlorhydric); it is not affected by perchloride of iron. Treatment with alkali, ether, and acetic acid, show it to be composed of caramel, glucose, and a salt of rosaniline."

The rosaniline of commerce often contains arsenic, and it is therefore dangerous to use this substance.

It can be recognized by M. Fauré's method, which consists in discoloring the wine by treatment with a strong dose of gelatine.*

A sample of the suspected wine is well shaken with the same volume of gelatine solution, and then filtered; the pure wine loses its color almost entirely, and turns decidedly green on the addition of volatile alkali (ammonia). On the other side, the wine which is colored by the rosaniline caramel is not changed by alkali, but according to M. Carles it regains its color on addition of an excess of acetic acid (white vinegar).

Elderberries.—Since the last century dyes have been manufactured from elderberries; they have been particularly used to color champagne of a pale red color. The manufacturers add to these dyes alum, in order to make the color more stable; but there is not enough of it manufactured to bring it into common use among the makers of white wines. M. Carles makes use of the following method to recognize the presence of the extract of elderberries. He takes a white porcelain pot, or large coffee cup which holds half a pint of water; pours into the water thirty to seventy-five grains of the suspected wine, and stirs the mixture with a spoon. The wine which contains an admixture of the extract of elderberries, turns green after a few minutes, while the mixture of pure wine and water does not change its color. Likewise those which are colored by "colorine," rosaniline, and cochenille. The wines which are colored with elderberries turn distinctly green on addition of volatile alkali; give, with acetate of lead solution, a pale red precipitate, and become blue on the addition of acetate of alumina. When the extract of elderberries does not contain alum, it is not unwholesome; but it imparts to the wine a strange taste, besides the color has too much of a violet tint, and is not durable.

Bilberries.—Their color is not a frank one; it is a red which can be recognized at the first glance, which has little intensity and not much brilliancy. It turns green on addition of acetate of alumina. Its presence may be recognized by the experiment we have mentioned in the beginning of this chapter.

Ammoniacal Solution of Cochineal.—The color which is obtained by the use of this substance is not frank; it is changed by tartaric, acetic, and other acids from violet to a brick-red. The orchil, the cudbear, and logwood extracts show the same peculiarites. These coloring matters dissolve in alcohol, and impart to it a violet tint, which changes into a

* M. Carles has obtained the same results by using albumen; he uses the half of the white of an egg well beaten with its own volume of water, on three ounces of wine which is to be treated.

frank red on the addition of a little sugar-caramel. In the wine, the presence of the organic acids changes this tint into brick-red in the case of the three first colors, and to yellow in the case of the latter. M. Carles pours ten to twenty drops of the wine which is thus colored into a porcelain dish holding half a pint of water. After a quarter of an hour the wine has assumed a violet tint, owing to the presence of the bicarbonate of lime in the water. In summarizing, we must say that wines which are colored with the above substances are not salable.

Aniline Red.—This color is somewhat related to the caramel we have spoken of, and contains always more or less arsenic; it is therefore unwholesome. This red has a very brilliant tint, and a mixture of the same with caramel from molasses is the most powerful coloring matter known. M. Falières, of Libourne, has invented a very sensitive method of detecting it: seventy-five to ninety grains of the suspected wine are introduced in a flask which holds a little less than two cubic inches; a small excess of volatile alkali is added, and the flask filled up with pure ether; after shaking the mixture well it is allowed to settle. The colorless base, *rosaniline*, dissolves in the supernatant ether. A portion of this ether is decanted into another flask, and some drops of acetic acid (white vinegar) are added. If the wine contains rosaniline, the ether will assume a pale red color. The reaction will be much more distinct if the ether is shaken with a few drops of water, which takes up all the color. This color shows the same behavior as the red caramel we have spoken of, and separates out of the wine in the same manner.

It is evident from all we have said that *none of these colors are stable*, and that a great number of them are unwholesome. The wines which are colored by these artificial means are in most instances the worst kind of white wines.

MIXTURES OF FERMENTED LIQUIDS.—It has been sometimes found that certain wines contain an admixture of cider; of liquids fermented from glucose syrups; of weak brandy, etc. These different mixtures can be easily recognized on tasting if they form a considerable part of the wine. The difference in the composition of the residues or of the extracts indicates to the chemist which of the foreign matters has been introduced.

All of these fraudulent processes are punished in France by the law as falsification of food.

Besides falsifications, giving a wine a false name and false origin constitutes an offense which is punished by the law, because, of whatever the quality the merchandise may be, there is an imposition practiced on the quality of the goods sold. The habit of the public in designating certain goods by the name of the country which produces the best quality, seems to excuse, in a measure, this giving of false names, but a merchant who possesses any self-respect would blush to designate ordinary wines by the names of those celebrated. They know that by cheating their customers they expose themselves to the danger of losing both reputation and trade.

CHAPTER IX.

COMMERCIAL ANALYSIS OF WINES.

Physical properties and commercial value of wines. General composition of wines; their chemical analysis, etc. The component parts of the wine considered separately. The physical analysis of wine. Analysis of sweet wines and cordials.

PHYSICAL PROPERTIES AND COMMERCIAL VALUE OF WINES.—The physical analysis of wine consists in the judgment of a connoisseur, corroborated by the use of scientific instruments. With the help of a trained palate it is possible to recognize by the looks, odor, and taste the different and slight gradations, qualities, color, flavor, bouquet, mellow or faulty taste, and likewise the defects of wines.

Fine wines of the highest quality can be appreciated only by the connoisseur. Qualities which are particularly appreciated by trained connoisseurs, and which in the aggregate make a perfect wine, cannot be measured and defined by chemical means. These qualities consist chiefly in the intimate combination of the elements which compose the wine, in the fineness of the bouquet, combined with a decided and sweet flavor, a mellow, velvety taste, and a brilliant color. Chemical analysis can give but a very poor idea of these qualities unless aided by tasting. This is so very true, that between the analysis which the most skillful chemist can make of our finest, but *young* red wines, and that of the ordinary wines from the south, which have gone successfully through vinification, and which have the same alcohol-percentage, there would exist but apparently unimportant differences, while in reality the value of the first wine may be twenty times greater than that of the other.

GENERAL COMPOSITION OF WINES, THEIR CHEMICAL ANALYSIS, ETC.—The complete chemical analysis of a substance consists, as is known, in isolating the principles or elements which compose it; in a word, to decompose it. A great number of chemists have devoted their attention to the more or less complete analysis of wines of all kinds. Chemists and observers agree that all natural wines contain about the same elements. The analysis of a good, ordinary wine can be summarized thus: it contains per liter, alcohol, 10 per cent; water, 90 per cent; extract, about 20 grammes. In this extract are contained the coloring matters, the organic salts, of which the principal is the tartar (bitartrate of potash), which alone represents a weight of from five to six grammes; mineral salts, acids (tannic, acetic, carbonic, tartaric, etc.); traces of ethers, aldehyde, essential oils; mucilages, pectine, and ferments. These substances are met with in various wines. The exact knowledge of the combinations formed in wines, and which impart to them their various flavors and bouquets, is still very imperfect. It is possible or has been thought possible to analyze more or less completely these compotent parts, but their synthesis has not been effected up to the present day.

The analysis of wines cannot be carried on in the same systematic manner as that of inorganic matters. Those who have devoted themselves to œnology know, that from the moment fermentation has transformed the must into wine, and until it begins to decompose, continuous changes go on in its taste, color, flavor, bouquet, and general composition.

On tasting a well made wine which is several years old, it is possible to recognize that certain substances which it contained originally have vanished; but as a result, compound substances which did not exist before have been formed; they impart to the wine a flavor and bouquet which are entirely different from those it had on leaving the fermenting tank. A portion of the organic and mineral salts, ferments, organic albumen, coloring and mucilaginous matters, various acids, tannin, etc., have been eliminated, either owing to the natural clearing, or to treatment with finings, or to racking. These slow but progressive, and, so to speak, daily changes, make a regular analysis impossible, because a majority of the substances which compose the wine are liable to become precipitated and form compound bodies, or to become insoluble. The alcohol combines with the acids, forming ethers, which produce the bouquet that did not exist before. On account of these constant changes it is impossible to define precisely the composition of a wine, and even in the most complete analyses there are many things which escape the notice of even the most attentive analyst.

It is also known that the composition of the same brand varies with each vintage, according to the degree of maturity, the stock and age of the vines, the duration and processes of vinification, the various methods of treatment, etc.

THE COMPONENT PARTS OF WINE.—From the commercial standpoint, the object of vinification should be to obtain wines which contain a sufficient quantity of preserving elements to fit it for good keeping and proper aging. The chief preservative elements of the wine are alcohol and tannin.

Alcohol.—The general properties of alcohol are well known—it imparts to the wine strength, heating, and intoxicating qualities. The maximum of alcohol which a wine can attain by the fermentation of rich musts is between 15 and 16 per cent. If the percentage is a higher one it is *due to the artificial addition of alcohol.* In proportion as the wine ages a portion of the alcohol evaporates, or it may become oxidized, and form acetic acid if too much exposed to the air. But when the wine is too old, when it degenerates, the alcohol undergoes a total decomposition without coming in contact with the air. This alteration has been particularly noticed in bottled wines.

Tannin.—Tannin or tannic acid is, after the alcohol, the most useful element in the preservation of wines, in the union of their component parts, in the maintenance of the coloring matters found in solution. It eliminates the ferments by forming with them insoluble compounds; it promotes the clearing of wines by combining with the finings and particularly with pure gelatine. Tannin is a substance of astringent, harsh taste, which is met with in several plants and which occurs in various forms—according to its origin. It is found in large quantities in the stones, skins, and stems of the grape, in the bark of the oak, in the gall-nut, quinine, caoutchouc, and in many other substances.

This substance is frequently used in medicine and the arts. As medicine, the tannin from gall-nuts is most frequently used. In trade two varieties of tannin are met with, whose difference is produced by the method of extraction employed. Gall-nut tannin extracted by ether is purer, but often retains an ethereal odor and taste. Tannin extracted by alcohol has no odor and should be preferred for the treatment of wines.

As it is sometimes difficult to obtain this substance in places distant from large cities, it is possible to introduce a large quantity of tannin into ordinary white wines by using the tannin which is contained in the grapes. This tannin can be obtained by extraction with boiling water. For this purpose we use seeds which have not yet undergone fermentation. For this purpose they are roughly crushed and boiled in a kettle for several hours. Afterwards the water should be decanted, and if not immediately required for use, should be fortified with alcohol up to 17 degrees. The liquid should be filtered and will then keep very well. If it is desired to increase the tannin in ordinary white wines, about forty pounds of crushed raisin seeds are introduced into a barrel of clear wine, which should be at least one year old; after two months draw off the wine.

In case it be found impossible to obtain grape seeds, oak bark can be used; either digest it in the cold with white wine or infuse with hot water. Oak bark has a rather strong woody taste. When possible, it is more advisable to use grape seed, which imparts to the wine a natural astringency. It is possible by studying varieties to increase in a natural way the quantity of tannin without using artificial means, and that is in all respects the best plan.

Among the varieties which are grown in the Gironde, there is particularly one which contains in its seeds and skins a considerable quantity of tannin. This is the *Verdot* (particularly the *Petit Verdot*). Wine makers who produce mellow wines, difficult to preserve and export, may improve brands by introducing into their vineyards a certain quantity of this excellent variety; particularly if they have spots well exposed to the south, for this variety matures rather late.

The barrels have also a great influence on the quantity of tannin which a wine contains. For those poor in this substance, new barrels from Bosnia oak should be selected, and rinsed simply with cold water. Barrels which are made from American woods, or which have already done service, should never be used in this case.

The fermentation of mellow wines should not be conducted in the same manner as that of the wines which we wish to become rich in tannin. In the latter case the grapes in the fermenting tank should be completely crushed, the stems should not be removed, and they should be kept immersed in the must during the whole period of fermentation, which should be attentively watched in order to draw off the must as soon as it is over. The supply of tannin may be recognized as inadequate if gelatine remains suspended in the liquid. White wines which have undergone fermentation in old barrels are generally those most lacking in tannin. Red wines generally contain enough tannin, owing to their long contact with the pomace in the fermenting tank, particularly if *new barrels made from oak* have been used. In wines of high quality, which are destined for bottling, an excess of tannin would impart too much harshness; this inconvenience can be avoided by stemming the berries completely before fermenting; avoid, too, as much as possible, their crushing, and draw off the must as soon as the first violent fermentation is over. If a wine contains too much tannin it has a harsh and rough taste during the first years; but after awhile this substance becomes precipitated, perhaps by forming insoluble

compounds, or even becoming transformed, as is generally suspected, into gallic acid. It is easy to precipitate a large portion of the tannin from wines which are too harsh, and which are destined to be used immediately. But this should never be done with wines destined for a sea voyage, or which are light colored, because, though the removal of the tannin helps to age them, it has, also, the disadvantage of discoloring them.

Free or Combined Acids.—The taste, the flavor, and the bouquet of wines can be modified by the free acids, the essential oils, the ethers, and by the various compounds which they contain, or which are being formed. The free acids which have the greatest influence on the taste are tartaric, malic, and several other higher acids, which are formed before the wine reaches its maturity, as well as acetic and carbonic acids. The two first mentioned acids are found particularly abundant in the imperfectly ripe grapes, and they impart to the wine a taste of harsh tartness.

Acetic acid develops chiefly in wines whose vinification has been faulty and neglected.

Carbonic acid is found in new wines which undergo an after-fermentation. This acid, which imparts to the sparkling wines the property of foaming, should be removed from mellow wines which are intended to be aged under proper conditions.

Flavor and Bouquet.—Flavor differs materially from bouquet. The flavor is an aromatic taste which may be agreeable or disagreeable, and which is judged by the palate. Bouquet, or aroma, is an odor, and can be appreciated only by the sense of smell. The flavor of each kind of wine, which is the characteristic taste, is appreciated when the liquid is introduced into the mouth, just as any other kind of dish is tasted. The non-odoriferous substances are those which contribute to the formation of the flavor. This is the reason why a wine may have a flavor and a sharply defined taste, but no bouquet.

The cause and origin of flavor is due to the particular taste of the different grape varieties in conjunction with the modifications which may be produced by the nature of the soil, by the site of the vineyard, methods of vinification and of conservation.

There is not much known of the formation of the bouquet. Certain œnologists believe it to be due to the essential oils which are chiefly contained in the skins of the grapes, and which, it is alleged, are dissolved during the process of fermentation. We do not exactly share in this opinion. We do not say that the skins do not contribute to the modification of the aroma, and consequently of the bouquet; but we do not admit that the bouquet has its seat in the skins, like some of the essential oils in the skins of certain fruit. That being the case, the wine would have a bouquet on leaving the fermenting tank; but it is known that this quality is acquired only after several years.

White wines which ferment in casks without coming in contact with the skins and seeds, ought, according to this theory, be deprived of aroma; but experience has proved that these wines do acquire a flavor and a bouquet, more or less developed according to the variety of grapes employed. It can hardly be said that Sauterne, Yquem, and certain other white wines, are deprived of this quality. It is even possible to find white wines which are possessed of it even in a higher degree.

We believe that the bouquet which (we find it here necessary to remark) develops only after the lapse of several years, is of a very complex nature, and is formed from substances which exist chiefly in the must, but which produce an aroma only after entering into certain combinations. These combinations are chiefly formed of alcohols and acids, and result in ethers or essential oils. The latter becomes more perceptible to the sense of smell after a considerable portion of the lees has separated out. It is our opinion that the skins contribute to the modification of the flavor rather than of the bouquet. The flavor and bouquet can be modified and improved by an intelligent selection of varieties which give the finest and most aromatic grapes, by selecting favorable sites, and such manures which do not increase the taste of the soil by their putrid odor.

As far as artificial means of imparting bouquet are concerned, we refer the reader to the chapter on *Blending*, where we emphasized that in this way only poor results are obtained.

Organic and Mineral Salts.—The organic and mineral salts which wines contain are numerous; but, with the exception of tartar (bitartrate of potash), they have not much influence on the taste. Tartar is that salt which is found in the greatest quantity in all wines. It is known that this salt separates gradually from the wine, and becomes precipitated with the lees, or adheres (mixed with coloring matters) to the walls of the barrels. New wines contain, on the average, five grammes per liter; but this quantity decreases with time. Tartar imparts to the wines a slightly acid taste, particularly if it is contained in abundance. It possesses the property of giving increased activity to fermentation, and of dissolving the ferments. It becomes, thus, very useful in the process of vinification. The other organic and mineral salts are also precipitated to a great extent with the lees. Thus it happens that all old wines contain much less salts than new wines.

Mellow, Oily, Velvety Taste of High-Class Wines.—The fine red wines of the Medoc and of other vineyards of the Gironde, as well as the fine Burgundy wines, retain, on aging, a decidedly fruity flavor, an oily consistence, and a mellow, velvety taste, which together with their peculiar flavor and bouquet, are the delight of connoisseurs. This mellow, velvety taste is produced only in those years when the grapes had a chance to become perfectly ripe. In bad years, when the grapes do not attain their perfect maturity, the wines may acquire more or less flavor and even some bouquet, but they are dry and lack mellowness. Many ordinary wines which have gone through the process of vinification in the proper way and date from a good vintage, possess as long as they are young, a decidedly fruity taste; but in most of their kind, this mellow taste does not keep, but vanishes gradually with time. In high-class wines, however, which date from good years, the mellow and oily taste is more prominent after the lees has settled than when they are young. We believe the substance which imparts this mellow and oily character to the wines is produced by a modification of the grape-sugar. This opinion is strengthened by the fact that mellow wines which are stored in cellars with irregular temperature, undergo in the end an imperceptible fermentation, particularly if they are in their first or second year and if they still contain some ferments. Very often—after such an imperceptible fermentation—the oily consistence disappears and the wines become dry. This fact makes us believe that under the influence of ferments and variations of temperature this substance undergoes the same transformations as the sugars.

Physical Analysis of Wine.—The main object of the physical analysis is to affirm the facts which have been ascertained by tasting. An expert can determine the alcohol-percentage of a wine by the use of his palate alone, even to within a fraction of a per cent.

Alcohol.—The alcoholic strength of a wine can be recognized by distillation. If this operation is carried on with care, the results are very exact. The distilling apparatus of Salleron is at present universally used. The distillation can be performed with less than sixty cubic centimeters of wine. In order to make use of this apparatus the wine to be distilled is poured into a small measuring cylinder, filling it up to a certain mark. Then this quantity is poured into a small retort, and the distillation started. The distillate is collected in the same measuring cylinder. When the latter is half filled up to a mark which is scratched in the glass for this purpose, the distillation is stopped, and the cylinder filled with distilled water up to the first mark to which the wine stood originally. The liquid is now well shaken, and a thermometer and an alcoholimeter are introduced into the same. After a few minutes both instruments are read, and the alcohol-percentage calculated from a table, which is specially prepared for this purpose.

Intensity of Color.—It is very easy to get at the intensity of color by comparing it with other wines, if one has a trained eye, and particularly if the examination is performed in a bell-mouthed silver cup.

If the samples are in a turbid condition, it is difficult to judge them. To get an exact idea of their color they should be fined with a very small quantity of albumen (white of egg) and well shaken for a minute. If there is reason to believe that albumen would not produce the desired effect, a small quantity of gelatine dissolved in a few drops of warm water, to which is added a pinch of tannin, should be used. After this the wine becomes clear in a day or so, and it is then much easier to estimate the intensity of its color. Should there exist some doubt concerning the origin of the color, the test should be applied which we have mentioned in the chapter on *Sophistications*.

Presence of Tannin.—Before exporting a wine it should be ascertained if it is fit to undergo the trials of a long voyage without spoiling, and if its color is stable and does not become precipitated too easily. If the wine originally contained the proper quantity of tannin, the color keeps better during a sea voyage. In order to ascertain if this is the case, either a barrel should be fined with double the usual amount (two tablets) of gelatine, or a bottle with the same quantity of gelatine in proportion; and after clearing, the difference in color will appear. If the gelatine has been precipitated, and if the wine is in a bright condition, it is a sign that it is well supplied with tannin. Should it not contain a sufficient quantity of tannin, the gelatine will remain in suspension. The trial may be completed by exposing a bottle filled up to the cork to a temperature of 120 to 200 degrees for one week, or, if it is summer, expose it to the sun's rays. Wines which withstand such a trial can be shipped without fear.

Saccharine Matters.—In order to ascertain how much sugar sweet wines contain, a very simple operation has to be done. A certain quantity is measured in a graduated cylinder, poured into a dish and evaporated—either on the free flame or on the water bath—to half of its bulk. This extract is now poured again into the cylinder, and the latter filled with water up to the mark indicated by the wine originally; the contents should be well shaken and the specific gravity ascertained by means of a saccharometer. Before using this instrument, the liquid should have cooled down. It is even advisable to let it stand for twenty-four hours, in order to allow it to separate from the tartar and the organic and mineral salts, which could possibly exercise an influence on the instrument. If a distilling apparatus is at hand the operation is still simpler. First the wine is distilled, and its alcohol-percentage ascertained by distilling off half of the wine; the other half, which remains in the retort, is poured back into the graduated cylinder, and this is filled with distilled water up to the mark which the wine had reached originally; after shaking well the saccharometer is used.

By calculating the sugar from the reading of the saccharometer, the salts which the wines contain are not taken into account. In some varieties these salts increase the reading of the saccharometer by a whole degree. Care should be therefore taken, if full-bodied and young wines are under examination, to deduct one degree from the reading. For purely commercial purposes there will be obtained in this way more correct data, particularly if the liquid has not been allowed to stand for twenty-four hours, and to get rid of the salts by crystallization.

Analyses of Sweet Wines and Cordials.—The cordials are composed of alcohol, sugar, and flavor. The extra fine cordials are more valued, for their better flavors are combined. Their aromas are sweeter, and they are older, thus they acquire a mellow taste, which is the result of the intimate combination of their aroma and their alcohol with sugar. This combination can be effected only with time; for, indeed, so long as they are new they always possess—regardless of the care exercised in their manufacture—a little harshness and roughness, which is due to the superabundance of aromatic substances, and also to an empyreumatic taste, resulting from recent distillation. The excellence of the taste of extra fine cordials can be appreciated only by tasting. Aside from the taste, it is necessary to ascertain the quantity of alcohol and sugar which they contain, in order to determine their commercial value, and in order to know, in case they are destined for export, if they contain enough alcohol to stand the trials of a voyage.

Alcohol.—The quantity of alcohol which these sweet liquids contain can be ascertained by distilling them in the same manner as described for ordinary wines. The Salleron apparatus can be used for this purpose.

Sugar.—The sugar in the sweet wines can be determined in the same manner as prescribed for ordinary wines.

CHAPTER X.

EXPERIMENTS ON ARTIFICIAL AGING.

The different methods in use; their effect on mellow and sweet wines. Fining. Continuous agitation. Exposure to the sun in closed vessels (wooden or glass). Application of heat (pasteurizing); its influence in the conservation of wines of the Gironde.

Wine attains the full development of its qualities only after a certain lapse of time. On leaving the fermenting tub it is far from showing the aroma, color, and flavor which it acquires after a few years, or, perhaps, even after a few months only.

The degree of perfection which a wine can attain is determined by the relative proportions of the different substances which compose the same. Certain wines, which are very poor in preserving substances (alcohol and tannin), begin to decompose immediately after fermentation. These wines, the value of which is not at all increased by time, should be consumed *as soon as the after-fermentation is over.* It is useless to age them. Other wines, which contain a sufficient quantity of these substances, require several years for their complete development.

In general, the bouquet and flavor of wines develop perfectly only when they have cleared perfectly—that means, when they fail to deposit any more insoluble matters, such as mineral or organic salts, ferments, and coloring matters, by remaining undisturbed for several months.

The old wines differ, as is well known, from the new ones of the same character by their color, their aroma, and by their flavor. These differences are due to various reasons:

The *color* is pale in an old wine on account of the coloring matter having partly separated out. This is due to the formation of several insoluble compounds which are carried down with the lees.

The *aroma* of the old wines is more fragrant, because *ethers* have formed through the combination of alcohol with the acids which are contained in the wine, and because the odor of the aromatic substances is no longer covered by the carbonic acid, which was liberated after the first fermentation of the young wine was over.

The difference in the flavor is due to several reasons, such as to the separating out of a large quantity of mineral or organic salts, which have been carried down with the lees, and which have become insoluble by their combination with the tartaric, acetic, and malic acids. This difference is *also* due to the precipitation of a part of the color.

All these facts tend to show that the wine, on getting older—providing it has been properly treated—contains less coloring matters (organic and mineral salts, free or combined acids, tannin, ferments, mucilaginous substances, alcohol) than it did shortly after fermentation. This result is obtained with the aid of time and labor judiciously applied. Several operations hasten the aging of wines: (1) Repeated treatments with finings; (2) Continuous agitation; (3) Exposure to the sun; (4) Application of heat. We are going to examine one after another the various changes which these processes cause the wine to undergo, varying with the composition of the latter.

Aging by Means of Treatment with Finings.—We have already shown the action of the various finings upon wines of different character, and the changes thus produced according to the chemical or mechanical influences which they experience. We have also shown the disadvantages which result from repeated finings. Indeed, the clarifying substances which act most energetically—such as pure gelatine—on account of their being coagulated and precipitated chiefly by tannin, carry down with the latter into the lees a part of the coloring matter, which is intimately associated with the tannin. The result of such a forced treatment with the finings is that the wine becomes poor in color and in tannin and that thus a part of its chief preserving element is removed. Another result is that a certain quantity of mucilaginous substances is also precipitated, and these latter, as is well known, give the fruity taste and the oiliness to the wine. The wine has been thus certainly aged, but it has not preserved its mellowness like wines which age naturally; on the contrary, it becomes harsh and dry.

Repeated and energetic treatments with finings should be applied only to very harsh and deeply colored wines or in cases when there is no time to wait for the transformation of the tannin into gallic acid.

Aging by Continuous Agitation.—The pitching and rolling of ships impart to the wines which make a sea voyage a continuous movement. This movement is augmented by allowing the casks to go imperfectly filled. During long sea voyages this prolonged movement modifies the character of the wine either in a good or in a bad sense. It renders insoluble a part of the coloring matter, precipitates or brings into suspension a part of the organic and mineral salts, and changes a part of the tannin into gallic acid; ethers are formed, and the wines become more or less turbid. Should the wine be rich in color, tannin, and alcohol, it will improve in quality; it will age much quicker than the wines of the same character which remain in the cellar. Should it be, on the contrary, poor in preserving materials—tannin and alcohol—it will arrive very turbid and ready to undergo the putrid fermentation. The expansion and the contraction which are caused by the variations of temperature which occur in the hold of a ship during a voyage through extreme latitudes, increase the precipitation of insoluble matters, the solution of salts, etc. *The movement* alone, *will do the same*, even if the temperature remains uniform. We were able to ascertain this fact by the following: While visiting the vineyards of the south, in 1854, a proprietor in the neighborhood of Castel-Sarrasin gave us his wines of the vintage of 1853 to taste. These wines were kept in small tuns of equal size, were all of the same kind, dating from a poor vintage, and were made from grapes which had grown on young vines belonging to an ordinary variety; they were very poor in alcohol, color, and tannin (they contained 8 per cent of alcohol). Their color, though not deep, was still brilliant enough, but the wine in two of these tuns showed a dull, leady color; they were also turbid, and possessed a slightly putrid odor. And still it was the same wine as in the other tuns; but these two tuns had been filled by means of a suction and forcing pump, and this operation had made them turbid, and had started in them, owing to their deficiency in alcohol and tannin, a complete decomposition by precipitating a part of their color. On the contrary, the wines which had not been fretted remained bright. Numerous and practical experiences tend to confirm the theory—*that the aging by means of agitation and sea voyages* is unfavorable to the weak wines which lack in preserving elements, while it favors the development of wines which are *rich in tannin and alcohol*. In order to obtain good results, the wines which are destined to make a voyage for aging purposes should first be thoroughly cleared by the application of finings and by racking. The barrels should be strong and iron hooped, and should not be completely filled—this in order to facilitate the motion of the liquid. For the same reason bottled wines similarly shipped should not be filled up to the cork. After the voyage the wine should be allowed to rest. If it has made the voyage in barrels, it should first be slightly fined; if it was bottled, it should be decanted, in most instances. If it is desired that the voyage should not age the wine, precautions of an opposite kind have to be taken—the barrels and bottles should be accurately filled.

We have compared the wines of Cos-Destournel 1848, of Saint Trelody and of Quinsac of the same year which were bottled and shipped in 1851 on board of a vessel bound for Calcutta, with the same wines which had remained in the cellar. In 1852 the bottles which had made the voyage came back; considerable sediments had formed in them, particularly in the Quinsac. They were placed again in the cellar. A month later they were tested (without having been previously decanted), in order to compare them with the wines which had remained in France. The differences in the color, in the aroma, and in the flavor were very great. Those which had made the voyage had acquired a brick-red color; their bouquet was much more developed, and they had more aroma. The wines which had remained in the cellar preserved their brilliant red color; were more fruity, mellow, and oily, and appeared consequently less old than the former.

Aging by Exposure to the Sunlight.—This method of aging was known to the ancients. Galienus, a celebrated Greek physician, and a contemporary of Marcus Aurelius, relates that in his time (in the year 180 of our era) the Romans used to age certain wines by exposing them to the sunlight on the roofs of their dwellings. The reason that this method of aging is so little used now, is due to the fact that it cannot be applied successfully to every kind of wine; particularly wines which contain less than 15 per cent of alcohol. These are little fit to undergo such a treatment. We are going to explain under what circumstances and on what kinds of wine this method can be used with advantage. We must, first of all, state that the direct action of the sun's rays on bottled wines precipitates their coloring matter rapidly, and that this action is more marked on partially filled than on completely filled bottles.

Bottled wines which are wrapped up in paper, or wines in wood, age much slower under the same conditions. We were able to confirm the truth of this statement in 1854, when we received from Spain a sample box of red wines of the vintage of 1853; there were two samples of each type. After having tasted them, and ascertained how much alcohol they contained, the bottles were corked again and placed vertically on a shelf near a garret window, fully exposed to the sun. It was in the end of the month of May. The other bottles which had not been opened, and which were wrapped in paper, were placed horizontally on the same shelf. The wines possessed a deep color, and had on the average 15 per cent of alcohol; they had a rather sweetish taste. Three months later came the consignment of wine, the sample of which we had selected; we were very much astonished to find in the remainder of the bottle which we had tasted a straw-colored wine, by no means deteriorated, but possessing a very marked taste of "rancio." The wine in the bottles which had remained full, and were wrapped in paper, had retained its red color and peculiar taste, but nevertheless appeared older and less colored than the portion which had been in the cask.

It is evident that this result can be attributed to the joint action of the sunlight and of the oxygen of the air which was contained in the bottle that had been opened.

These Spanish wines, which showed high alcohol-percentage, and which still contained some sugar, had, therefore, improved on being exposed to the sunlight in partially filled bottles.

If this process is applied to the wines of the Gironde, or similar wines, they are spoiled instead of being improved. The following experiments prove this:

November 16, 1866, we placed on the roof of a cellar in Bordeaux, well sheltered from rain and wind, but exposed to the sun, four bottles of white glass which were only half filled with wine, stoppered with large corks of the best quality. These samples remained on the roof until the eighteenth of February; they had, therefore, the best opportunity to undergo changes of temperature ranging from 32 degrees to 77 degrees. In the following are given the results of their tasting, and of their comparison with the wines which had remained in the cellar:

No. 1. Wine of 1865; had a frank taste, ordinary color; alcohol, 10 per cent. The same after insolation in well corked and half-full bottles, flattish, moldy; slightly altered taste of an old wine; color, paler; considerable sediment.

No. 2. Wine of Sainte-Eulalie d'Ambere's, 1865; very fine color, excellent taste, decidedly mellow; alcohol, 10 per cent. The same after insolation, acid; considerable sediment.

No. 3. First crop Bassen, 1865; brilliant color, fruity taste; alcohol, 10 per cent. The same after insolation, flattish and acid; voluminous sediment.

No. 4. Wine of Banjuls, 1863; red, sweet wine; frank taste; alcoholic strength, 17 per cent. The same after insolation, decided taste of "rancio;" brick-red color; considerable sediment; frank taste. *The taste appears to be finer, more aromatic, and older* than that of the wine which had remained in the cask; it also has less sugar than the latter.

These experiments show that insolation can be employed with advantage only in the case of wines which contain more than 15 per cent of alcohol, also of sweet wines and of white wines which are fortified up to 18 per cent of alcohol, and which are destined for the production of wines after the fashion of Madeira; but wines with about 10 per cent of alcohol cannot be treated by this method of aging without being damaged more or less, on account of the oxidation of a part of their alcohol *to acetic acid.*

Aging by the Application of Heat.—Heat has been applied in different ways and in different degrees to the aging of wines. It produces more or less important changes in their composition, either improving or deteriorating them: First, according to the wines submitted to its action, whether in presence of the air, or in closed vessels, and depending how full the vessels are; second, according to the degree of heat to which the wine is exposed; third, according to the time the wine is heated; fourth, according to the composition of the liquid, and to the percentage of alcohol contained.

The first experiments, on heating wines, are lost in the mist of antiquity. Galienus, whom we have already mentioned, relates that in his time the Romans used to heat the wine in stoves. The Cypriotes, the Greeks, the Italians, the inhabitants of Madeira, and the Spaniards, age their wines in places which have a very high temperature. Modern authors mention several methods of heating; but they do not specify the wines to which the application of heat is advantageous or injurious; and yet this is the essential part of the question.

Numerous experiments enable us to affirm that heating, if it goes

higher than 86 degrees, is injurious to the fine and *mellow* wines of the Gironde, and to any wines with a delicate bouquet which do not have more than 12 per cent alcohol. This is true, regardless of the manner in which the heat is applied.

The fine wines which have, at the same time, an aromatic flavor and bouquet, a fruity taste, and are decidedly mellow, get, through heating, a certain taste of "rancio;" but at the same time they become dry, lose their mellowness, their freshness, and contract a "*cooked*" taste, which changes their character and makes them resemble the wines from the south of France.

Conditions of Exposure to Heat.—Wines which are exposed to the action of heat in direct contact with the air, lose a part of their alcohol by evaporation; the oxygen of the air makes them lose a part of their color, and, if the contact with the air is a prolonged one, they become weaker and undergo a radical change. If exposed to the heat in closed vessels which are not quite full, they lose a part of their color; and if they contain more than 16 per cent of alcohol, they contract a taste of "rancio." But if they are low in alcohol, and remain long under these conditions, the oxygen transforms a part of their alcohol into vinegar. In well filled and closed vessels, they do not undergo many changes, particularly if the heating does not last long, and does not go beyond 158 degrees; a small part of the coloring matter is always precipitated, however, and the taste is perceptibly changed. No matter how rapidly the heating has been done, the wine will always acquire a "cooked" taste and a slight odor of lees.

Influence of the Degree of Heat.—Whatever the wine may be which undergoes this treatment we should avoid applying too much heat, because there is danger that some of the substances which are in solution may be either precipitated or disassociated, and that thus the natural taste of the wine may be changed. In order to obtain good results we may adopt the extreme limits of 113 degrees and 158 degrees.

Influence of the Duration of the Heat.—The higher the temperature to which the wine is raised, the shorter the heating period should be.

Influence of the Character of the Wines.—Wines which improve most on heating are the sweet wines with a high percentage of alcohol. In order that they should not suffer changes on being heated they should contain at least 18 per cent of alcohol. As the alcohol gradually evaporates during the heating of the wines, its alcoholic strength should be ascertained from time to time and enough alcohol should be added afterwards to make up for that which has evaporated.

Preservation of Wines by Heating.—The learned chemist, Pasteur, once communicated a memoir on acetic fermentation to the academy, and published in 1866 an investigation, "Studies on Wine," in which he describes a process of preserving the wines by the application of heat. One of his processes consists in submitting the wines in loosely corked bottles to a temperature of 122 degrees to 152 degrees for a few minutes. Let them cool, cork and store them as usual. According to this honorable chemist the changes which the wines undergo are chiefly due to microscopic organisms; the germs of these organisms exist in all fermenting liquids, and a temperature of 131 degrees to 152 degrees is sufficient to kill them. Wines which have undergone such a treatment can be exposed to the air, according to the same authority, without being liable to the great changes they would suffer previous to such treatment.

Pasteur's communication gave rise to many discussions among the wine experts. It is said that the application of heat for purposes of aging wines has been known since long ago, and that it has been made use of in Cette to age the wines artificially. Indeed, several houses in Cette have used this method, but have at present partially given it up. The following contains the details of the method used by the Cette wine makers. The new wines were transferred into tubs which contain a worm in connection with a boiler. With the help of steam the temperature of the tub was raised to 77—86 degrees, and so continued for one week. The next week the temperature was raised to about 104 degrees, and was gradually increased so that at the end of three weeks 158—167 degrees were reached. The wine then became brick-red in color; it was allowed to cool and blended with other wines, because it usually acquired a bad taste. The application of heat hastens the aging of wine but makes it lose its oily consistence, and the precipitation of the coloring matter imparts to it a common taste of the lees.

Pasteur explained that by the use of his method he did not pretend to age the wines, but only to preserve them.

As far as we are concerned we do not advise the application of heat in preserving or aging wines of high quality of the Gironde. According to our opinion the quality most important to preserve in our wines is their mellow taste. The germs liable to rise and destroy the mellow taste and oily consistence of the wines by producing an after-fermentation may be more easily separated from the wine if it is allowed to rest at a low and uniform temperature, and the racking be judiciously applied, than if heat is brought into play. Care should be taken to use sulphured casks, and to avoid the free access of air. It should be further remembered that the wines of the Gironde which are made from good varieties and with the necessary precautions are not liable to undergo any injurious changes; they keep and improve better if the usual methods are employed, than if artificial means are used to hasten their aging and clearing.

Experiments on Pasteurizing Wines.—In the following are recorded the results of pasteurizing various wines in a cellar in Bordeaux, November 16, 1886:

The wine was transferred into Bordeaux bottles, corked, wired, and afterwards put into a basket, with an upright set of eight pigeon-holes for the bottles. This basket was placed in a boiler whose bottom was covered with straw. Among the bottles there was one which was filled with distilled water, and which contained a thermometer. This bottle was corked in the same way as those which contained the wine. The boiler was then filled with water up to the neck of the bottles. The basket was taken out only when the temperature of the water had reached 125.6 degrees, after a slow and gradual heating.

The wines submitted to this experiment were the following:

No. 1. Wine possessing a frank taste; rather dry; color ordinary; perfectly transparent; 10.4 per cent of alcohol.

No. 2. Wine of very frank taste; decidedly mellow; fine color; alcohol, 10 per cent.

No. 3. Wine with brilliant color; fruity taste; aromatic; alcohol, 10.2 per cent.

After the pasteurizing, a bottle of each number was placed in a cellar

which had a constant temperature. At the same time a bottle of each kind of wine which had not been pasteurized was placed in the same cellar. In order to recognize the influence of the pasteurizing on the keeping qualities of the wine in contact with the air, the contents of each heated bottle were divided into two parts; one half was placed in a garret in an open bottle, which was only lightly covered, the other half in a hermetically sealed bottle. Together with these bottles was placed one bottle of the wine that had not been pasteurized.

Each number represented five different subdivisions:

(*a*) A sample of the wine bottled and stored in the ordinary way.

(*b*) A sample of the pasteurized wine bottled and stored in the cellar, under the same conditions.

(*c*) Sample of the wine exposed to the air in a bottle only partially filled.

(*d*) Sample of the pasteurized wine exposed to the air in a bottle only partially filled.

(*e*) Sample of the pasteurized wine in a bottle only partially filled and hermetically sealed.

In order to control accurately the results of these experiments the wines remained in the cellar, or were thus exposed, from November 16, 1866, to February 18, 1867. Now, before judging ourselves, we decided to have them tasted by two cellar foremen of Bordeaux, expert tasters.

The wines were given to them in the following order, without telling them which were the pasteurized wines or those which had been exposed to the air.

No. 1. Pasteurized wine exposed to the air in a partially filled bottle.

Wine (not pasteurized) exposed to the air under the same conditions.

Pasteurized wine in a corked bottle, half full, and placed horizontally.

Pasteurized wine kept in cellar, in full bottles, placed horizontally, and well corked.

Wine (not pasteurized) kept in cellar, in full bottles, horizontally placed.

The tasters find that the three first samples have undergone changes but not in the same degree (ignoring the fact that they taste like the same kind of wine). These three samples are turbid. The unpasteurized wine contains a large amount of acid, and has lost more color. The pasteurized wine is flattish, but is less changed. The pasteurized wine which was in a partially filled but well-corked bottle shows signs of a beginning change.

As far as the same wines, pasteurized and not pasteurized, but in full bottles, are concerned, the tasters agree that the natural wine has a finer taste than the pasteurized sample. The difference in the color is not noticeable.

No. 2 (Same method of experimenting). The pasteurized wine which was exposed to the air is flattish and turbid. The wine which was not pasteurized, but exposed to the air, is deeply changed and more turbid than the first one. The heated wine which was in corked but half-filled bottles is turbid, flattish, and acid. In the full bottles the difference is very small.

The wine which was not pasteurized has a finer taste; the pasteurized wine has deposited more sediments in the bottles than the non-pasteurized.

No. 3. The pasteurized wine which had been exposed to the air is flattish, but not acid; considerable sediment. The wine which had not been pasteurized is more deeply altered. The wine which was pasteurized in partly filled bottles is flattish and turbid, but not acid. In the full bottles the pasteurized wine appears to be richer in body but of more common taste; by moving the bottles, the pasteurized wine becomes turbid, while the unpasteurized wine remains clear.

The following conclusions can be drawn from these experiments:

1. That pasteurized wines stand the access of the air without undergoing such a radical change as wines which have not been treated in this manner; but nevertheless they assume, through prolonged contact with the air, a flattish taste and become sour and moldy even in closed vessels which are not completely filled.

2. That the fine and aromatic wines, if pasteurized and protected from the access of the air, have generally after this operation a more common taste than the unpasteurized wines which are preserved in the ordinary way. We have not yet been able to ascertain if the pasteurizing has an appreciable influence on the precipitation of the coloring matter and salts during sea voyages. We have noticed, however, already, that after performing this operation a deposit is formed, and that the color of certain wines decreases. It is, therefore, advisable to store them after pasteurizing in a cool cellar, and to rack them carefully, shutting out the air as much as possible. Without this precaution one would run the risk of sending off wines which would arrive at their destination more or less turbid.

Aging by the Combined Use of Several Processes.—Before subjecting any wine to the different processes which we have described, care should be taken to precipitate the matters which they keep in suspension, by a thorough treatment with finings. Artificial methods of aging should never be applied to the first-class red or white wines of the Gironde; because if even an early development of the bouquet is obtained, there is always the danger of destroying its most precious quality, their mellow taste. To-day the connoisseurs in wines do not look for wines which are dry and harsh to the palate, even if they possess a bouquet; such wines are only too frequently met with. They value particularly wines which, notwithstanding their age, have preserved their fruity, velvety taste and oily consistence, which can be preserved only by storing the wines in cellars with a regular temperature, and in air-tight vessels, by racking at the proper time, and by keeping the air off as much as possible, and by avoiding as much as possible the application of finings.

The wines which improve most by the successive applications of several of the above described processes are: First, the very harsh and deeply colored wines; second, the fortified wines which contain at least 18 per cent of alcohol; third, the sweet fortified wines which contain from 18 to 20 per cent of alcohol.

The fortified, dry, or sweet wines age very rapidly, if they are first agitated, then exposed to the sunlight, and afterwards subjected to a thorough treatment with finings; but it is important that they should be fortified as soon as the alcoholic strength decreases through evaporation, for if they should have less than 15 per cent of alcohol, instead of acquiring bouquet they would become "pricked." It is also often necessary to increase the sugar of the sweet wines which are aged in this way.

CHAPTER XI.

EMPTY BARRELS.

The influence of different kinds of wood on the durability of the barrels and on their fitness to resist the humidity of cellars; influence of various substances contained in the staves, which are dissolved by the wine. Preparation and preservation of new casks and barrels. Treatment of empty barrels, which have been used already; changes which they are liable to undergo; acidity, moldiness, rotting; how to contend with these changes; inconvenience of using casks which have undergone a change. Brandy barrels.

INFLUENCE OF DIFFERENT KINDS OF WOOD ON THE DURABILITY OF THE BARRELS, AND ON THEIR FITNESS TO RESIST THE HUMIDITY OF CELLARS—INFLUENCE OF VARIOUS SUBSTANCES CONTAINED IN THE STAVES, AND WHICH ARE DISSOLVED BY THE WINE.

Oak wood yields to the wine several substances, of which the most important are tannin, gallic acid, mucilage, organic albumen, and several other substances which possess a pronounced odor and taste. All timber from this species seems to contain the same soluble substances; but there are, among the different varieties of oak, some which contain a much larger quantity of soluble substances than others. The Bosnian oak contains the largest amount of soluble matter. A short time after the introduction of this variety into France the wine makers began to fear for the future of their wines. They noticed the large quantity of dissolved matter which gave to the new wines a strong woody taste and much harshness. But to-day, thanks to a long experience, we know that staves which are made from this wood, far from doing any harm, improve the wine by promoting the settling of the lees. We know also that the odoriferous substances which they contain do not possess any disagreeable properties. However, the material for staves which is most valued on account of its agreeable odor, is that from the north of France—from Dantzic, Stettin, and from Angoulême. Casks which are made from American timber do not contain as much soluble matter as other varieties; but still they are considered by the French wine makers to be the least fit for storing wines and alcohols.

On aging, the wine gets rid of a large portion of the dissolved matters, which are neutralized by combining with various substances found in the wine. Thus the tannin, which contributes to the keeping power and clearing of the wine, is partly precipitated by combining with various substances contained in the wines or introduced with the finings. The organic albumen is precipitated chiefly by the alcohol, and thus also helps to clarify the wine. The odoriferous substances in the wood increase the bouquet of the wine. Upon the whole, the preserving of new wines in new casks of oak wood is favorable to their clearing, because of tannin and organic albumen contained in the staves; but it should be borne in mind that these wines should be transferred to the new casks immediately after leaving the fermenting vats, and before the after-fermentation is over; otherwise their bright condition would suffer, and they would acquire a strong woody taste which would last for several months. After a certain lapse of time the woody taste will disappear.

Preparation and Preservation of New Casks and Barrels.—New casks after leaving the coopers's shed have only one small gimlet hole;

this hole is made by the workmen to test the air-tight condition of the cask. New casks, which are destined to contain new wines, should be stored in a place which is not too moist. We should be equally careful not to keep them in places which are too well ventilated. In moist places the casks burnish and the hoops become rusty or rotten; in places which are too warm and exposed to dry air the wood shrinks and they get too dry, making it necessary to cooper them up well again before using.

The most convenient place for storing empty barrels is a dry cellar, which should be kept closed. The casks are placed on benches or blocks of wood; those of the lowest row with the bunghole upwards and those of the upper rows with the bunghole downwards, in order that the dust should not blacken the insides nor penetrate through the gimlet hole. If new casks are not used for several years it is advisable, in order to prevent the inside becoming moldy, to make the bunghole, and burn a piece of sulphured wick inside. Then keep the cask well bunged, and repeat this operation every six months.

The day before pressing the young wine in the fermenting vat, or before transferring it into barrels, if it is a white wine, the bungholes should be drilled out with a good wimble, and fitted with bungs wrapped in a linen cloth. Pour into each cask from one to two gallons of boiling water; then drive the bung in again, and the cask or barrel is rinsed by agitating. The boiling water and the steam expand the air in the barrel, and in the pores and in the smallest fissures of the staves, making it thus possible to see the least flaw. After having thus rinsed the barrels, the water should be thrown out before it becomes quite cold; after that, the casks should be rinsed again with cold water, and drained. Before filling them with wine, it is advisable—if they are destined to hold red wines of the best quality—to moisten their insides with a glass of old brandy; in which case, care should be taken that all parts of the staves are reached. These precautions are, as a rule, sufficient for the preparation of the casks which are destined to hold red wines. We have already spoken of casking white wines.

If it should happen that very fine flavored or old wines have to be kept in new casks, the greater portion of the soluble matter in the staves could be extracted in the following way: In each cask a couple of gallons of boiling lye is poured. This lye can be made from ashes or potash; and in case these materials are not at hand, from any other alkaline substance, such as slaked lime, pulverized chalk, etc. It has been noticed that alkaline substances dissolve out of the staves a larger quantity of matter than pure water. After having rinsed the barrel or the cask several times with the lye, it is poured out, and the rinsing is continued with a new quantity. Afterwards, boiling water is used to remove the alkaline matter. This water is poured out while it is still hot, and replaced by a gallon or a gallon and a half of cold water, acidified by one fifth of a pint of sulphuric acid. After the treatment with acidified water, hot water is used to remove the acid. Again, before draining, the cask is once more treated with cold water. These various manipulations can be avoided by wine-seasoning the new casks which are destined to hold old wines, to do which, new barrels are first treated with boiling water, in the manner we have described above. Then they are filled with ordinary wine of the same color as that which they are destined to hold. For this purpose, also, ordinary white wines may be used. In a fortnight these wines will absorb most of the soluble matter from the staves.

Treatment of Empty Barrels which have been Used Already; Changes which they are Liable to Undergo; Acidity, Moldiness, Rotting; How to Prevent and Combat these Changes.—As soon as a barrel has been emptied, it should be rinsed several times with water; care being taken to regulate the work according to the amount of lees which the wine contains. When the water runs off entirely clear, the barrel is drained for a few minutes; a small piece of sulphur wick is introduced through the bunghole and burned; after which the barrel is put aside to dry. After twenty-four hours again a small piece of sulphur wick is introduced and burned; this time the barrel should be bunged as hermetically and as carefully as if it were filled with wine. The barrel having been treated in this manner, for some months will experience no change, provided it is kept in a cellar, the temperature of which is uniform, and neither too dry nor too moist. Should the necessity arise of keeping this barrel a long time without further use, it would be necessary to repeat the sulphuring every three months, and to keep it hermetically bunged. There are two methods of burning the sulphur wick in the empty barrels The first consists in introducing the wick by means of a hooked wire, or, still better, on a small pan; when the sulphur has burned down, the pan is drawn back and the barrel bunged. The other way to do it is to cut out a piece of the sulphur wick about four to five inches long; one end of this piece is cut into a bird's-mouth joint and the wick on this end cleaned from the sulphur which adheres to it; the other end is now lighted and introduced into the bunghole, while the portion of the wick which is free from sulphur is pressed with the hand against the side of the bunghole; in the meantime the bung, which has been previously wrapped in a linen rag, is introduced into the bunghole and hammered in. That the combustion of the sulphur is going on in the interior should be ascertained by applying the ear to the staves of the bulge. A hissing sound produced by the droplets of sulphur which fall on the inner walls of the bulge should be heard. If no sound is heard it means that the wick has ceased to burn; in such a case it would be necessary to ascertain this fact by taking out the bung cautiously.

By this method the combustion of the sulphur is going on in the barrel without the surrounding air having access to it; the result is, that with the same quantity of sulphur it is possible to impregnate the barrel with a larger quantity of sulphurous acid than by burning with the bung open. This makes a barrel fit to keep longer without undergoing any change, because the oxygen of the air which it contained is more thoroughly exhausted than when the air had access. The use of this method, however, offers some inconveniences. As the burned wick remains sticking to the walls of the bunghole, there is always danger that it may fall into the cask and communicate to the wine a disagreeable taste, unless great care is exercised in taking out the bung; sometimes, also, it happens—if the casks are not bunged with great care—that the rag around the bung burns, and that then the gas and the expanded air find an outlet and carry with them the flame of the wick, which carbonizes the walls of the bunghole. These are the reasons which generally make people use the wickholder.

Always avoid leaving the casks empty for several days without rinsing them; they should be cleaned without delay, as soon as the lees are emptied. The casks should be drained in the cellar on benches; if they are allowed to drain in the sun, particularly if they have not been previously sulphured, the action of the heat transforms the alcohol which adheres to the interior sides of the staves rapidly into acetic acid, and barely a few hours suffice to acidify the air which they contain, and even the interior surface of the staves.

Changes Which the Casks May Undergo; Their Treatment; Inconveniences of Using Casks Which Have Undergone a Change.—The casks which, after having been emptied, are neither rinsed, sulphured, nor bunged, are apt to undergo various changes, which make them more or less unfit for holding wine, particularly wine of high quality. These changes are: flattish odor, acidity, mold, and rot.

Flattish Odor—Origin and Treatment.—The cause of the flattish odor is due to the liberation of carbonic acid, which is generated in the cask. This odor is chiefly met with in casks which have remained bunged without previous cleaning. It reminds one, more or less, of stagnant lees which are slightly acid. The sulphur cannot burn in such casks. It is very easy to expel the carbonic acid. As this gas is much heavier than the air, it suffices to place the cask over the drain, with the bunghole downwards, in order to renew the air completely. The cask is allowed to remain in this position for one or two hours, and is then rinsed carefully. Should the cask be acid, and smell flattish at the same time, the following treatment should be adopted, in order to rid it of acidity.

Acidity—Cause, Origin, and Treatment.—This alteration is produced, if an empty cask remains several days without being attended to. The staves of the cask, which are impregnated with wine, become acid on coming in contact with the air, which latter oxidizes the alcohol, and transforms it rapidly into acetic acid. The higher the temperature the more rapid is this transformation.

Under such conditions the interior of the cask has a very decided acid odor. The treatment of this evil consists in neutralizing or in extracting completely the acetic acid which has sometimes penetrated deeply into the pores of the wood. The following shows how this may be accomplished: After having rinsed the cask with water, a hot lye solution should be applied; this solution may be prepared from wood ashes (preferably from the ashes of vine shoots)—potash quicklime. The cask should be rinsed several times with this lye, which should be thrown away before it cools completely; then, if it is possible, the cask should be filled with fresh water, which should remain in it three or four days. After that the cask should be emptied and rinsed in the ordinary manner. The water should not be allowed to remain longer in the casks, for it would become slimy, and in the end putrefaction would set in.

Moldiness—Cause, Origin, and Treatment.—The mold which forms on the inside of the casks is due to their prolonged contact with a moist atmosphere, as commonly met with in the majority of cellars. Thus, whether the bungs have been neglected, whether there are defective staves, or even if the hoops do not fit tightly, this moist air penetrates them and, even though sulphur has been burned in them, moldiness sets in it at last. If they have not been sulphured the mold appears much sooner.

The mold is a kind of whitish moss consisting of microscopic fungi, the bad taste and disagreeable odor of which are due, it is generally supposed, to the presence of an essential oil. Moldy casks can be recognized by their odor. The simplest way to treat casks which are thus affected is to take out the bottom and examine them; if the moldiness appears to be superficial, it can be easily removed with the help of water and a stiff brush; if, after thorough rubbing and washing, the inner surface of the staves assumes again the natural color of the wood impregnated with wine, this is a sign that the wood has not been attacked; it is sufficient in this case where the bottom has been taken out, to place the cask on its side, and let it dry; it may even be exposed to the heat of the sun without fear of acidity. When thus cleansed, the bottom of the cask is replaced, and the whole rinsed in the ordinary way. If, on the contrary, the staves remain brown after washing and rubbing, they are more than moldy—they are more or less deeply rotten.

Rotting—Cause, Origin, and Treatment.—Rotting is the decomposition of the wood. Its cause is the same as that of moldiness, viz., moisture. A cask whose inner surface is rotten cannot be used for holding wine. If the staves of a moldy cask show brown spots, they should be scratched off, and all the wood removed which is not sound or which is without its natural color; without this precaution, whatever may be done, it will be only possible to conceal the bad taste without removing it. If a cask needs to be entirely peeled of its moldy skin, the inner side of the staves should be slightly carbonized before putting on the finishing touches. It is hardly necessary to add that the use of doubtful casks for wines of good quality should be avoided, even if the casks have been previously treated in a suitable manner. For if the wine remains a long time in the casks it penetrates deep into the pores of the wood. Thus, one is apt to spoil the wine, and to lose, by ill applied economy, the value of a good barrel of wine. Such inferior casks, if it is at all necessary to make use of them, should be employed for holding only the poorest kind of wines.

Brandy Barrels.—These barrels do not require other manipulations, after having been emptied, than to be bunged and removed from the influence of humidity; the alcohol which impregnates their staves is sufficient to preserve them. It is detrimental to drain and dry them completely. If they have remained empty for a long time they are slightly moistened with alcohol in order to prevent molding. The new barrels which are destined to hold brandies are rinsed and drained for at least twenty-four hours. When their staves are dry they are moistened with one or two glasses of alcohol, which is allowed to remain in them; they are then securely bunged and shaken well. We should avoid leaving water in these barrels, for if once the alcohol is evaporated they undergo, if exposed to humidity, the same changes as the wine casks. It is important that the casks which have been moistened with alcohol should be placed outside the rooms where the wine casks are stored, in order to make the sulphuring of one of them by mistake impossible; such a mistake may produce a terrible fire, particularly if the casks were lately emptied.

All these remarks apply to casks which have been already used for holding alcohol or which are destined for new brandies; that is, for those brandies which have just left the still and which are not to be sent off immediately. Should the necessity arise of sending off brandies in new barrels it will be useful—in order to prevent the "woody" taste—to leave the casks full of water for three or four days and to treat them afterwards in the same manner as we have shown above for wines. Ordinary wines may be kept in barrels which have already contained brandy and even olive oil, provided it was not rancid; but we should avoid the use of such casks for wines of high quality.

So far as barrels are concerned which have been used for rum, kirsh, vinegar, absinthe, bitters, or any other liquor of penetrating odor, they are entirely unfit to hold wines, on account of the essential oils, the entire removal of which is quite impossible.

CHAPTER XII.

LIQUEUR, OR SWEET WINES.

General composition. Various processes of vinification. Treatment. Aging. Clarifica ion. Manufacture of "liqueur" wines with the help of similar wines. Artificial sweet wines. Vermout.

Sweet Wines are those which, after having gone through their violent fermentation, either in tanks or in casks, still contain a certain quantity of sugar in solution. In order that such a result may be reached, it is necessary that the must should be very rich in sugar. It should have from 16 degrees to 25 degrees, according to the Baumé spindle. The wines uniting these conditions contain from 15 per cent to 16 per cent of pure alcohol, without having been fortified. The sugar they contain gives them a higher specific gravity than that of water. By extension of the term, foreign wines, which do not contain an appreciable quantity of sugar, but which have been strongly fortified, are also called sweet wines. Such are *ports*, dry Madeiras, sherries, etc. These, in reality, are dry, but have been artificially fortified with alcohol. Some varieties of these wines are found, to which a small quantity of sugar has been added, in order to destroy their dryness and render them more mellow; notwithstanding this, they do not taste sweet. There are other varieties which are fortified while they are still a little sweetish.

The process employed in making these wines varies in each establishment.

First process.—The density of the must may be augmented in a natural way by allowing the grapes to become overripe. In warm and dry climates the berries dry up partially, and a certain portion of their water evaporates.

Second process.—In cooler and moister climates the grapes first rot and then are wasted by the sun; in this case, also, their water evaporates. This can be seen in the vinification of the wines of Barsac, Monbazillac, etc.

Third process.—In some vineyards of Spain, the drying of the grapes is hastened by twisting the stems of the bunches; the rising of the sap is thus stopped.

Fourth process.—In Andalusia the must is concentrated by ebullition. This process is also used in the south of France.

Fifth process—After the well-matured grapes are picked, they are dried on screens, or on straw in the sun; they are not pressed before their skins become wrinkled. In this way in Germany, Hungary, Alsace, etc., the *straw wines* are made.

Sixth process.—The grapes are dried in an oven or in a drying stove.

Seventh process.—Alcohol is added to the must before the fermentation has started, so that the liquid contains from 18 to 20 per cent of alcohol; in this way, by preventing fermentation, the saccharine matter is preserved.

Eighth process.—Lastly, dry wines are blended with syrup prepared from raisins or with concentrated and fortified musts.

The dry "liqueur wines," that means those that are completely through with their fermentation, receive an addition of brandy, either after leaving the fermenting tank, or after their violent fermentation in the barrel is over.

Treatment of Sweet Wines; Their Conservation.—The various processes of vinification of sweet wines produce enormous differences in the character of these wines. The treatment should vary according to their alcohol-percentage. It should never be forgotten that the "liqueur wines," be they dry or sweet, which contain less than 16 per cent of alcohol, require *the same treatment as ordinary* wines, if it is desired that they undergo no changes. Without this precaution they are *susceptible to the same influences*, that is, liable *to ferment, to become turbid, and at last to become pricked.*

In order that "liqueur wines," be they dry or mellow, natural or artificial, may be preserved in storehouses with uneven temperature, in upright standing bottles, or in partly filled casks, it is necessary that they should contain at least 18 per cent to 20 per cent of alcohol. If they have this percentage, particularly if they still contain some sugar, a high temperature will age them, and they will keep quite well without requiring constant attention. The barrels should be quite full, but there is no need of filling them up oftener than once a month. But before subjecting them to these conditions it is indispensable to ascertain *exactly their alcohol-percentage.*

Aging.—As we have already said, a high temperature is favorable to the aging of "liqueur" wines, *provided their alcohol-percentage is not too much lowered by evaporation*, which must be ascertained and watched.

Fining.—The clearing of sweet wines may be effected in two ways: by the use of finings, or by filtration. Both processes are often used at the same time. The kind of finings most suitable for each variety of wine should be chosen. If the wine is dry, and contains a considerable quantity of alcohol—as, for instance, the Madeiras, ports, etc.—the clearing with substances which contain albumen, or the white of egg, is perfectly successful. If these substances cannot be had, fresh blood should be used, but that only with ordinary wines. When the wine is very syrupy, it should be tannified with an alcoholic solution of tannin, and then treated with a strong dose of pure gelatine.

This method is particularly useful with large quantities of liquid. When only small amounts have to be treated, they are filtered through paper, woolen strainers, or closed filters. In order to avoid too rapid evaporation, the whole operation should be performed as rapidly as possible. Thus a perfectly clear liquid may be obtained.

These wines should remain undisturbed as much as possible, and be racked before sending away; for however clear they may be, it is seldom that they do not deposit a sediment, either on the bottom or on the walls of the casks. They age more rapidly in wood than in bottles.

IMITATION OF SWEET WINES WITH SIMILAR WINES.—The scarcity of certain foreign wines, their high price, the high custom duties which have to be paid on them, etc., have induced French wine makers and wine merchants already producing wines similar to those to adopt the processes of vinification which are used in foreign wine-growing districts.

In order to imitate sweet or dry wines, which are known in French commerce under the name of "*liqueur*" *wines*, it is necessary to have the various preparations and flavoring extracts on hand which are sometimes used in foreign wineries. These preparations are *saccharine matters, extracted* from the raisins or from the fortified musts; they are known in France under the name of *calabres*. They can be prepared with and without the application of heat.

Calabres Prepared Without the Application of Heat.—The must from very ripe grapes, having a specific gravity of 12 to 14 degrees, is fortified with enough alcohol to make the percentage 17. This is done as soon as the must is pressed; the alcohol stops the fermentation; if less alcohol should be added the must would begin to ferment. Other wine makers stop the fermentation of the must by means of sulphurous acid, and make preserved musts or unfermented wines. (Compare *Practical Method of Stopping the Fermentation of Musts.*)

Calabres Prepared With Application of Heat.—The making of these calabres consists in concentrating the musts by boiling. As soon as the must has left the press-room it is freed from the solid particles as much as possible (compare description of this operation in Book I of this work), and then concentrated in a boiler until it shows (being hot) from 20 to 25 degrees by the aerometer of Baumé; the foam should be skimmed off with care. After cooling, alcohol is added in the same proportions as in the previous case, or this concentrated must may be used for the making of unfermented wines.

Syrups are also made *from grape juice whose acid has not been neutralized* by boiling the must until it has from 30 to 32 degrees Baumé; but this kind of syrup is very colored and is only used for brandies and dry wines..

Syrup from Grape Juice whose Acid has been Neutralized.—This syrup is made in the following manner: The must is freed from its impurities by straining it through a basket, whose bottom is covered with several layers of straw. Then carbonate of calcium (powdered marble) or powdered chalk is stirred in. When the effervescence has stopped, that means when the tartaric, acetic, and malic acids are neutralized, the must is decanted and filtered from the sediment through blankets. There now remains nothing to be done but to clarify. For this purpose to twenty-two gallons of liquid two and four tenths pounds of blood or white of thirteen eggs are added. Blood is preferable. It should be well mixed; the pans which are used should be flat, and the whole operation should be conducted rapidly if it is desired to obtain colorless syrups. The foam should be carefully skimmed off and the liquid boiled down

until the Baumé spindle indicates 32 degrees. As soon as the boiling is done, the syrup should be allowed the least possible time to remain in contact with the air, for it very easily becomes colored. It should be kept in barrels completely filled. If the syrups are made in deep pans they assume a fawn-colored tinge.

For the same purpose, also, saccharine matters which are foreign to grape-juice—such as the *juice of the sugar cane, the syrup from white refined sugar, a mixture of candy-syrup with white wine, sugar-cane molasses, and honey*—are sometimes used. All of these substances should be mixed with alcohol or with old brandies.

FOR COLORING the deep-colored wines of the Roussillon, caramel, richly colored and aromatic alcoholic infusions or tinctures, of which we shall give the composition further on, are used.

In order to impart a taste of old wine, an *alcoholic infusion of the green peel of walnuts* is used; this infusion is made by pounding walnuts, which are allowed to turn brown in the air during twenty-four hours, on which is poured per each two and two tenths pounds, nine tenths of a quart of brandy (58 degrees); the infusion should be allowed to stand for three months before it is drawn off; the older the infusion is the better it fulfills its purpose. The same purpose can be attained by the alcoholic infusion of the roasted shells of bitter almonds.

In order to obtain this infusion, the shells of the almonds are crushed and roasted either in a coffee roaster or in a furnace. When their color has turned russet, they are thrown quite hot into a barrel with a large bunghole, and alcohol of 65 degrees is poured on them without allowing them to become cold. The proportions should be half a gallon of alcohol on three and three tenths pounds of shells. The mixture should be well stirred and allowed to stand at least a month before it is drawn off. Aging improves the infusion; this infusion can be replaced by one of roasted millet grass. The millet grass is roasted in the same way as the almond shells. Afterwards it is crushed, and while still hot, alcohol is poured on it and the mixture stirred.

BOUQUET.—We refer the reader, as far as the alcoholic infusions of iris, raspberries, etc., are concerned, to the chapter on *Artificial Bouquets.* We shall speak here of the aromas, whose mode of preparation we have not described.

Tincture of Calamint.—The tips of the stems and of the leaves of calamint are put in a barrel with large bunghole, or in any other vessel, and digested with alcohol of 85 degrees strength for a fortnight. The leaves and stems of the calamint should not be pressed together in the barrel. The roots of *Calamous aromaticus* fulfill the same purpose, and the extract is obtained in the same way, with the exception, however, that the roots are cut into small pieces.

Tincture of Cachou.—Pulverized cachou, five ounces; alcohol of 85 degrees, half a gallon. The mixture is allowed to stand for a fortnight before drawing off; care should be taken to stir this from time to time, in order to facilitate the solution of the cachou in the alcohol.

Tincture of Cloves.—Crushed cloves, one pound; alcohol of 85 degrees, three quarts. Same treatment as for the preparation of the cachou tincture, but in this case eight days of infusion are sufficient. These tinctures of cachou and of cloves are more aromatic if they are prepared at a temperature of 100 degrees than if they are made at a lower temperature.

Elder Blossoms.—These blossoms are mixed with powdered sugar, which, after a fortnight or a month, becomes impregnated with their perfume. This perfume can be extracted by dissolving the sugar in a small quantity of water. Sometimes a small bag, which is filled with these blossoms, is suspended through the bunghole in the wine; but in this case, the flowers must remain in the wine longer than one month.

Essence of Tar.—Three quarts of brandy of 58 degrees, in which a pound of the best tar has been mixed, are slowly distilled in a sand bath, or in a water bath from a small retort. Not more than two quarts should be distilled; the distillate should be preserved in well corked bottles.

Infusion of Coffee with Tar.—Coffee is roasted in the usual way; in the hot infusion, one fourth of its bulk of liquid tar is poured; this tar should be prepared by dissolving good tar in double its weight of alcohol of 85 degrees.

The various preparations which we have described should be stored in places adapted to their nature, namely: The sweet and non-alcoholic liquids in cool cellars and in closed vessels; the alcoholic liquids in store-rooms or ordinary cellars.

Practical Methods.—For the maker of "liqueur" wines, it is indispensable to have before his eyes *typical and genuine samples, new and old*, of the wines which he has to imitate, in order to enable him to ascertain: 1. Their composition; 2. Their alcoholic percentage; 3. Their specific gravity; the changes which time makes them undergo; their flavor; their bouquet, and their peculiar taste.

In order to imitate these types, the wine maker has to look among the "liqueur" wines for those which resemble most the former. In France, these wines are found only in Roussillon, in Languedoc, and in the Provence.

The best types among the white wines are the *Muscats*, which Rivesaltes produces; Frontignan and Lunel follow. The *Muscatelles* (or *Petits Muscats*) which are made in great quantities in the vineyards of the Héraults, in the Provence, in Roquemaure, in Ciotat, fulfill the same purpose, but they are very much inferior to the Muscats. These wines are used for imitating *Malaga*, *Malvoisie*, etc., by means of the various preparations which we have just enumerated. If the French Muscats date from a good year, if they are well made and strongly fortified, and if they have remained from eight to ten years in the cask, they can, without any other addition but of alcohol, bear comparison with the foreign Muscat wines, and are sometimes even superior to them. The artificial Muscat wines which are made from ordinary white wines by flavoring them with elderberries or elderflower extracts, do not give good results. They cannot be compared even with the Muscatelles.

Artificial Wines.—The advice which we have given in the preceding paragraphs, gives, if followed, excellent results; but these results come pretty high to the wine maker, particularly if the best varieties of wines which we have mentioned are chosen. Many people are hunting, not for *excellency*, but for *cheapness;* it is on this account that most of the firms of Cette, which make a specialty of the liqueur wines, have lost their reputation by *manufacturing* these wines at a very low price. This came about in the following manner: The great firms which made a specialty of this branch of the wine industry, saw their existence threatened by rival merchants, who offered wines at wretchedly low prices. They were thereby compelled to produce merchandise which could be sold at the same price, or lower. However, the wines which are made in Cette, or in its neighborhood, should not be sold by reliable firms *as foreign wines.* Let it not be understood that all liqueur wines which come from abroad are of irreproachable quality. Then, too, there are frequently sold to us very ordinary wines, sweetened with poorly prepared musts, having a doughy taste, and arriving in a turbid condition. There are many among them which are colored artificially with molasses, caramel, etc. The consignors are allowed to clarify them by filtration, before they leave the warehouse; this is done by the foreman cooper, who has the wines in the vaults of the custom house in charge. Thus they may arrive in a clear condition.

But the ordinary wines from Cadiz, Madeira, etc., are far from being equal to the best brands of similar French wines. Aside from that, certain Spanish firms, in order to be able to compete with French wines, *manufacture* these wines from the ordinary country wines, with the help of syrups, *caramel* (which they use extensively, or, rather, misuse), and alcohol. In this way they produce a mixture of the kind we are going to speak of. Unfortunately, these artificial mixtures enjoy some prestige on account of arriving directly from the producing country. Nevertheless, sensible purchasers are not deceived, and pay only for the real value of the wines.

The *artificial "liqueur" wines*, or *imitations made out of dissimilar wines*, are concocted in the following manner: White or red wines, which are not acid, and which have no defects, are taken. Among the white wines those are chosen which have the highest alcohol-percentage, and which are the cheapest; among the red wines those are chosen which have a frank taste; if it is possible, they should be first fortified on the premises of the proprietor—but this only when the fermentation is over.

These wines have, then, on the average, from 18 to 20 per cent of alcohol. They should be kept in places which have a very high temperature; the barrels should be only partly filled and should be exposed to the sun; they age thus very rapidly, but in order that they should keep without undergoing detrimental changes, it is necessary that their alcohol-percentage should not go below 18.

M. Pasteur recommends keeping these wines in well corked and only half filled bottles; these bottles should be exposed to the sun under glass sheds. It is certain that under such conditions they would age more rapidly, for the temperature of the wine could be raised higher by this method than by the usual method of keeping in barrels; the oxygenation would also proceed more rapidly; but if the wine has less than 18 per cent it is liable to become "pricked."

If sweet wines have to be imitated, the artificial wines are sweetened with "calabres" prepared with the application of heat. If their specific gravity is required to be high, syrup made from raisins is added, in order to make their specific gravity equal in saccharine to the typical wine. Then the bouquet is imparted to them by intelligently using the tinctures and preparations which have been described above. Color is imparted to them with the help of the infusions we have already mentioned. To imitate Muscat wines elder blossoms are used; but neither of the preparations made by the use of these flowers can replace the ordinary *Muscatelles.*

Still, notwithstanding the inferiority of the wines which are manufactured from wine dissimilar to that to be imitated, there are authors, who call themselves œnologists, who profess that, for making "liqueur" wines, it is not absolutely essential to use natural wines. And this method is what several firms in Paris are practicing—making *entirely artificial wines*, in the composition of which not a drop of grape-juice enters. In this case the wine is replaced by weak brandy, which has, on the average, 20 per cent, and which has been diluted with the same quantity of tartar solution. This latter is water, in which there have been dissolved either seventy-five grains of cream of tartar (while hot), or thirty grains of tartaric acid, dissolved cold.

To these weak brandies some of the preparations which we have enumerated are added; they are then sweetened with cane sugar, glucose syrup, or with equally adulterated grape syrups.

These preparations do not contain anything unwholesome. They are liquids composed merely of water, alcohol, saccharine matters, tartaric acid, and flavoring extracts, which, with the help of a label and much credulity on the part of consumers, pass for the wines the general and unadulterated types of which the majority of consumers have never tasted.

VERMOUT.—In order to make a good vermout a white wine should be taken, possessing as frank a taste as possible. With this wine an infusion is made, according to the rules we are going to give, of various aromatic plants, of which wormwood is the most important. The best vermouts are made in Italy.

In the trade several varieties of vermout are distinguished: 1. The quinquina vermouts, after the Italian fashion, which have tonic, aperient, and vermifuge qualities. 2. The dry vermouts, called Madeira vermouts. 3. The mellow, aromatic vermouts. 4. The ordinary vermouts.

Vermout shows many peculiarities, according as the wine used in its manufacture is new or old, dry or mellow; wine with an agreeable flavor, or with an earthy taste. The quantity and variety of the plants which were infused, the time of infusing, the methods of preparation, etc., have also an influence on the taste of the vermout. Aside from these there are found varieties in the taste even of the vermout of each individual manufacturer.

In order to make a good vermout it is necessary:

1. That the white wines which are destined for this purpose should be old (at least one year), that they should have a frank taste, without harshness or tartness. White wines which continue sweet after the fermentation is over, should be preferred to dry wines for the preparation of mellow vermouts. If the wine be dry it would be necessary to add syrup.

2. These wines should be clear and their alcohol-percentage should be from 18 to 20 after fortifying. This condition is indispensable to the vermouts distined for export and for consumption in tropical countries.

3. That the plants should be carefully cleaned and the hard substances crushed and powdered.

4. The period of the infusion should be attentively watched—the higher the temperature the shorter the time required.

5. The wine after infusion should be racked, clarified, and again racked, and if its condition is not perfectly bright it should be clarified a second time or filtered and poured back into the cask. It should then be allowed to rest in a cellar possessing an even temperature.

Before shipping, these wines should remain in the cask at least a month. Newly made, they have a taste of weeds, which disappears with time. The vermouts which are six months or a year old are far superior to the younger ones.

Firms which make a specialty of vermouts should have certain casks for containing vermouts which are clarified and ready. The oldest should be sent off first, and in proportion as the casks become empty new vermout is made in order to give it time to age. After complete clearing and allowing to remain a long time in the casks, these wines improve, the combination of the aromas becomes more intimate, and they continue clear during the voyage. On the other hand, if they are sent off soon after making, even though they be perfectly clear, they become turbid and deposit a sediment during long voyages.

The recipes which follow are calculated for two hundred-gallon lots:

QUINQUINA VERMOUT.

White wine, of frank taste, old, and clarified, 18 per cent alcohol	200 gallons.
Wormwood	2 pounds.
Rosemary	2 pounds.
Red Peruvian bark (quinquina), or yellow, crushed and previously infused with one quart of alcohol of 86 degrees	4 pounds.
Rhubarb	½ pound.
Angelica root	1 pound.
Holy thistle	2 pounds.
Cowslip	2 pounds.
Veronica	2 pounds.
Alcohol infusion of Seville oranges	3 quarts.
Alcoholic tincture of iris	$\frac{7}{10}$ quart.

The various plants, after a thorough cleaning and crushing, should be put into the wine. The infusion should be poured from one vessel into another, stirred, and allowed to stand thus from three to six days, according to the temperature; the mixture should be stirred several times every day.

The white wine chosen for this purpose is dry or mellow, according to the vermout desired. Dry vermouts require dry wines, and sweet vermouts mellow ones. If it is not possible to obtain a sweet wine, the vermout should be sweetened after infusion, by adding forty pounds of refined sugar to each two hundred gallons, and two gallons of alcohol of 85 degrees to the same. These quantities may be increased or diminished, if desired. The sugar should be previously crushed and dissolved in the wine, being frequently stirred to assist dissolution. The vermouts which are made according to this recipe, are very aromatic and good tonics. Consumers sometimes find them too bitter and too astringent, in which case it is necessary to age them before selling.

Astringent and Tonic Vermout made with Imitation Madeira.—We have made excellent vermouts of this kind with the following plants:

Assorted wormwood	2 pounds.
Costmary	1 pound.
Génépides alpes	1 pound.
Origanum vulgaris	1 pound.
Cascarilla bark	1 pound.
Assorted tea	1 pound.
Angelica root	1 pound.

Crushed coriander	4 pounds.
Cinnamon	2 pounds.
Calamint	2 pounds.
Gentian	1 pound.
Rasped nutmeg	½ pound.
Tincture of iris	$\frac{7}{10}$ quart.
Fresh slices of Seville oranges	5 pounds.
Galanga	1 pound.
Tormentil	$1\frac{3}{16}$ pounds.
Cloves	1 pound.

Two hundred gallons of imitated Madeira wine.

Muscat Vermout.

Assorted wormwood	2 pounds.
Elder blossoms which have been assorted and mixed a week before with eight pounds of powdered sugar	4 pounds.
Crushed coriander	9 pounds.
Nutmegs	1 pound.
Cinnamon	2 pounds.
Alcoholic tincture of iris	$\frac{7}{10}$ quart.
Sweet orange peels, well pulverized	6 pounds.
Angelica root	1 pound.
Galanga	1 pound.
Germanda	2 pounds.
Cloves	1 pound.
Quassia	½ pound.
True acore	2 pounds.
Lesser centaury	2 pounds.
Elecampane	2 pounds.
Holy thistle	2 pounds.

For this variety of vermouts, sweet wines are preferred. The Muscat wines are suitable for this purpose; in case they cannot be had, syrup should be added—preference being given to neutralized raisin syrup. The latter should be as little colored as possible; raw cane sugar can be taken, or even refined white sugar.

Italian Vermout.

Wine	220 gallons.
Wormwood	2.6 pounds.
Fresh oranges, cut in very thin slices	50 oranges.
Holy thistle	2.6 pounds.
Calamint	2.2 pounds.
Angelica root	0.4 pounds.
Cinnamon	2.2 pounds.
Nutmegs	1.4 pounds.
Gentian	1.3 pounds.
Germanda	2.2 pounds.
Lesser centaury	2.2 pounds.
Elecampane	2.2 pounds.

Some manufacturers do not make use of the last three plants.

This vermout, though of good quality, is inferior to those which are made according to the former prescriptions.

Some manufacturers have a practice of coloring the vermouts with caramel. Others, instead of infusing the plants in white wine, infuse them in alcohol, and then pour the alcoholic infusions into the white wines. Aside from the objection that the astringent principals are not dissolved, the chlorophyl of these plants gives to these infusions a dark green color. Vermouts which are made in this way are, too, more liable to deposit sediments. First class vermouts should have the *natural color of white wine*, viz.: light amber.

Treatment of the Vermouts.—Vermouts should be treated exactly in the same manner as the liqueur wines, of which they are but a variety; if thought to be wanting in alcohol, it should be ascertained if the percentage of this ingredient is higher than 16. In order to keep well, the dry vermouts should be treated as ordinary wines; the sweet ones, if their alcohol-percentage is below 16, are liable to ferment again, particularly in warm countries. It is therefore necessary to fortify them so that they should contain from 18 to 20, or at least 17 per cent of alcohol. If they are too bitter, they should be blended with aromatic vermouts, which are made without using bitter substances, or they should be diluted with good white wines with frank taste, having at least 17 per cent of alcohol, and to which two pounds of white sugar per gallon have been added. In large establishments the astringent and aromatic substances remaining in the plants after the first infusion are extracted by a second infusion or by distillation.

STATEMENT OF THE IMPORT DUTIES

OF ALL THE PRINCIPAL COUNTRIES TO WHICH CALIFORNIA WINES, BRANDIES, AND RAISINS ARE OR MAY BE EXPORTED.

Prepared by WINFIELD SCOTT, Secretary of the Commission.

Demands are frequently made at the office of the Board of State Viticultural Commissioners for a reliable statement of the tariffs of the principal foreign countries to which the viticultural products of California are at present, or may be in the future, exported, whether from San Francisco or from Atlantic ports. These statistics have been collected from the Consuls of the various countries, resident in San Francisco, and are therefore official and correct.

WINFIELD SCOTT,
Secretary.

ENGLAND AND HER COLONIES.

ENGLAND.

Wine, in casks, not over 30 degrees proof	1 shilling per gallon.
Wine, in casks, between 30 and 42 degrees proof	2 shillings 6 pence per gallon.
Wine, sparkling, under 30 degrees proof	1 shilling per gallon.
Wine, sparkling, between 30 and 42 degrees proof	2 shillings 6 pence per gallon.
All wines over 42 degrees proof	3 pence additional for each degree.
If sparkling and in bottles, if worth not over 15 shillings	1 shilling per gallon additional.
If over 15 shillings	2 shillings 6 pence per gallon additional.
Spirits	10 shillings 4 pence per proof gallon.
Spirits, not tested as in cordials	14 shillings per gallon.
Spirits, if bottled and in bond	3 pence per dozen.
Raisins	7 shillings per hundredweight.

CANADA.

Wine, up to 26 per cent alcohol	25 cents per gallon.
Wine, each degree between 26 and 40 per cent	3 cents per gallon.
Wine, sparkling	$3 per dozen.
Brandy	$2 per imperial gallon.

NEWFOUNDLAND.

Claret	40 cents per gallon.
Spanish reds and Italian	35 cents per gallon.
Malaga	35 cents per gallon.
Port and Madeira	$1 65 per gallon.
Hock and Burgundy	85 cents per gallon.
Champagne	$3 per gallon.
All other	12½ per cent and 90 cents per gallon.
Brandy	$2 40 per gallon.

QUEENSLAND.

Wine, sparkling	10 shillings per gallon.
Wine, all other	6 shillings per gallon.
Brandy	12 shillings per gallon.
Brandy, coloring, over 35 per cent alcohol	12 shillings per gallon.
Raisins	2 pence per pound.

TASMANIA.

Wine, sparkling	10 shillings per gallon.
Wine, all other, in wood	6 shillings per gallon.
Wine, all other, in bottles	8 shillings per gallon.
Brandy	15 shillings per gallon.
Brandy, coloring, over 35 per cent alcohol	15 shillings per gallon.

NEW ZEALAND.

Wine, sparkling	9 shillings per gallon.
Wine, all other, except Australian, containing less than 40 per cent proof spirits	6 shillings per gallon.
Wine, Australian, containing not more than 35 per cent proof spirits	5 shillings per gallon.
Spirits in bottles, jars, etc.	16 shillings per gallon.
Spirits in bulk, jars, etc.	15 shillings per gallon.
Raisins and dried fruit	2 pence per pound.

NOTE.—There is a discrimination of 1 shilling per gallon in favor of Australian wine. The latest advices indicate that South Australian wine will probably be admitted free, the latter colony agreeing to admit New Zealand oats free.

NEW SOUTH WALES.

Wine, sparkling	10 shillings per gallon.
Wine, all other	5 shillings per gallon.
Brandy	12 shillings per gallon.
Brandy, coloring, containing over 35 per cent alcohol	14 shillings per gallon.
Raisins	2 pence per pound.

VICTORIA.

Wine, sparkling	8 shillings per gallon.
Wine, all other	6 shillings per gallon.
Brandy	12 shillings per gallon.
Brandy, coloring, containing over 35 per cent alcohol	15 shillings per gallon.
Raisins	2 pence per pound.

SOUTH AUSTRALIA.

Wine, sparkling	10 shillings per gallon.
Wine, all other, up to 35 per cent proof	6 shillings per gallon.
Brandy	14 shillings per gallon.
Brandy, coloring, containing over 35 per cent alcohol	14 shillings per gallon.
Raisins	2 pence per pound.

CEYLON.

Claret, bottled	1 rupee and 25 cents per gallon.
Claret, bulk	50 cents per gallon.
Sparkling wines	50 cents per gallon.
All other wines, bottled	1 rupee and 50 cents per gallon.
All other wines, bulk	1 rupee per gallon.
Spirits	4 rupees per proof gallon, and 50 cents for every 10 degrees over proof.

FIJI ISLANDS.

Claret and Australian wines, bottled or bulk	2 shillings per gallon.
All other still wines	4 shillings per gallon.
Sparkling wines	6 shillings per gallon.
All spirits	14 shillings per gallon.

NEW GUINEA.

Spirits	12 shillings per gallon.

JAMAICA.

All wines	2 shillings 6 pence per gallon.
All spirits	10 shillings per gallon.

TRINIDAD.

Wines, sparkling	4 shillings per gallon.
Wines, all other, bottled, under 35 per cent alcohol	2 shillings 6 pence per gallon.
For each degree over 35 per cent	3 pence.
Wines, all other, in wood, up to 22 per cent	8 pence per gallon.
Wines, all other, in wood, up to 32 per cent	1 shilling per gallon.
Wines, all other, in wood, up to 42 per cent	2 shillings 6 pence per gallon.
For each degree above 42 per cent	3 pence.
Brandy	9 shillings per gallon.

BERMUDA.

Wine	20 per cent ad valorem.
Alcohol and all distilled liquors	4 shillings per gallon.

BRITISH GUIANA.

Wine, not over 26 per cent proof and not over $2 per gallon .... 50 cents per gallon.
Wine, bottled .... $1 per dozen pints.
Wine, all other .... 80 cents per gallon.
All spirituous liquors .... $2 50 per proof gallon.

CAPE COLONY.

Wine .... 6 shillings per imperial gallon.
Distilled spirits .... 2 shillings per imperial gallon.

OTHER COUNTRIES.

FRANCE.

Wine, from European countries .... 4 fr. 50 c. per hectoliter.
Wine, from all other countries .... 4 fr. 50 c. per hectoliter.
Alcohol and distilled liquors of all kinds .... 30 fr. per hectoliter.
Liqueurs .... 30 fr. per hectoliter.

GERMANY.

Wine, in casks, leather bottles or jugs of at least 50 kilogrammes gross weight .... 24 marks per 100 kilogrammes.
Wine, in small bottles or small leather bottles or jugs .... If sparkling, 80 marks per 100 kilogrammes; if still, 48 marks per 100 kilogrammes.
Fruit wines and cider not included.

Dried grapes .... 24 marks per 100 kilogrammes.
Fermented grapes .... Same as wine.
Fruit brandies .... 180 marks per 100 kilogrammes.
Wash and singlings .... Free.

ITALY.

Wine in casks .... 15 francs per 100 hectoliters.
Wine in bottles .... 30 francs per 100 hectoliters.
Brandy and other spirits in casks .... 25 francs per 100 hectoliters of pure alcohol.
If less than 80 proof .... 20 francs per 100 hectoliters.

RUSSIA.

Arrack, rum, brandy (French), and prune brandy .... 11 rubles per pud, brutto.
Grain spirits in bottles, liquors, kirchwasser, gin, whisky, and all spirits flavored with various fruits, also arrack, rum, French brandy, and prune brandy .... 75 copecs per bottle.

Remarks.—All grain spirits of all kinds in barrel and other large packages are prohibited for importation.

Wine of grapes—
All imported in wood .... 3 rubles 50 copecs per pud, brutto.
Not mousseux .... 40 copecs per bottle.
All kinds mousseux .... 1 ruble 25 copecs per bottle.
Raisins .... 1 ruble 80 copecs per pud.
All duties payable in gold.

SPAIN.

Wine, sparkling .... 150 pesetas per hectoliter.
Wine, all other .... 50 pesetas per hectoliter.
Brandy .... 20 pesetas per hectoliter.
Other distilled liquors .... 1 peseta per liter.
All preserved and dried fruits .... 1 peseta per kilogramme.

DENMARK.

Wine and fruit juice, unfortified, in bottles .... 13.44 cents per Pot.*
Same in barrels .... 2.73 cents per pound.
Grape wine, in casks .... 22 per cent ad valorem.
Grape wine, in stone jars .... 45 per cent ad valorem.
Liquors which cannot be graded .... 13.44 cents per Pot.
Same, 8 degrees strength or under .... 50.4 cents per eight Pots.
Same, for each ½ degree over 8 degrees .... .1 cent per eight Pots.

SWEDEN.

Wines, all kinds, not exceeding 21 per cent of alcohol .... 15 ore per liter.
Wines, all kinds, between 21 per cent and 25 per cent of alcohol (in casks) .... 30 ore per kilogramme.

*4.7 Pots equal 1 gallon.

Wines, all kinds, between 21 per cent and 25 per cent of alcohol (in other packages) .... 65 ore per liter.
Wines, all kinds, over 25 per cent of alcohol .... 1 krone 50 ore per liter.
Brandy and spirits in casks and made from grapes in any other country than France .... 75 ore per liter of 50 per cent alcohol at 15 degrees Celcius.
Same in other packages (regardless of the percentage of alcohol) .... 1 krone 11 ore per kilogramme.
Raisins .... 14 ore per kilogramme.
No allowance for tare.

NORWAY.

Wines, not exceeding 21 per cent alcohol, in casks (16 per cent for tare) .... 11½ ore per kilogramme.
Wines, not exceeding 21 per cent alcohol, in bottles .... 11½ ore per liter.
Wines, between 21 per cent and 25 per cent alcohol, in casks (16 per cent for tare) .... 36 ore per kilogramme.
Wines, between 21 per cent and 25 per cent alcohol, in bottles .... 36 ore per liter.
Wines, over 25 per cent alcohol .... Same as brandy 100 proof.
Brandy, in bottles .... 1 krone 60 ore per liter.
Brandy, in other packages, 100 proof (16 per cent tare for casks) .... 1 krone 71 ore per liter.
Raisins (20 per cent tare on cases) .... 12 ore per kilogramme.

BELGIUM.

Alcoholic liquors (distilled) used as beverage, up to 50 degrees strength; Gay Lussac at 15 degrees Centigrade, in casks .... 100 francs per hectoliter.
Same, each degree in excess of 50 degrees .... 2 francs per hectoliter.
Same, in bottles, regardless of strength .... 200 francs per hectoliter.
Wines (subject to Internal Revenue tax of 23 francs per hectoliter) .... Free.
Wines, over 18 per cent alcohol .... Excess at the rate for alcoholic liquors.
Raisins .... 25 francs per 100 kilogrammes.
Dried grapes .... Free.

SWITZERLAND.

Wine in casks, flasks, or jars .... 3 francs and 50 rupins per 100 kilogrammes.
Cognac and alcohol, in casks—for each degree of alcohol up to 100, as measured by Gay Lussac's alcoholometer .... 20 rupins per 100 kilogrammes.

HAWAII.

Alcohol and other spirits .... $10 per gallon.
Alcohol for medicinal uses .... $3 per gallon.
Brandy, etc. (between 30 and 55 per cent of alcohol and above 55 per cent pro rata) .... $3 per gallon.
Wines (sparkling), quarts .... $3 per dozen.
Wines (sparkling), pints .... $3 per two dozen.
Wines (dry), quarts .... 40 cents per dozen.
Wines (dry), pints .... 40 cents per two dozen.
Wines (fortified), between 21 and 30 per cent alcohol .... $2 per gallon.

MEXICO.

Wine, red or white, in glass, no allowance for leakage or breakage .... 20 cents per kilogramme (net weight).
Same in wood .... 12 cents per kilogramme (net weight).
All other spirituous liquors under same conditions .... 25 cents per kilogramme (net weight).
Raisins .... 10 cents per kilogramme (net weight).

SALVADOR.

Vinous liquors .... 5 cents per kilogramme (gross).
Distilled liquors .... 30 cents per kilogramme (gross).
Raisins .... 10 cents per kilogramme (gross).

NICARAGUA.

Still wines .... 3 cents per pound (gross).
Sparkling wines .... 5 cents per pound (gross).
Distilled liquors (between 12 and 25 degrees alcohol) .... 40 cents per pound (gross).
For every degree above 25 .... 3 cents per pound (gross).

COSTA RICA.

Wines in bottles .... 3 cents per kilogramme (gross).
Wines in bulk .... 5 cents per kilogramme (gross).
Liquors (whose introduction is allowed in barrels) .... 80 cents per kilogramme (gross).
Liquors (introduced in other packages) .... 60 cents per kilogramme (gross).
Cognac and all brandies (in barrels or demijohns) .... 80 cents per kilogramme (gross).
Cognac and all brandies (in other packages) .... 60 cents per kilogramme (gross).
All dried fruits, including raisins .... 13 cents per kilogramme (gross).

GUATEMALA.

Red wines (in whatever packages)	25 cents per bottle.
White wines (in whatever packages)	28 cents per bottle.
Sherry (in whatever packages)	28 cents per bottle.
All others	35 cents per bottle.
Brandy and all spirits up to 20 degrees Baumé	63 cents per bottle.
All dried fruits	7 cents per pound.

HONDURAS.

Wines, in cask or bottle	2 centavos per pound.
Brandies, in cask or bottle	30 centavos per pound.
All dried fruits	8 centavos per pound.

ECUADOR.

Wine	10 centavos per kilogramme (gross).
Brandy	Cane brandy prohibited.
Other brandy	25 centavos per kilogramme (gross).
Raisins	5 centavos per kilogramme (gross).

COLOMBIA.

Claret, in barrels or demijohns	2½ cents per kilogramme.
White wine, in barrels or demijohns	2½ cents per kilogramme.
All other wine	40 cents per kilogramme.
Brandy and distilled liquors	40 cents per kilogramme.
Raisins	20 cents per kilogramme.

CHILI.

Red wines, in bottles	$3 per dozen.
Red wines, in wood	32 cents per liter.
White wines, in bottles	$2 25 per dozen.
White wines, in wood	25 cents per liter.
Wine spirits	50 cents per liter.
Cognac	$4 per dozen.
Cognac	42 cents per liter.

VENEZUELA.

Wines for medicinal purposes	1.25 bolivares* per kilogramme.
Bordeaux and Spanish reds	.25 bolivares per kilogramme.
All others	.75 bolivares per kilogramme.
Sweet liquors (not rectified)	1.25 bolivares per kilogramme.

* One bolivar equals 19.3 cents.

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THIRD BIENNIAL REPORT

OF THE

CALIFORNIA STATE BOARD OF FORESTRY

FOR THE

YEARS 1889-90,

TO

GOVERNOR R. W. WATERMAN.

MADE IN ACCORDANCE WITH THE PROVISIONS OF SECTION FIVE OF AN ACT "TO CREATE A STATE BOARD OF FORESTRY, AND TO PROVIDE FOR THE EXPENSES THEREOF," APPROVED MARCH 3, 1885.

SACRAMENTO:
STATE OFFICE, : : : : : : : J. D. YOUNG, SUPT. STATE PRINTING.
1890.

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ILLUSTRATIONS.

Prepared by J. G. Lemmon and wife. Artotyped by Britton & Rey, San Francisco.

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AN ACT

To Create a State Board of Forestry, and to Provide for the Expenses Thereof.

[Approved March 3, 1885.]

The People of the State of California, represented in Senate and Assembly, do enact as follows:

Section 1. There shall be established a State Board of Forestry, consisting of three persons, appointed by the Governor of the State.

Sec. 2. Each member shall hold office for the term of four years, and until his successor shall be qualified.

Sec. 3. The Board may appoint and prescribe the duties of its Secretary, and elect one of its own members Treasurer, both to hold office at the pleasure of the Board.

Sec. 4. The duty of the Board shall be to collect statistics and other information with regard to forestry, tree culture, and tree preservation, throughout the State; to correspond with various forestry societies and individuals, for the purpose of obtaining such information; to learn by investigation and experiments the adaptability of various trees to the different sections of the State; to disseminate such information throughout the State in such a manner as to aid and encourage the purpose for which this Board is formed; to assist in enforcing and carrying out all national and State forestry laws, as far at practicable; to act with a special view to the continuance of water sources that may be affected in any measure by the destruction of forests near such sources; to do any and all things within their power to encourage the preservation and planting of forests, and the consequent maintenance of the water sources of the State.

Sec. 5. The Board shall report biennially to the Governor a detailed statement of its work, which shall include all disbursements that may have been made. All printing required to be done by the Board for their official use shall be done by the Superintendent of State Printing.

Sec. 6. There is hereby appropriated for the use of this Board, out of any moneys in the State Treasury not otherwise appropriated, the sum of five thousand ($5,000) dollars for the two years beginning the first of April, eighteen hundred and eighty-five, said sum to be used for the payment of the salary of the Secretary, not to exceed the sum of one hundred and twenty-five dollars per month, the necessary traveling expenses of the members of this Board, the employment of assistants, and such other needful expenditures as this Board may incur, and the State Controller will draw his warrants on the State Treasurer in favor of the Treasurer of the Board for the same.

Sec. 7. The members of this Board shall receive no compensation.

Sec. 8. All Acts or parts of Acts in conflict with this Act are hereby repealed.

AN ACT

To Enlarge the Powers of the State Board of Forestry, and to Provide for the Expenses of said Board.

[Approved March 7, 1887.]

The People of the State of California, represented in Senate and Assembly, do enact as follows:

Section 1. All the members of the State Board of Forestry of this State, and all assistants now employed or hereafter to be employed by said Board, are hereby endowed with all the powers of peace officers, for the purpose of making arrests for any violation of any law applying to forest or brush lands within this State, or prohibiting the destruction thereof.

Sec. 2. There is hereby appropriated for the use of this Board, out of the moneys in the State Treasury not otherwise appropriated, the sum of twenty-nine thousand five hundred dollars for the two years beginning the first of April, eighteen hundred and eighty-seven, said sum to be used for the payment of the salaries of the assistants of said Board, the necessary traveling expenses of the members of said Board, and such other needful expenditures as said Board may find necessary, and the State Controller shall draw his warrant on the State Treasurer in favor of the Treasurer of the Board for the same.

Sec. 3. This Act shall take effect and be in force from and after its passage.

COMMISSIONERS' REPORT.

To his Excellency R. W. WATERMAN, *Governor of California:*

Your Board has the honor to report a good measure of success attending the various operations conducted by it during the past two years.

Increased attention has been given to the forest fire service and development of resources looking to the permanency of present and rehabilitation of depleted forest areas. Our best energies have been enlisted in the effort to induce some action from the general Government tending to a proper administration of their timber lands within this State, as much a matter of public policy as of equitable relief to our people and your Board, upon whom is now imposed the onus of combating the destructive agencies at present tolerated upon the Federal territory.

To this end we drafted a memorial to Congress synoptically setting forth the urgency of the plea, embodying a few of our most salient grievances and outlining suggestions for their redress.

No legislative action has as yet flowed therefrom, but this Board recognizing that the community of interests in all forest lands are so inseparably interwoven as not to admit of the pursuit of divergent forestry methods, and that however useful as such may be the arbitrary lines of demarkation which define individual, State, or Federal ownership of forest lands, they must be disregarded in the operations of any rational, comprehensive, and successful system of forest management.

Hence our agitation of this subject as affecting the public domain in its relations to our State lands, shall be conscientiously and continuously persevered in until the recognition we demand is granted and the nation redeemed from the stigma attaching through its inertia in the matter.

It is a pleasure to record in connection with this memorial (which is incorporated within our report) the persistent efforts of our Representatives in both houses of Congress to secure us enactments in accordance with its recommendations, and the united and loyal support tendered us by the general public and the entire newspaper press of the State.

Much of this support has been voluntary and unsolicited, an encouraging sign of an intelligent and patriotic interest in the issues at stake, and of appreciation of our efforts to advance them.

Chiefly through our instrumentality and the unsparing efforts of Hon. Wm. Vandever, a portion of the public domain embracing lands upon which are situated the famous California big trees, have been withdrawn from sale and dedicated as national parks. The threatened destruction of these remarkable and isolated groves of forest giants was most imminent, and their extermination would have been one of the public disasters of our generation. They are now safe from the woodman's ax, but they still are guaranteed no immunity from fire, and one of the first acts of this Board upon the reconvening of Congress will be to urge the adoption of a measure supplementing the good work already begun by making provision for their complete guardianship against other sources of danger.

Continuation of the forest map work, a conspicuous feature of our previous reports, has with propriety been temporarily suspended.

All the forest areas of California have recently been sharply and intelligently defined, and maps illustrating their limits, density, and species, and timber and fuel value, have been issued by the Department of the Interior under the direct supervision of Prof. S. C. Sargent, which, of itself, is a sufficient guarantee of the highly scientific and practical character of the work, while in the detail of mechanical execution nothing is left to be desired. It is hardly possible to overrate the value of this work, without doubt the most finished and exhaustive contribution to forestry of this or perhaps any era.

It is not within the limit of probabilities that accessions to the timber lands either through natural or artificial means, or their disappearance through destructive forces during the next few years, will be on a scale of such magnitude as to materially impair the usefulness and accuracy of these maps; whenever such becomes apparent, this function of our work will be resumed.

For cognate reasons, the purely botanical work of the Board has been abridged and confined to some addenda to and revisions of the pines, as skillfully and conscientiously elaborated at the hands of Mr. Lemmon. The indefatigable efforts of the Botanical Staff of the California Academy of Sciences, and the zeal of the half score of individual collectors, have, through the medium of scientific publications of the day, brought into prominence every recent contribution to dendrology of interest to this coast.

The scientific and economic value of most of our native species has been fully determined, and profitable results in the interest of immediate reforestation can be better expected of those species whose limits, habits, and known requirements are now familiar to us, than of new, untried, or little known native kinds.

The two great orders, the Coniferæ (cone-bearers) and the Cupuliferæ (acorn-bearers), and which constitute nine tenths of all the woodland wealth of California, have been thoroughly exploited; the former in the unparalleled monographs of the late Dr. Englemann; the latter, at the scholarly hands of Prof. Edw. Lee Greene, of Berkeley, Cal.

It is fitting that this Board should acknowledge the benefits arising from, and the knowledge of tree lore to be derived from the study of "Kellogg's Oaks"—a knowledge only made accessible through the private liberality of Dr. McDonald, of San Francisco, and skillful and masterly revision by Professor Greene; a California enterprise in every particular, it is an encouraging exponent of the sentiment of our people in becoming fully aroused to the importance of every detail affecting forests or forest interests.

New considerations arise or are daily brought to our notice, impressing us more strongly than ever with the beneficial results to the State that may ultimately be expected to flow from systematized forestry. Hitherto, arguments in this line have been mainly directed to investigation of the uses of our forests as conservators of favorable climatic conditions; as perpetuators of our water sources, and as the field of continuous supply for our lumber mills and correlated industries. While these considerations are and ever must be paramount to all others, yet their merits and importance have been so exhaustively dwelt upon in

previous reports that it becomes a work of supererogation to more than reaffirm them here.

Yet another consideration, and one upon which insufficient stress has heretofore been laid, and which appeals to us as strongly through our pockets as our hearts, is the urgent necessity of maintaining intact from vandalism the unequaled beauty of our California forests.

Our State is fast becoming a world-famed center for tourist travel and both winter and summer resort. "Accessibility to the redwoods or the timber country" has now become one of the stereotyped inducements to travelers and patrons of many of these resorts, and the unsurpassed grandeur of these forests has been and must for all time continue to be a prominent feature in the attraction of visitors to our State, whose presence is a conceded benefit to us all.

This class is further augmented by those who seek the mountains for purposes of sport. So jealously has the State guarded the interests of the native fauna, that the statute books are weighted down with provisions against their possible extinction in every particular save one.

The propriety of this does not admit of dispute; not alone in the interest of those who desire the health and recreation incident to field sports, but in defense of that hardy and independent class who look to the product of the rod and gun for a livelihood, or to the forests as furnishing an unfailing food supply when all other means are exhausted.

In the passage of many wise and conservative measures having a single eye to the importance of this question, the one thing above excepted, and which seems to have escaped the vigilance of framers of laws protective to fish and game, is the danger to both in our constantly recurring forest fires. Large game driven out and away from the shelter of the timber; smaller species and the young of all burned up in countless numbers.

Close seasons for game fishes are rigorously prescribed, and with but few violations are generally observed, yet continuous and unabated open seasons are fraught with less danger of extermination to the finny inhabitants of any stream than the destruction by fire of its timber-sheltered watershed; the uniformity of the flow, the coolness of the waters, and the supply of food are all enhanced by the adjacent forest—materially impaired and endangered by its loss.

These are considerations of sufficient gravity to warrant us in believing that all interested directly or indirectly in the preservation of the fish and game of this State from extinction will heartily coöperate with us wherever possible to avert the most serious danger to which they are exposed.

THE LUMBER INDUSTRY AND INTERESTS.

For many years and with good foundation, the lumbermen of the State were arraigned for injudicious cutting and needless waste of timber in their logging operations. The still fallen but now unserviceable monarchs of the forest in places accessible to mill work, bear mute but unimpeachable testimony to the truth of these charges. Now, it becomes a pleasure to record not only a general reformation in this particular, but to know that in some districts waste of any kind is reduced almost to a minimum.

Errors by the most experienced loggers will sometimes result in the falling of a tree unsuitable for sawmill uses; but this loss is offset by the more general economy now practised in utilizing what was *once* waste material.

In the San Bernardino District, five mills convert the main cuts into building material; the upper cuts they turn into fruit-box lumber, and, to complete the good work, they are followed by charcoal burners, who utilize the tops and branches until not only is every vestige of the crop profitably converted, but the consumption of the inflammable debris results in providing an assurance against fire, worth more than all other preventive or remedial measures combined. No other heavily cut-over timber belt in the State is now so free of logging refuse as this, and, as a proof of the assertion made above, none have for some years past been so exempt from extended or progressive fires. The result is a far-reaching, spontaneous second growth of superior quality and of unparalleled thrift and vigor. So pleasing is the contrast presented with some of the periodically fire-swept districts, that it becomes pitiable to contemplate the disaster that would here follow in the wake of an established fire.

Nearly one half of this territory in question is still land of the Federal Government, and the felonious negligence which tolerates and leaves to the hit-or-miss game of chance the escape or destruction of these struggling and promising forests, becomes a crime that cannot be condoned, but only the subject for our reproach, rebuke, and condemnation by future generations.

To the lumbermen and millmen must be accorded hearty commendation for the unsparing and self-sacrificing efforts they now put forth for the repression of fires.

Not infrequently work in the best of the season is completely suspended and all hands repair ten, twenty or more miles to combat an incipient blaze, and this Board gratefully recognizes the efficiency and value of the services rendered.

Self-interest cannot be alleged as their only incentive. None know better than the millmen that the mature and largest timber is seldom destroyed by even the hottest fires; that it is the trees of one foot in diameter and downward that are the doomed victims; none know better than they that generations must elapse before those destroyed could become merchantable products; none more cognizant than they that the burning out of this second growth and underbrush facilitates and lessens the expense of their logging operations.

Only in the case of large, stationary mills, whose plant embraces a costly system of flumes and tramways for the handling of distant timber, can fires be otherwise than a distinctive gain; yet of many fires investigated, in only one isolated case can even suspicion attach to any mill owner or employé, and in that instance the resulting damage from inability to control will be an ample deterrent for the future.

Hence it becomes a pleasant duty to aggressively maintain in behalf of the guild at large, that self-interest alone has not actuated them in this course, but that consideration for the rights of others has been equally instrumental—to pledge them our assistance, and to leave no resources untried to secure them the relief which in equity and justice they are entitled to at the hands of the general Government.

With the gradual adoption of close economies, with reasonable care in the selection of trees, and the reduction of all unnecessary waste, it seems to us that the lumbering interests of the State will continue

to flourish long after the time allowed by the statisticians of the Department of the Interior.

Such may not be the case with the redwood forests, of which nearly every available stick of timber has been measured, and if the ratio of increase of our export trade is maintained, in less than forty years our redwood forests will exist but in theory. Still, upon the Sierra Nevada side of the State the lumber resources seem to be boundless, and to endure for all time.

Some of the largest mills, whose individual output is ten million feet (B. M.) per annum, still have within reach, and without taking stock of anything except the best and most accessible timber, enough to supply their full capacity for one hundred and fifty years to come.

These mills are few in number, and vast stretches of forest of the finest quality in Plumas, Sierra, and Lassen Counties, have never yet been assailed by the lumbermen, and whose productive capacity is almost beyond the computation of figures.

Further, as the result of recent close and painstaking examinations of some of the most heavily cut-over timber belts upon the crests of the Sierras in Butte, Tehama, and Nevada Counties, it is our carefully digested opinion that legitimate lumbering as now practised there, nor the results of more reckless operations in the past, give any evidence tending to show that the continuation of present methods, or extended operations in the future will impair in the slightest existing hydrologic conditions.

For this fortunate state of affairs we are not indebted to the lumbermen, but to the happy arrangements of Nature, whose distribution of species has been so effective that only about one third of this forest cover is available at present for millmen's wants.

Much of this territory, in fact most of it in the districts referred to, has been stripped long ago of its Sugar Pine (*P. Lambertiana*); since then a return has been made for the Yellow Pine (*P. ponderosa*), and more recently still another inroad for the best of the Spruce (*Pseudotsuga Douglasii*); but there still remains a magnificent growth of the Balsam, Red Fir, and Flat-Leaved Cedar, which, however valueless at present from the lumberman's standpoint, as fully and completely subserves the preservation of the conditions dependent upon forest covering as their more coveted but no whit more useful timber coöccupants would have done.

Indeed, except for the occasional telltale stump, the inexperienced may walk or ride for many miles upon the most important watersheds of the mountains, at points where many basins concentrate to form the beginning of our chief watercourses, and be impressed with the idea that he is traveling through the virgin forest.

The exhaustion of the more esteemed species may, in time, compel the lumberman to return for these now neglected sorts, but by the time the standing spruce and pines of these hyperborean counties have been used up, the now flourishing second growth of young timber will be ripe for the ax, and another long renewal of the prosperity of our lumbering industries.

This, always presupposing that at an early day some adequate means will be found of coping with the fire evil, and that young forests of twenty to forty years' growth will not be swept from the face of the earth with no more consideration than would be accorded to so many noxious weeds.

TRADE.

The volume of our lumber trade is fast increasing, and rapidly rising to the front rank in importance among our business enterprises. New avenues of export trade are being daily developed, the increment from year to year showing a remarkable and steady gain. Wherever our native redwood has been introduced it has met with most flattering success, and on its merits secured a footing and created a demand that not even the imposition of foreign import duties against it can succeed in abating.

As a general all around utility lumber, it readily takes second place among all known timber trees, yielding first rank only to the perhaps doubtful supremacy of *Pinus strobus*, the common eastern White Pine.

An illustration of its merits and popularity is quickly shown by the fact that it is now on sale by many dealers in the Eastern United States, and again that our traffic in this article with the Australian Colonies has grown within recent years to large proportions despite a constant issue of Government publications claiming to show a diversity and value of native forest products, all sufficient to supply all possible domestic wants.

The statistics of our trade with the colonies, now being collated by the Forester, through the courtesy of the United States Custom House at San Francisco, and which will be shortly issued as a supplement to this report, will not only show our chief foreign markets, and the remarkable increase in the trade since the last publication on the subject by the National Bureau of Statistics, but seem to indicate that Australians are becoming practically aware of the great superiority of our woods for general building purposes, and make more eloquent appeal to us in behalf of careful forest management than any words can do.

The drain upon our redwood resources, for domestic uses alone, is enormous, exceeding two hundred million feet (B. M.) a year, and our success in holding forever the far West Pacific trade now tributary to us, depends upon our vigilance in maintaining the reproductive character for all time of these fast diminishing storehouses of our wealth.

In the matter of these redwood forests, so remarkably confined to a minute fraction of the earth's surface, and to a limited zone even in California, their extension in area through natural agencies is improbable to the last degree; hence, it seems that their almost sempiternal powers of reproduction from the root was an endowment directed solely to the end of neutralizing the war of extermination that has been waged upon them during the past forty years.

That this power of self-reproduction from the stem is not eternal we now unfortunately know to be true.

After felling the trees, the subsequent growths have been burned over and destroyed and new shoots have appeared. This process has occurred in some localities twice, and the parent root has responded once more in the supreme effort to reassert its indestructible character; but in most cases where a third time they are assailed by flame, the vitality of the tree succumbs, and the charred but undecaying stump remains for all time a monument to our egotism and shame.

It is to be hoped that if the setters out of fires in the redwoods anticipate the full measure of forgiveness to be accorded them for seventy and seven misdeeds, it is to be devoutly wished that the whole of the older scriptural doctrine may prevail, and that a generous supply of the seventy-eighth fire may be kept in perpetual ignition for their exclusive benefit.

Our southern redwood belt, *i. e.*, the redwood-producing district of San Mateo, Santa Clara, and Santa Cruz Counties, having been extensively cut over prior to the invasion of the northern counties by lumbermen, presents a better field for more accurate determination of the future prospects of this important tree than can be predicated of its ultimate status farther northward.

Here upon the seaward side of the Coast Range are still large and valuable bodies of uncut timber, but from the eastern slopes of these mountains which align nearly the whole length of the Santa Clara Valley, every stick of timber has been cut for more than twenty years past; railroad facilities, and the nearness of many flourishing towns having furnished a market for every product including fuel, with the result of leaving a "clean up" not exhibited in any other part of California. Even the Tanbark Oak (*Quercus densiflora*), originally associated with it in great quantity, has been cut out, and lacking the regenerative powers of the redwood has practically disappeared.

The largest part of this field is now covered with a second and third growth of great density and vigor, careful inquiry from residents showing that upon areas from which the redwood has completely disappeared is that which within their knowledge has been burned over three or more times.

The natural habitat of the tree is confined to good soil, its greatest development occurring upon lands of great depth and fertility; and striking illustrations of the erosions and washing away of large tracts of fruitful lands in these burnt and reburnt districts abound to the westward of Menlo, Redwood City, and San José. None such are visible upon lands protected by a secondary growth of not above twenty feet in height. These hillsides in many cases are exposed to bedrock, bereft of all soil and utterly and forever unfitted for the natural or artificial propagation of most trees, and certainly for the best of all—the redwood.

The greater demand for this lumber, its narrower limits, the greater time required to perfect its maturity, all indicate what in our judgment does not hold true of the northern Sierra forests, to wit: its early exhaustion for commercial requirements alone. The cleanness with which these forests are cut further presents a menace to our climatic future, which, as we have shown, does not exist in our interior timber country; hence if we are to be in nowise influenced by consideration concerning the future lumber supply of the next generations, at least the gospel of self should urge upon us such means as will maintain, unimpaired, our water supply and contingent benefits, when the only obligation exacted is vigilance in seeing that the axman's work is not supplemented by fire.

FOREST FIRES.

In this particular, and with many disadvantages to labor under, we have to commend the activity of our agents, and to note that the State has been very generally posted with the customary fire notices, and our attention has frequently been called to instances where this formality has at least exercised a restraining and salutary influence.

In several cases arrests have been had of suspected violators of the law, but prosecution failed for lack of evidence or the inefficiency of the statutory enactments relating thereto.

We shall again submit to the Legislature recommendations for the amendment of these laws, increasing their stringency, and requesting a joint resolution urging upon the Governor of the State the necessity for an annual proclamation, which shall recite the law upon the subject and offer adequate rewards for the conviction of its violators.

Such action will secure widespread publicity, and tend to convert the residents of our wooded districts into a volunteer constabulary, whose presence and watchfulness would have a restraining effect upon evildoers.

Those engaged in clearing their own lands, and through whose culpability fire extends beyond their own limits, should not be held guiltless, but be dealt with as rigorously as willful offenders; nor be permitted to jeopardize the lives and property of others through their negligence.

A force of Fire Wardens is maintained by the State of New York for the guardianship of the Adirondack region and the timbered watershed of the Hudson at considerable cost, but with a heavy balance to the credit of the Forestry Board in the value of public and private property saved from loss.

So far as practical, we have endeavored to establish a similar service; but, in view of the enormous territory under supervision, no fully effective results could be expected that did not entail an expenditure of $100,000 per annum. Even then, no service could be prolific in results that did not aim to subdue *all* fires in the timber district, wherever or however originating, and irrespective of individual, State, or Federal ownership; and it becomes a moot question to determine if even the higher law of necessity and self-preservation is sufficient to justify the recommendation of a policy of burdensome taxation upon ourselves to make good the Federal shortcomings, and preserve, at our cost, the timber integrity of the public domain.

The President of the United States, impressed with the importance of this matter, submitted a message to Congress urging upon that body the necessity of some provision to properly police these lands; and correspondence has been had by this Board with the Department of the Interior, urging our claims for recognition in event of such provision being made.

If successful in this issue, by close coöperation of State and Federal authorities, we confidently believe that our fair State can at an early date be redeemed from the plague of forest fires; or their mischievous results, if not wholly abated, reduced to inconsequential losses.

EXPERIMENTAL FORESTATION.

Planting of State lands devoid of trees, or reforestation of those from which the timber has been stripped, and which, from default of final payments, have reverted again to the State, though most pertinent to the functions of this Board, cannot be undertaken until all danger from

the fire nuisance and roving bands of sheep engaged in stealing pasture be fully abated.

Further, to insure a continuous policy of successful scientific management, these lands should be deeded in trust to this Board and its successors, until such time as they are restored to a paying condition, and the income derived therefrom may be disposed of as directed by the Legislature. Your attention is again called to the iniquity of the school land law as it now stands, the details of which have been fully ventilated in our previous reports.

Briefly, the law was ostensibly framed in the interests of the public schools as a means of providing school funds; practically, it operates chiefly to enrich a few timber speculators, who can strip the land of everything of value, and throw it back unpaid for to the State in a condition that will require generations for its restoration to useful or productive ends.

The patriotic popularity of any measure directed for the *apparent* benefit of the schools, when backed up with a little cheap claptrap, always goes with a rush and without too close scrutiny into the merits or demerits of the question at issue. Such has been the case with the present law, which promised much upon its face, but in practice has become a farce, and permits not only the reckless spoliation of the forests, but has impaired beyond redemption the integrity of one of the grandest endowments in the cause of free education ever conceived by this or any other country.

For the reasons given above, our experimental work has been chiefly confined to the introduction and dissemination of forest trees and seeds that, after testing upon our station grounds, give promise of sufficient utility and value to justify their transplantation to other parts of the State.

Investigations have been had with the single end in view of encouraging the planting of so called waste lands for the purpose of redeeming from aridity, and reclaiming to forestry, lands wherever situated unsuitable to general or special agriculture.

We have made our experimental stations the vehicle for the gratuitous distribution of both seeds and young trees from Del Norte to San Diego, and embracing with two exceptions every county in the State.

Our distribution is made in a way not to conflict with the interests of the nurserymen or commercial dealers, but to the contrary, as our many testimonials show, to their marked advantage in promoting a demand for their products which our recommendations have created.

It is not amiss to cite here a single instance, that of the Sugar Gum (*Eucalyptus corynocalyx*), which, though not originally introduced into the State by this Board, through it received its first impetus and widespread introduction throughout Southern California. We are now informed through many sources that the energies of both seed men and growers are taxed to the utmost to supply the demand for this most useful tree.

Two of our stations are now in a high condition of improvement, alike instructive and beautiful. The requirements of the last Legislature have been fully complied with, and the State now holds in fee simple title to two most valuable properties; one located at Chico, the other at Santa Monica, worth, with the nursery stock and improvements thereon, in the aggregate not less than $40,000.

Desirable sites at intermediate points, including valuable water rights, are tendered the State free of cost, for the establishment of other stations for the development and stimulation of forest tree planting. Acceptance of these stations depends upon the action of the Legislature in making proper provision for their maintenance and support. Unless this be done, the Board cannot in good faith accept them at the hands of the donors.

The esteem and popularity in which this branch of our work is held, and the very general interest it has aroused in every quarter of the State, is evidenced by the increasing number of visitors to our stations, and the voluminous correspondence which has grown up in connection therewith during the past year; an interest intensified by the ambition of our citizens and land owners to redeem and convert sterile and unproductive hills into profitable and beautiful features of the country; to make plantations that shall not alone yield the fruits of industry and skill, but concurrently add their quota to assist in maintaining the climatic equilibrium so essential to retain in order that California may continue to enjoy the supreme distinction as the possessor of the most perfect climate in the world.

This Board is indebted to, and desires to make general acknowledgment to their many correspondents, whose zeal and services have encouraged and aided us in spreading the gospel of tree planting. For especial services in the matter of painstaking reports, the undertaking of unpromising experiments, for donations of seeds, trees, and many valuable publications, we are under obligations to Hon. Wm. E. Alvord, of San Francisco; Congressmen Morrow, Clunie, and Vandever; B. E. Fernow, Chief of Forestry Division, Washington; Forest Commissioner E. T. Ensign, of Colorado; Mr. Frank E. Gallaher, of Santa Barbara; C. E. Mohr, of Pleasanton; Abbot Kinney, of Lamanda Park, and Prof. E. W. Hilgard; to the Forest Departments of both France and Austria, for their reports; and for seeds and reports from Dr. Schomburgk and J. Ednie Brown, of Adelaide, of South Australia; to Baron F. von Mueller, Government Botanist of New South Wales, and Mr. F. M. Bailey, Director of the Botanic Gardens of Queensland, Australia. To these latter four gentlemen we are indebted for seeds never heretofore introduced into California, and which give early promise of ready adaptability to many parts of the State.

Our unqualified appreciation of the efficient and concientious services of the officers and agents of the Board is freely expressed; services highly instrumental in bringing this institution to the degree of usefulness and importance generally accorded to it by the people of the whole State.

WALTER S. MOORE, Chairman.
J. D. SPRECKELS, Treasurer.
F. J. MOFFITT.

FINANCIAL REPORT OF SECRETARY.

Room No. 35, Flood Building,
San Francisco, Cal., January 1, 1891.

To the Commissioners of the State Board of Forestry:

Gentlemen: I have the honor to submit herewith a report of the finances of the Board for the two years ending January 1, 1891.

The Legislature appropriated for the uses of the Board of Forestry for the years 1889–90 the sum of $30,000, which amount, by the experiences of the past two years, has proven entirely inadequate for the work the Board proposed to undertake. With this sum, however, the Board has accomplished a great deal in the way of tree planting and forest preservation, as the report of the Head Forester, and an inspection of the Experimental Stations at Santa Monica and Chico, will show.

The posting of "Fire Notices," and the publicity given to the reward offered for evidence against depredators as fire-setters, have also been productive of a great saving to the people.

FINANCIAL STATEMENT.

Appropriation, 1889–1890		$30,000 00
Salary Head Forester	$3,150 00	
Traveling, etc., Head Forester	1,327 47	
Salary Forestry agents, posting notices, etc.	5,658 60	
Expenses of experimental stations	3,301 95	
Wages and incidentals, plantation employés	6,692 38	
Salary, Secretary	2,625 00	
Contingent expenses, Secretary	46 20	
Salary, Botanist	600 00	
Contingent expenses, Botanist	168 65	
Traveling and incidentals of Commissioners	308 98	
Seeds, trees, etc., distributed	564 71	
Stationery, porter, postage, printing, etc., main office	400 65	
Rent, furniture, fuel, etc.	1,431 00	
Insurance and legal expenses	39 00	
		26,314 59
Balance to credit of Board		$3,685 41

It should be borne in mind that three months are yet to intervene between the date of the above statement and the expiration of the time in which the last appropriation has to run. The balance shown it is thought will barely suffice to pay the necessary expenses of the Board, the care and cultivation of the plantations already set out and growing, the expense of illustrating by artotypes the present report, the sending of the same through the mails, the traveling expenses of the Commissioners and officers, and the necessary incidental expenses of the main office.

Respectfully,

SANDS W. FORMAN,
Secretary.

January 1, 1890.

REPORTS OF W. S. LYON, FORESTER.

PART I.

REPORT ON THE CONDITION OF THE EXPERIMENTAL STATION AT SANTA MONICA.

The grounds at this station have been subdivided into three sections: One is exclusively reserved for the rearing of young forest tree seedlings; a second space is alloted to the individual planting of different species, with a view to the ultimate development of each to its uttermost capacity of either ornament or economic value; the third portion for the making of practical forest plantations *en bloc*, and of growing these latter under different systems of treatment.

The methods followed in the nursery are those generally pursued in California—a large proportion of the trees being reared in pots and boxes, a custom not generally prevalent in Eastern or European forest nurseries.

This method offers less root disturbance than is encountered in the nursery row system, and admits of prolonged planting into the heats of summer, which in our country of intermittent rainfalls would not be practicable under the open nursery row plan, except by recourse to the costly and tedious operation of removing and sacking each plant with a considerable ball of soil.

Aside from the trees needed for our own requirements in making the forest plantations referred to, a very large number are being grown for general distribution. The intention in making this distribution is, that parties applying for, and receiving trees from the Board, shall within one year thereafter render in writing to us a brief report setting forth the measure of success that has attended the planting; the character of the land where planted, the amount of cultivation, or water, or both, that has been given, or if none; and to report the growth made by each species sent during the current season under these different conditions.

As it is improbable that our stations can ever be located in all parts of this State, and as an auxiliary to our work in determining varieties best adapted to diverse soils and climates, we expect by this means to extend our operations over a very large area, and to interest each recipient in becoming a close and independent investigator. This plan has already been the means of furnishing reliable information from many points in the State, and though records so obtained may lack the value of reports from trained observers, yet when properly sifted and collated become valuable coefficients to our general work and furnish reasonable data upon which to base future operations.

It has been our policy to send out a limited number of individuals, and as great a variety of species as the condition of our supply and the as far as known nature of the district where sending would admit of.

As a rule, the number sent out to one person is limited to fifty plants, deviations from this only occurring where the shipments were made to distant points or remote from railroad facilities, and the costs and risks of transportation so great that an added number have been sent to cover these extra risks and expenses.

Exceptions have also been made in interest of Boards of Education and School Trustees, who have desired to plant shade trees upon school grounds, and who had no fund upon which they could draw for the purchase of them through ordinary channels. Besides these, various State eleemosynary institutions, and town or municipal parks have been supplied; but by far the most extended of our distributions have been among village improvement associations, or to farmers' clubs for the planting of highways, avenues, and country roads—an object in itself only less commendable in small degree than the planting of permanent forests.

In addition to this, during the past two years we have sent out small collections to four hundred and twenty-one persons who have filed upon timber culture claims within this State, and who seemed to be wholly at sea as to the requirements of the Act and as to the trees they could plant with best results and least loss. As these parties have now, or will have, ample time to test the value and success of the varieties sent out, their labors become a valuable adjunct to our work, and must before their time expires result in the afforestation of a very considerable portion of our now treeless districts.

In many cases filings upon these lands have been speculative, with no intention on the part of the original locator to comply with the law; the forfeiture clause will sooner or later make them revert to the Government, while the experience derived through experimenters upon adjoining claims must result in marked benefit to the public, whether the forestation of the lapsed claims be undertaken in the future by State, national, or individual effort.

A number of applications have been received by us for trees sufficient to plant out an entire timber claim, and though anxious to facilitate in every way the operations of the tree planter, and to devise ways and means to overcome the many obstacles to the planting of waste lands, we cannot be expected to discriminate in the favor of any individual to such an extent as would leave us powerless to meet the requirements of future applicants.

This tree distribution has exercised a widespread influence for good throughout the State. It has stimulated individual planting to an extraordinary degree. Our recommendations have been the direct incentive to the actual planting of a great number of small tracts, from five to twenty acres, and not a few up to two hundred acres. Incidentally, this has imposed upon the Board a great mass of business far exceeding the narrow limits originally contemplated by growing and distributing a few trees haphazard. It now involves every detail of forestry in its widest significance; all the economic uses of trees, their values, costs, and profits; all of their possible ranges of soil and climate; their fitness, or otherwise, for a multitude of purposes under an infinite variety of conditions—have furnished the material for a mass of correspondence from all parts of the State, so far reaching and voluminous, that the enlargement of this report three hundred fold would not embrace it.

To illustrate the diversity of the subjects brought to our notice, and to show the willingness of the general public to conform to our request to furnish us with the reports needed to extend the field of our usefulness, we will embody with this report as an appendix, a very few letters bearing upon the problems we are called upon to solve.

That there need be anticipated no abatement of interest in all that pertains to tree planting, is evidenced by the fact that we have now on file more than three times as many applications for trees for the present season as we received last year.

We were never before so well arranged or supplied to meet these requisitions, and for that section of the State most readily accessible to the Santa Monica Station, are prepared to supply the wants of those desiring to make tests in different localities with the subjoined list and stock of young forest trees:

SPECIES OF EUCALYPTUS.	Local Name (when known).	Number Pot Grown.	Size of Pot—Inches.	Height of Plants (Nov. 1, 1890)—Inches.	Number Box Grown.	Height Box Plants (Nov. 1, 1890)—Inches.	Total Each Species.
E. rostrata	Red Gum	611	2½	8 to 15	22,600	4 to 10	23,211
E. viminalis	Manna Gum	120	2	6 to 8	15,150	10 to 14	15,270
E. corynocalyx	Sugar Gum	160	2	4 to 6	2,100	3 to 4	8,614
E. corynocalyx	Sugar Gum	52	2½	6 to 8	5,860	6 to 8	
E. corynocalyx	Sugar Gum	42	4	10 to 12	400	2 to 3	
E. globulus	Blue Gum				2,200	2	6,060
E. globulus	Blue Gum				3,860	8 to 12	
E. diversicolor	"Karri" of S. W. Australia	210	2	6 to 12			5,115
E. diversicolor	"Karri" of S. W. Australia	5	3	12 to 16			
E. diversicolor	"Karri" of S. W. Australia				4,900	6 to 10	
E. leucoxylon (var.?)	Iron Bark				5,600	6 to 8	5,635
E. leucoxylon (true)	Iron Bark	35	3	12 to 15			
E. obliqua	Stringy Bark, messmate	99	2	6 to 8	90	6 to 8	3,508
E. obliqua	Stringy Bark, messmate	31	3	10 to 12	3,288	10 to 12	
E. polyanthema	Many-flowered Gum	37	2	567	3,100	8 to 10	3,137
E. goniocalyx	Bastard Box	240	2	4 to 8	1,103	10 to 14	1,343
E. paniculata	White Bark, N. S. W.				770	8 to 10	770
E. marginata	Jarrah	150	2	4 to 5			661
E. marginata	Jarrah	460	2½	6 to 8			
E. marginata	Jarrah	51	3	8 to 12			
E. amygdalina	Giant Gum	47	2½	6 to 8	382	8 to 10	451
E. amygdalina (var.)	Giant Gum	22	3	15 to 18			
E. Gunni	Swamp Gum	264	2	10 to 12	78	12 to 14	342
E. colophylla	Handsome Leaf	22	3	8 to 12	300	4	322
E. Stuartiana	Apple-scented Gum	247	2½	10 to 16			247
E. pilularis	Black Butt	31	2	6 to 7	165	10 to 14	196
E. piperita	White Stringy Bark, N. S. W.	158	2	6 to 8			158
E. amygdalina (var. regnans)		56	2	4 to 6	80	6 to 8	136
E. obliqua (var. fissilis)		122	2	5 to 7			122
E. punctata	Leatherjacket, N. S. W.	106	2	8 to 12			106
E. siderophloia	White Iron Bark				90	4 to 6	90
E. botryoides	Bastard Mahogany				70	4 to 6	70
E. melliodora	Yellow Box, Victoria	22	2½	12 to 16			22
E. platypus		17	3	16 to 18			17
E. stricta		10	2½	6 to 8			10
E. Pressianum		4	2	4			4
E. Leuhmani		4	2	5			4
E. corymbosa	Bloodwood, N. S. W.	3	2	6			3
E. saligna	Flooded Gum, N. S. W.	2	2	6			2
E. citriodora	Sweet-scented Gum	2	2	4			2
E. ficifolia	Fig-leaved Gum	1	2	4			1
E. alpina		1	2	3			1
E. (?)	Unknown Species	12	2	6 to 8			12
E. tetraptera		4	2½	8			4
E. eugenioides	Eugenia-like Gum	1	3	10			1
Total							75,647

Name of Tree.	Local Name (when known).	Number in Nursery Row.	Size, in Inches.	Number in Boxes.	Size, in Inches.	Number in Pots.	Size, in Inches.	Total Each Species.
Pinus pinaster	Cluster Pine	6,113	12 to 15	358	8 to 10	512	10 to 15	6,983
Pinus Austriaca	Austrian Pine	5,895	5 to 7	12,470	4 to 5	186	3 to 4	18,551
Pinus Strobus	White Pine	3,295	3 to 4	2,605	3 to 4	2	6	5,902
Pinus Torreyana	Torrey's Pine	1,662	4 to 6	132	10 to 12	387	7 to 8	2,181
Pinus ponderosa	Yellow Pine	249	3	91	3			340
Pinus insignis	Monterey Pine	135	14 to 16	70	10 to 12	61	10 to 12	266
Pinus sylvestris	Scotch Pine	152	3 to 5	52	6	24	4 to 6	228
Pinus pinea	Stone Pine	80	10 to 14			102	10 to 14	182
Pinus Canariensis	Canary Isle Pine					153	10 to 12	153
Pinus Coulteri	Coulter's Pine					62	5	62
Pinus Laricio	Larch Pine	61	3 to 4					61
Pinus Montana	Alpine Pine	61	3 to 4					61
Cupressus sempervirens	Italian Cypress			7,800	10 to 12			7,800
Cupressus Guadalupensis	Guadalupe Cypress			2,720	6 to 8			2,720
Cupressus macrocarpa	Monterey Cypress			2,054	10 to 12	11	12 to 16	2,065
Chamœcyparis Lawsoniana	Lawson Cypress	315	16 to 20			32	12 to 15	347
Larix Europœa	Larch, European	152	4 to 10					
Larix Americana	Larch, American					2	10	2
Sequoia sempervirens	Redwood					103	10 to 20	103
Sequoia gigantea	Big Tree	40	4 to 6			3	6	43
Abies concolor	Balsam Fir	23	4					
Casuarina quadrivalvis	She-oak			430	8 to 12	615	10 to 20	1,045
Pittosporum undulatum		91	10 to 12	2,285	8 to 10	31	8 to 10	2,407
Robinia pseudacacia	Black Locust	1,964	15 to 20					1,964
Lagunaria Pattersoni		96	10 to 12	1,310	8 to 10	205	7 to 8	1,611
Quercus pedunculata	English Oak	1,404	10 to 16					1,404
Quercus agrifolia	Encino					17	6 to 8	17
Catalpa speciosa	Catalpa	1,305	2 to 3 ft.					1,305
Catalpa Kœmpferi	Catalpa Kœmpfers	33	2 to 3 ft.					33
Sterculia deversifolia				420	4 to 6	270	4 to 6	690
Sterculia acerifolia	Flame tree					4	15 to 18	4
Juglans nigra	Black Walnut	119	2 to 3 ft.					119
Juglans rupestris	California Walnut	361	2 to 3 ft.					361
Juglans (?)	Japan Walnut	16	2 to 3 ft.					16
Melia Azedarach	Umbrella tree	67	1½ to 2 ft.					66
Carya sulcata	Western Hickory	71	6 to 8					71
Carya alba	Shag Bark Hickory	13	4 to 6					13
Carya olivœformis	Pecan Hickory	17	6 to 8					17
Acer macrophylla	Oregon Maple	73	3 to 6 ft.					73
Zelkowa Keaki	Elm (Japan)	119	3 to 5 ft.			24	24	143
Prunus illicifolia	California Cherry					76	4 to 8	76
Santalum Pressianum	Quondong					12	6 to 8	12
Acacia acanthoptera						47	4 to 5	47
Acacia falcata						63	4 to 6	63
Acacia retinoides						52	3 to 4	52
Acacia armata				1,200	6 to 8	315	8 to 10	1,515
Acacia obliqua				200	4 to 6			200
Acacia decurrens	Black Wattle					6,090	4 to 10	6,090
Acacia melanoxylon	Blackwood					3,996	5 to 10	3,996
Acacia pycnantha	Golden Wattle					853	3 to 6	853
Albizzia lophantha	Bastard Acacia					1,510	12 to 18	1,510
Pithecolobium pruenosum						190	10 to 12	190

RECAPITULATION.

Eucalyptus	75,647
Conifers	49,095
Acacias, and allies	14,516
Miscellaneous	10,403
Total available stock	149,661

In addition hereto, we have about twenty-five thousand seedlings that will require another season's growth to bring to the most suitable condition for general planting. They comprise chiefly, *Pinus Masoniana, P. pyrenaica, P. Parryi, P. Thunbergi,* and *P. inop; Abies Mertensiana, Thuya gigantea, Cedrus Deodara, Fraxinus Oregana,* and *F. dipetela,* var. *trifoliata.*

Our second subdivision, as already stated, has been reserved for the isolated plantation of individual specimens, sufficient space being allotted and duplicates planted to permit of the future development of each, and to admit of cutting in order to yield a supply of material at hand from which to make careful timber, fuel, or other economic determinations. We have now above two hundred species there represented, and when it is borne in mind that the total number of forest trees of the United States falls below five hundred species, are satisfied that the showing now made is creditable for an institution still in its infancy.

Many of the exotic species introduced into gardens, grounds, or parks in this State have had no opportunity, either from want of space or a want of knowledge of their requirements, to exhibit their fullest growth and best development; we aim to obviate these defects upon the station grounds, and to combine with an arboretum for our own uses an opportunity for the public and those interested in forestry, sylviculture, or ornamental planting to determine for themselves the ultimate appearance of these species, to the end that their own planting may be conducted with both intelligence and success.

Our strict forest plantations have so far been carried on to the determination of requirements of cultivation rather than exhibiting the value of species; concurrently much valuable information will be derived upon this point. Our system contemplates planting with the same species three tracts of land. Upon one the trees are set without regard to clearing brush, weeds, or other obstacles to growth; these trees receiving neither water, cultivation, nor any previous preparation of the soil. A second subdivision receives, where possible, preparation of the land and some subsequent cultivation. The third receives both cultivation and irrigation. These experiments were only inaugurated last winter, and it is yet too early to predicate results. With the first method, as was to be anticipated, we have scored a large percentage of failures; enough, however, have survived the ordeal of one summer to justify us in continuing the experiment still further. If results finally attained demonstrate that a reasonable measure of success attends the planting of *any* forest tree in California under such conditions, a great stride will have been taken in the direction of ascertaining if our barren hills may be converted to any profitable uses, or at least to uses not involving a great outlay of capital and labor before they be made productive. It is a question of secondary importance in other countries, or at least in countries visited by frequent and copious rainfalls, and where the character of the soil and timber to be grown thereon become the prime factors in every operation of forestry. In this country the adequacy of the rainfall must at all times be the leading consideration, and as results attained by these experiments will indicate what may be expected to follow over a very great part of the State, we do not hesitate to pronounce these comparative tests now in operation to be one of the most valuable practical experiments that can be undertaken, and promising within a few years to yield more definite results than any and all others that could be devised.

PART II.

SOME NOTES ON THE GENUS EUCALYPTUS.

As will be seen in the foregoing list, our collection of eucalyptus still takes numerical precedence over all others.

The reasons for this are obvious and many, nor is it necessary to enter into an exhaustive dissertation upon the comparative merits of the eucalyptus family for timber purposes with our own native or other exotic woods to account for this.

Leaving aside all other considerations, for unparalleled rapidity of growth the genus, with a few exceptional species, still stands preëminent as the quickest grower ever introduced into the State, and the facility and rapidity with which treeless areas can be converted into forests by its use must tend to enlarge its planting, perhaps to the discouragement of the planting of more valuable woods.

Until quite recently the name eucalyptus, or rather its use in California, was exclusively used to cover a single species, the common Tasmanian Blue Gum, and though it is now many years since the introduction of other species, the Blue Gum, by virtue of the wide publicity given to its merits, has continued far in the lead over all other species planted, and to-day still constitutes quite 95 per cent of all the eucalyptus plantations made.

A great impetus was originally given to the planting of Blue Gums along the lines of our railways by reason of its reputed value for railway ties;* its continued growth and use for this purpose in Algiers and in the Australian Colonies, and in parts of the world with climatic conditions not dissimilar to our own,† and by the well known fact that if adapted to this purpose that the thousands of miles of railroad running through the treeless regions of the west and southwest would furnish a market for all the ties that could be grown for many years to come, had stimulated this planting to an exceptional degree.

Its reputed durability was about nine years as against only seven to eight years for the White Oak, and only the same period for our average redwood tie,‡ and with the enormous annual consumption of six and one third millions upon this coast, it is no matter for wonderment that

*South Australia Forest Reports, 1887-88, p. 9.

† "Extra Tropical Plants," von Mueller, p. 132.

‡ Mr. B. E. Fernow, in an admirable and exhaustive treatise upon this subject modestly published as "Forestry Bulletin, No. 4 of the United States Department of Agriculture," gives the average life of a redwood tie as eleven to twelve years. This has reference only to its resistance to decay. For railroad purposes over main lines and when subject to heavy traffic, they, by reason of deep cutting, become unserviceable in from seven to eight years. This practically fixes their duration of life for railroad uses. Decay not being the only factor determining their longevity—a tie set in 1856, and taken out this year, after thirty-four years being found absolutely free from decay. For this information I am indebted to Mr. J. H. Wallace, Assistant Superintendent of Track of the Southern Pacific system, from whose instructive report on eucalyptus ties I shall make further quotations.

the planting of this tree should have been prosecuted to an extraordinary degree.

The experiments conducted by the Southern Pacific Company with eucalyptus (Blue Gum) ties at Rose Creek, Nevada, between the years 1877 and 1888, show that their resistance to decay only endures about seven years, while their susceptibility to checking and cracking makes them practically unsuitable for this purpose. Great difficulty was experienced on this account of keeping the rails properly spiked down. "Some few of these ties remained for eleven years, but under ordinary circumstances would have been removed several years sooner than they were, the object of leaving them in so long was to ascertain only what their life would be with reference to decay." *

The unfortunate experience of the railroad company with regard to the durability of this wood seems to find ample corroboration by the observations of those who have grown it extensively for fuel, and who uniformly accredit with speedy decay the lowest tiers of cordwood.

Despite these adverse results, we can hardly accept them as final, and have now in hand experiments under way which, when perfected, will demonstrate if the tendency of the wood to check and crack, and its liability to decay, are not adventitious properties readily controlled by harvesting at the proper season of the year, or by proper curing, or by both.

We are amply justified in following up tests with this wood to the uttermost possible limit; rarely can the case be cited of the introduction of any exotic throughout the extra-tropical latitudes of the world which has resulted so successfully and has accommodated itself to such varying conditions as that of the Blue Gum.

We know of its successful introduction into South Australia, where it has to endure worse extremes of climate than subjected to here;† and its value for forest uses, where its treatment is fully understood, is most strongly attested by the fact that so late as 1887 it constituted 20 per cent of all the trees planted by the forest administration of that colony, and in numbers planted was only exceeded by the Sugar Gum.‡

In our own State it exhibits a ready adaptability to nearly all soils and localities where the mercury does not fall below 22 to 24 degrees Fahrenheit, and may be considered fairly naturalized, seeding freely, and reported as now reproducing itself spontaneously in several sections of the State.

Entirely independent of the results obtained by our experimental timber tests upon this wood, the planting of Blue Gums must continue for years to come to occupy a prominent place among our active industries. It still holds the lead in popularity as a quick and effective means of producing abundant though inferior fuel, while local industries, dependent upon its growth, are being established in the State. For some years a manufactory in Alameda has been profitably engaged in the production of an extract of crude oil inimical to the formation of incrustations in boilers.

More recently, still another in Los Angeles is engaged in the distillation of the refined oil of eucalyptus. Their efforts have been attended

* Letter from Mr. J. H. Wallace, October 3, 1890.

† Report of Progress and Condition of South Australia Botanic Gardens, 1887–88–89, by Dr. R. Schomburgk.

‡ Forest Reports of South Australia, 1888, by J. Ednie Brown.

with flattering success, their product being declared equal to the very best European article. The well known antiseptic qualities of this oil, together with its non-irritant character, is causing it to largely supplant the mineral disinfectants heretofore used in such vast quantities. The annual importation of this oil by the United States amounts now to not less than fifteen thousand pounds per annum, all of which may, in all probablility, be produced in a short time within our borders.

Many side products, including aerated waters charged with its extracts, are coming into general use, and in view of its continued propagation by the nurserymen of the southern half of the State in the ratio of one hundred to one of any other species of forest tree grown, it is fair to assume it will maintain its supremacy and deserved popularity as an "all around utility" tree for many years to come.

It will be noticed by consulting the list heretofore given, that of thirty-six species of eucalyptus grown this season at Santa Monica Station for distribution, and our own planting, that less than one third the number of species embrace more than 90 per cent of the individuals reared. This selection, or preponderance, in favor of a few varieties, is due primarily: First, to the greater reputed merits of the favored species as gathered from reports and records of organized Forest Boards elsewhere; secondly, to the success had by individual planters over a wide and diversified area of the State.

Our own experiments, extending over less than three years, are still in their infancy, and though instructive, must necessarily as yet be only of corroborative value to results had over a longer period of time.

All, or nearly all of the species here enumerated, have been grown by Mr. Ellwood Cooper, of Santa Barbara, and nearly all are reported to us from the State University, and a number of the same from other points where they have been grown as objects of ornament or curiosity.

In all cases special care or cultivation has been given, or fertile and favorable locations had, which has resulted in the growth of superior specimens, but which has established nothing whatsoever in determining the forest or other economic value of these many claimants to our favor, our knowledge of which for forestry purposes is still an unknown quantity.

With the system now observed in our tree distribution, it is confidently believed that with the data thereby obtained, we can, within a few years, unerringly indicate to every tree planter in every quarter of the State the trees he should plant to yield him the most unequivocal returns for the time and capital invested.

Careful collation of such material as is obtained by us daily in letters like that of Mr. Price,* when supplemented by our own trial tests, we believe will give an assurance of confidence to tree planters that must stimulate the making of forest in a superlative degree.

Fully one half of all our eucalyptus consist of the Red Gum referred to in this letter, and the Manna Gum, respectively, *Eucalyptus rostrata* and *Eucalyptus viminalis*. Neither of these species fall within the list of so called alpine sorts enumerated by von Mueller. †

But our correspondence seems to indicate their stronger heat and cold resistant power than any of the species heretofore introduced.

At Alpine, Lancaster, Rosamond, Palmdale, Mojave, and Keene, in

* See appendix for letter.

† "Extra Tropical Plants," p. 134.

Los Angeles and in Kern Counties, snow not infrequently occurs and low temperatures prevail every winter.

To all of these points trees have been sent, with the weight of testimony to the effect that these two species have given the best satisfaction and shown the most endurance.*

From Dehesa, Perris, Jamul, San Jacinto, and other San Diego County points where mountain plantings have been made at elevations within the range of occasional snows, reports corroborative of the above have been uniformly received.

Throughout the length of the San Joaquin Valley, the Blue Gum is not rarely winter-killed, and its possible northern limit may approximately be located at Sacramento.

Two years ago, large trees of this species succumbed to frost at points in Calaveras, Stanislaus, Merced, Tulare, and Fresno Counties, where young plants of the Red and Manna Gums were uninjured.

Last winter (1889–90) our own young plantations of these two kinds at Chico, Butte County, were unaffected, although they endured for four consecutive days a temperature of 24 degrees Fahrenheit, and as well have made satisfactory growth under stress of the long continued high summer temperature of the upper Sacramento Valley.†

From Hesperia, Indio, Salton, and points upon the so called "desert" of San Bernardino and San Diego Counties, where the greatest summer heats prevail, and whither we have sent trees, reports as yet are too conflicting upon which to predicate reliable information.

In the matter of resisting drought, the comparative merits of the Red, Manna, and Blue Gums, as determined by our own experiments upon dry, uncultivated hillsides at Santa Monica, show them to be nearly even, the Manna Gum scoring a few points in advance of the others.

The equable climate that prevails here throughout the year gives us no opportunity of testing the behavior of these trees under extremes of temperature; but in the very important matter of determining their action under prolonged drought, our observations can be carried out to final and correct conclusions.

That the Manna Gum should prove satisfactory upon this point, is but in harmony with its reputed success in Quorn, South Australia,‡ where it survives more difficult conditions than any quoted in our report.

The capacity of the Red Gum to endure arid situations, as shown by our correspondence and our own trials, is somewhat perplexing.

From its local history, its successful growth could only be anticipated upon low lands, or moist river bottoms. Such it naturally affects in the Colonies, even to lands periodically inundated; and its promise of success here upon dry exposures is in the nature of a pleasant surprise.

The wood is reputed to be greatly more durable underground than the Blue Gum, and to have superseded generally all other native timbers in Victoria for railway construction, ties, etc.

From a timber standpoint there is little doubt of its complete superiority to either the Blue or the Manna Gum; and even if future tests should result adversely to its adaptability for railway uses in this

* The summer temperature at these points sometimes reaches the excessive heat of 108 to 110 degrees Fahrenheit, accompanied by high, drying winds. See letters in appendix.

† It should be mentioned that the "Stringy Bark" (*Eucalyptus obliqua*) withstood this test as well.

‡ S. Australian Forest Reports.

country, its undoubtedly greater fuel value than the Blue Gum should be an incentive to its more general planting.

Explanatory of our rearing these two species in excess of all others has led us to dwell upon claims to their excellence largely known to the general public. Our justification lies in the fact that at the present time, and with present knowledge, they offer greater promise of general success under diversified conditions than any yet sent out.

Of other species now growing here, we will only allude to those which within a brief time have developed some especial merit commendatory of their general use.

EUCALYPTUS CORYNOCALYX (SUGAR GUM).

This tree, during the three years since it was first disseminated by the Board, has come into exceptional favor, emphasized by almost daily inquiries addressed to us for information in obtaining the seeds or plants in large quantities.

We unhesitatingly pronounce it to be by far the most satisfactory eucalyptus yet introduced for street, avenue, or sidewalk planting within the thermal districts of the State.

An inflexible scale of excellence, by points, of trees designed for these purposes cannot be formulated for all places. The *points* cannot be disputed; their *sequence* may vary with the conditions and requirements exacted by different localities.

For the section of the State mentioned, we suggest the following arrangement:

1. Umbrageousness.
2. Hardihood (as to drought, not extremes of heat or cold).
3. Strength to resist high winds.
4. Rapidity of growth.
5. Freedom from insect pests.
6. Ornamental beauty.
7. Longevity.
8. Freedom from litter, or continuous leaf dropping.

To these might be added, as an important factor, immunity from the attacks of rodents, but as this is a consideration largely under our control it should not affect the rating or standing of a roadside tree.

The Sugar Gum takes a high rank in all these essential points. At five years of age we have seen trees still under forty feet in height with a natural crown diameter fully as great; an uncommon feature of the genus, as all know who have continuously and laboriously "cut back" other species in the attempt to promote a lateral growth.

Its restriction to a limited zone is predicated by reports reaching us of its yielding to slight frosts. Careful inquiry into the alleged causes of failure from this source has elicited the information that copious irrigation, succeeded by an autumn of unusual heat, had stimulated a luxuriant growth of rank and tender foliage that was summarily blasted by a quickly intervening frost.

Other credible observers report its being killed (when young) by an exposure to 28 degrees Fahrenheit, where such precocious growth did not obtain.

This brings us again somewhat in conflict with Australian reports, which uniformly ascribe to it a considerable amount of endurance against both heat and cold.

Mr. West, an agent of the Victorian Government, and recent visitor to this coast, says that the planting of this species for *all* purposes is making great strides, and is largely superseding the planting of most other species.

This statement is strongly corroborated by Mr. J. Ednie Brown in his reports, wherein it is seen that nearly 35 per cent of all the trees planted in the various forest reserves of the department in South Australia during 1888 and 1889 were this species.

Of two hundred and thirty-six thousand trees gratuitously sent out by the same department during that season, one hundred and nine thousand were of this sort; and as evidence that it is in no way falling into disfavor, we may state that 45 per cent of the trees now being reared in the department nurseries continue to be Sugar Gums.

Here in California many planters enthusiastic over its beauty will plant largely the approaching season, and before many years we will be able to define sharply its possible limitations for this coast.

EUCALYPTUS DIVERSICOLOR (THE "KARRI").

Another of the denser foliaged species; pronouncedly of more rapid growth than the Sugar Gum, and the subject of many favorable reports to us upon dry situations.

This is one of the giant gums sparingly introduced by growers into this State under the name of *Eucalyptus colossea.*

EUCALYPTUS MARGINATA (THE "JARRAH")

Is handicapped by the general verdict of "slow growth," and as well seems to require a liberal amount of moisture. Trees of considerable size are flourishing in the favorable locality of Berkeley, while in that exceptionally favored spot, Cahuenga, Los Angeles County, exist a few trees quite six years old. None of these yet exceed thirty feet in height or have a largest stem diameter of over seven inches. Information confirming its slow growth are received from many quarters, and ranging from Alameda to San Diego County.

Our distribution of seeds and plants of this species last year was extended over a large area, in the hope of discovering some congenial locality where its growth might be commensurate with that of some other species. If there be any section of our State where this tree will come to early maturity, or to a size sufficiently large to convert its timber into piling, there seems to be no reasonable doubt but that it would yield the most valuable forest crop that could be grown. With all our wealth of serviceable native Pacific species, we have nothing adapted to this purpose until it has been subjected to the costly, and even then insufficient process of creosoting.

The "Jarrah" enjoys absolute immunity from the attacks of marine borers and is practically indestructible, and, if it can be grown here, a ready home market for wharf or jetty purposes is assured for every stick raised. In view of these merits, we shall continue its further distribution, limiting its issue, if possible, to localities abounding in ferruginous

soils, as upon such, in its native habitat, it attains its most rapid and perfect development.

EUCALYPTUS GUNNI (WHITE SWAMP GUM).

Under this name we are now growing the species described in Bulletin No. 6 of this report as *Eucalyptus polyanthema.* Flowering or fruiting specimens of this species not existing as yet in the State, we shall only issue it under a ?, awaiting future opportunity to confirm the nomenclature.

Except for the interesting contrast it presents to the "Jarrah," it would be passed over to await complete identification. Its phenomenal growth demands more than passing notice. In our own plantation a number of individuals exceed thirty feet, and one has attained to thirty-four feet and a stem diameter of seven and one half inches within twenty months of the time of planting.

This result is unparalleled, and I have searched in vain for authentic reports of a similar tree growth ever occurring under like or any other conditions.* During this time the growth made by a Tasmanian Blue Gum, standing within one hundred and fifty feet of this "swamp gum," is less than eighteen feet.

OTHER VARIETIES.

Of other varieties upon our list which arrest attention is *Eucalyptus calophylla*, striking in view of its handsome foliage and rather showy panicles of pure white flowers; it is the close congenor of the Scarlet-flowered Gum (*Eucalyptus ficifolia*), both now widely dispersed in Southern California and flowering freely in many places.

Eucalyptus calophylla is held in good esteem for timber, the wood being light but very strong.

The young plants of *Eucalyptus platypus, E. pilularis, E. Stuartiana, E. eugenioides, E. stricta,* and others, exhibit considerable ornamental value, but in view of the remarkable leaf modifications which most species undergo with age, it is unwise at this stage of our knowledge to assume that these now attractive qualities shall be enduring. In view of the important part which this genus promises to play in the future afforestation of this State, much space has been accorded to its consideration; but that the Board recognizes that it cannot fill all requirements, and that other trees must occupy a prominent place in the general forest economy of the State, is shown by the second list now in reserve for planting at and distribution from Santa Monica Station.

Brief mention will be accorded some of these other genera and species, while more extended monographs will follow those showing special adaptability to our State, and whose economic merits are so great as to justify close investigation.

* For conditions, see Forestry Bulletin No. 6.

PART III.

THE "CLUSTER PINE" IN CALIFORNIA.

PINUS PINASTER—"CLUSTER PINE," "MARITIME PINE."

This tree is so easily reared, so readily transplanted, the seed so inexpensive, and its successful growth so independent of expert management, and withal, so amenable to all treatment and all situations, that we have entered upon its propagation to a considerable extent. Small specimens were planted upon the south (hot) side of a bluff during April, 1888, and have had neither care nor other water than rainfall since; over 90 per cent have grown, and are now sturdy, stocky trees of five to seven feet in height.

The bluff is so nearly perpendicular that excavations the height of the young plants had to be made to admit of setting them in a vertical position. The experiment was made primarily to determine the vitality of the species under hardship; incidentally, to test its value as a restraint to landslides.

During the excessive rainfalls of the winter 1889–90, these young pines were not washed out, but neighboring hills covered with a puny growth of Audibertia species, Rhus, and Adenostoma were badly gullied and washed. The native "brush," while a conceded and valuable auxiliary to this work, is unreliable, lacking size, strength, and root depth enough to prevent or arrest when started the momentum of a landslide.

A good illustration of this exists at Arrowhead Hot Springs, San Bernardino County, where the Arrowhead (the denuded area) is, after seasons of heavy rainfall, most sharply defined. When two or three seasons of scanty precipitation occur, the native brush growth reasserts itself, and the vast scar upon the hillside becomes almost obliterated.

It is not contended that the Cluster Pine is the only tree that would accomplish its rehabilitation; any equally rapid growing and of equal hardihood would accomplish the same purpose, provided the season of planting out was not one of excessive rainfall; but rapidity of growth is an indispensable condition.

Pinus tuberculata, the Tubercled Pine, is indigenous within a few miles of Arrowhead, but of such exceptionally sluggish growth that it would never accomplish the results that could be achieved with the Cluster Pine, and with one heavy winter would fare no better than the periodically swept away remaining native growth.

As this Arrowhead is an attractive objective point to the curiosity seeker, its forestation will hardly ever be attempted.

Attaching the importance which we do to the quick-growing, deep-rooting properties of plants suitable for this purpose, it may be asked why we single out the Cluster Pine to the apparent exclusion of other species.

So far, we have found a preponderance of points in its favor. During the past season we have grown *Pinus pinea* (Stone Pine), *Pinus insignis* (Monterey Pine), *Pinus Canariensis* (Canary Pine), and *Pinus Sabiniana* (Digger Pine), upon a site closely approaching the conditions existing where the Cluster Pines are planted. All the species named are quick of growth, but the percentage of loss in all has been greater than in the case of the Cluster Pine.

The *P. Canariensis* proved a failure; the Stone Pine displays strong vitality, but has made but little growth; the same is true of the Digger Pine, the Monterey Pine being the only remaining one that has done well and slightly outgrown the Cluster Pine in size, but at the loss through drought of a greater number of individuals.

This pine, the Monterey, has long been considered unique amongst the Coniferæ for its unrivaled celerity, and has (presumably on this account) been widely diffused abroad, meeting with great favor and being in great demand in the Australian colonies.

In California, remote from the seacoast, cultivated specimens at ten years only slightly exceed the growth made by the Cluster Pine, but near the coast the Monterey generally exceeds it greatly in growth made in the same time. A single exception exists perhaps where they are planted in rolling sands—such as exist in the Golden Gate Park—where, as I am informed by the Superintendent, Mr. McLaren, the growth of both species is about uniform.

Well grown specimens of the Cluster Pine, as far inland as Oroville, give assurance that the lower foothills of the Sierra Nevada Mountains below the timber line would furnish a congenial home for this invaluable tree along the whole distance of the San Joaquin and Sacramento Valleys. Practically, with all our timber riches, we have no coniferous or other tree native to this coast, which furnishes a supply of naval stores.

The only tree we know of that greatly excels the Cluster Pine in its yield of tar, resin, and turpentine is the Georgia Pitch Pine (*P. palustris*), and which not only is reported to take fifty years to reach the maturity which the Cluster Pine attains in twenty to twenty-five, but judging from the inferior and stunted appearance of the few of the former we have seen upon this coast, no great inducement can be offered for its planting.

From official correspondence we learn that the estimated area planted to the Cluster Pine in the Departments of the Landis and Gironde alone, in France, during 1888–9, amounted to twenty-one thousand hectares (nearly fifty thousand acres). Originally only planted with a view to reclaiming the sand wastes that align the bay of Biscay, it has proven so profitable a crop that of late years its cultivation has extended over better lands; enough of its products now being yielded annually to make the republic almost independent of foreign supplies of turpentine, tar, resin, and charcoal. After the tree is exhausted by constant tappings for its oils, it is felled and converted into a superior article of charcoal, which furnishes one of the chief fuel supplies of the people.

England, who annually pays us $3,000,000 for naval stores, some years ago, influenced by the pronounced success of these plantations, attempted similar operations in Devonshire, upon the south coast, and though the trees have thrived, the humidity and summer coolness has seriously acted to prevent the formation and yield of the precious fluids.

No such objections can possibly exist in California. We cannot learn of any tests having been made in this State to determine the freedom and quantity of sap flow in the summer months, but it is almost impossible to surmise that results upon this score should be other than the best.

Upon this coast we are entirely dependent for all these supplies so largely used in many arts and manufactures exclusively upon the eastern markets. Their consumption is enormous, and that of turpentine and resin constantly increasing, and their production here not only implies profitable returns to the producer, but indirectly great prosperity to the State in retaining at home wealth that otherwise must go abroad.

We have named the *Pinus insignis* in connection with this as the only species tested here comparable in the matter of early maturity with others, but is lacking completely in all the economic properties that make this so valuable.

From a timber standpoint neither take a high rank, and the planting of pine trees exclusively for timber uses, unless undertaken by the Government, will not universally find favor with the public—at least until the American idea has been modified in regard to these things.

The Scotch and Weymouth Pines take from seventy to one hundred and thirty years of growth to become serviceable for timber, and most of the California species of natural growth much longer; from careful countings had during the past summer over some of the most closely cut districts in this State, I find that the smallest trees cut of *Pinus Lambertiana* and *P. ponderosa* will chiefly show more than one hundred and fifty annual growths, and the general average approach about two hundred.

In countries where the laws of entail exist this is considered no deterrent, but probably under our institutions and our national haste will forever defeat the extensive planting by individuals of such slow maturing crops.

In France, twenty-five years is the extreme of time allowed to bring the Cluster Pine to maturity. From the remarkable growth made in this State in fourteen years (thirty-five to forty feet), it may reasonably be expected that they will attain complete maturity many years earlier.

At our northern station, young plants of Chamæcyparis, Torreya, and other hyperborean conifers "sunburn" somewhat during the prolonged summer heats; this phenomenon is not observed with the Cluster Pine, which has without protection made more thrifty growth than in the cooler, more humid atmosphere of the Santa Monica Station.

Its assured success there, and at the few points observed along the Sierras, impresses one with the certainty that the endless and now unproductive wastes of the northern Sacramento Valley foothills might quickly be converted to assured wealth-producing uses.

The extreme aridity of most of these hills, and except in a few favored districts, they having no immunity from sharp frosts, will operate for all time against their plantation with eucalyptus or probably wattles, while aside from the objections already noted against the planting of timber-yielding pines, the altitude is not great enough for our native ones at least to come to perfection.

These hills below the well defined timber line are chiefly covered with

a scrub growth of *Pinus Sabiniana*, *Arctostaphylos*, *Ceanothus*, *Rhus*, and other native "chaparral."

Except as a forest cover, this growth serves no appreciable purpose; the few inroads that have been made into it in the vicinity of mining camps for fuel are insignificant; the northern valleys are abundantly supplied with superior White Oak fuel, and it is most improbable that any increment to the valley population, however great, will create the drain on these foothill resources for fuel that exists in the southern end of the State.

Should the future bring forth an unanticipated demand for this fuel, by the time such arises, plantations of this pine will be in condition, after yielding its especial products, to furnish of its residue a fuel equivalent in value to most of the scrub now indigenous there. Several land owners have agreed to make plantations in this region for us during the coming winter, and we will be glad to coöperate with all others desiring to make a test of this tree so amenable to harsh conditions and unskillful treatment.

It carries well, and during the winter season with roots properly "puddled" may be transported long distances without soil, and consequently a minimum of weight. We therefore bespeak for it a very general trial.

PART IV.

WATTLES, AND WATTLE PLANTING IN CALIFORNIA.

For general purposes, the limits which define the successful growth of the Blue Gum in this State cover the area upon which we may hope for good returns with most of the wattles.

One of the hardiest acacias known, the *A. melanoxylon* ("Blackwood"), stood uninjured for twelve years in the grounds of General Bidwell, at Chico, but was killed to the ground in the winter, I think, of 1887–88; it then measured sixteen inches through the stem near the ground.

Trees of the same species the same year were uninjured at Sacramento, but the many dead limbs in the tops of the Black Wattles and its near allies, show that they did not escape unscathed. At Stockton they were uninjured, but at points farther south in the San Joaquin Valley, they were killed, where Blue Gums survived though severely injured; the shelter and continuously higher temperature that exists in towns and cities than in the adjacent open country accounting for the escape of the more northern examples.

Upon the peninsula of San Francisco and in the circumscribed area of the country surrounding the bay, most species come to great perfection, increasing in size and beauty as we retreat from the seaboard, until advancing farther north, east, and south, their development is checked by lower winter temperatures, not to again reach its maximum till we pass Point Concepcion on the south.

For many years, the public interested in such matters have been fully conversant with the economic value of many species of wattles; their ready adaptability to a large part of our State, and to a great variety of soils, has been almost as widely known. So long as twelve years ago the management of the University of California not only planted out freely upon their own grounds, but impressed with the utilitarian character of the trees made, and have at intervals continued to make, a very general distribution of their seeds.

Whatever of impetus to the planting of these trees might have been expected to flow from this, received a disastrous check with the introduction or appearance in this State of the white cottony cushion scale.

If not the original, they at least quickly became the favorite nidus of this virulent pest: originally confining their depredations to citrus trees, they soon spread to nearly all vegetation, and for a time impaired, and at one time fairly imperiled the vast horticultural interests of the State. The preference of this scale for acacias soon became freely known, and not only resulted in a discontinuance of their planting, but in the wholesale eradication and destruction of many promising young plantations.

Since that time the complete success attendant upon the introduction

of a parasite destructive to this pest which has proven its ability to at least keep it in check, if not to extirpate it, has removed the only barrier which now exists to the planting of wattles for pleasure or profit.

Pleasure is not one of the elements or factors upon which we expect to lay much stress in tree planting as a business operation, otherwise than in the ornamentation of grounds, parks, drives, etc.; but if the sensation ever occur, or be anticipated, or result even to the most practical, it will surely flow where the practice has to do with most of the wattles.

All of the broad-leaved species are so gratefully umbrageous; all of the feather or pinnate-leaved sorts so indescribably graceful and picturesque; nearly all of such superlatively rapid growth—many so brilliant of flower and grateful of fragrance—that it is hard to speak of the family or of any operations attendant upon their rearing that shall eliminate all considerations of pleasure.

Of profit that results, we must be more conservative, less adjectival; but all indications seem to point unerringly to the fact that prompt and remunerative returns will accrue as the reward from groves of these trees.

The chief economic virtue they possess lies in their bark as a tanning material; and the same argument which was used to advocate their planting twelve years ago now applies, but with precisely redoubled force, since the price of native bark has in that time advanced from \$7 and \$8 to \$14 and \$16 per ton.

By "native bark" we refer to *Quercus densiflora* (the "Coast Chestnut Oak"), which practically supplies all the tanners' bark used upon this coast. Its excellence as a tanning material is undisputed, and has chiefly, without doubt, contributed to the excellence and enviable reputation which the heavy sole, harness, and trunk leathers of California manufacture enjoy.

The yield of tannic acid from this bark, and its availability, is very great—analyzing as high in bark of best grade as 16.7 per cent, and freely giving up in the vats an estimated percentage of 12 to 13 of tannin. Its continued use, to the exclusion of other barks of equal strength, would be assured except for the grave fact that its supply is fast approaching the vanishing point.

From interviews had with many leading tanners, we find a very general feeling of alarm over the steady enhancement in value and scanty supply of bark offered.

Great sums are invested in tanneries here, and it forms one of our chief industries; and if in the near future we are compelled to look to eastern markets to furnish this indispensable requirement of the trade, it can only result in a suspension of the business and removal of their plants from the State. So impressed are the tanners with the situation that confronts them, that they are prepared to gladly undertake expensive risks of time and hides to make practical working tests of any material that gives fair promise of being an available substitute for oak bark.

That the enhancement in the price of this article is not due to the action of any speculative trust or combination, but to a legitimate rise from the scarcity of the article, is vouched for by our own examination into the northern and southern tan oak regions.

Its natural habitat is the redwood country, and in many localities, even in the Santa Cruz district where the redwoods still stand intact, every available oak has been stripped.

Even in Humboldt, whence our greatest supply is now drawn, bark-cutters are compelled to invade places once considered impracticable and carry out the crop on pack animals, and trails have been laid through most precipitous country to get at this precious product.

Some of the best oak lands remaining have been swept by fire, and, though this tree is remarkably tenacious of life, and revives from ordinary burnings, the bark becomes constricted and impaired in value, nor does it become fit for stripping for some years thereafter. These facts have led us to turn our attention to the wattles as offering the only possible means of averting the disastrous results of the bark famine which must overtake this State within a very few years. Complete returns of consumption we have been unable to secure, but have ascertained that thirty-one tanneries (less than one third in the State) consumed eighteen thousand tons in 1889, and the estimated annual consumption is now not far from fifty thousand tons, and the assurance of a continuous supply of this or any equally good substitute would stimulate the expansion instead of a decline of the industry dependent thereon.

Wattle growing as an industry has only of recent date been inaugurated, even in the Australian colonies. The native "bush," however, has for many years furnished the sole source of supply for local tanners, and their requirements, together with export demand to Great Britain, has seriously infringed upon the wild supply, and resulted in the adulteration of the bark with spurious or inferior sorts to an extent that has brought the product into disrepute, and caused lately the fullest inquiry into the whole subject by Mr. J. H. Maiden, F.L.S., of Sydney, New South Wales, from whose invaluable monograph * we shall quote such points as we think have a bearing upon the subject of their growth and commercial value in California.

Mr. Maiden, out of a list of over forty wattles or acacias that yield a greater or less amount of tannin extracts, finally cuts the list down to three species as giving the most promising returns for commercial uses. They are as follows:

Acacia pycnantha—South Australian Broad or Golden Wattle.
Acacia decurrens—Sydney Black Wattle.
Acacia mollissima—Tasmanian and Victorian Black Wattle.

There are other species whose merits, aside from their bark value, are so marked, that we shall briefly allude to them hereafter; but the three above named have been so extensively tried in different portions of the State, have proven so accommodating to varied conditions, and so far exceed all other species in their practical yield of both bark and tannic acid, that it is sufficient to recommend them for this purpose to the exclusion of all others.

In quantity of tannic acid yielded, the Broad-leaf or Golden Wattle is an easy first—a free average of many analyses amounting to 37 per cent, rarely falling below 32 per cent, and in exceptional instances the enormous yield of 46½ per cent, or nearly one half the total weight of bark, has been pure tannic acid.

* "Wattles and Wattle Bark," by J. H. Maiden, F.L.S., Sydney, 1890.

From examinations of this wattle made by direction of Professor Hilgard in 1884,* a return of 46.8 per cent of tannin was obtained from barks dried at same temperature, showing conclusively that no loss has been sustained in this essential in the removal of the tree to this country.

Indeed, it would indicate if anything that in some parts of our State this wattle had found a more congenial home than in its native habitat of South Australia; that is, so far as reaching its fullest size and maturity at an earlier age than there.

This is a most important factor, as the consensus of opinion of all investigators is to show that the ratio of tannin increases with the size and maturity of the bark.

Illustrations of their remarkable precocity here, are clearly shown by comparing the records of thirteen tests made by Mr. Maiden of this wattle grown upon Government forests at Belair, South Australia, with our own.

The heights, ages, and diameters of butts of these trees are given:

In age they range from three to seven years; in height, from eight to fourteen feet, and in diameter, from one and three fourths inches to four and one half inches.

All the trees upon our Santa Monica plantation indicate a growth about twice as rapid as this. None of our trees are planted over twenty months, and are about two years (twenty-five months) from the seed.

Many of them now exceed a butt measurement of four inches in diameter and a height of sixteen feet, figures only reached in the samples sent to Mr. Maiden after a growth of five to seven years.

The poorest of ours exhibit a diameter of two inches and a height of nine feet—results requiring three or four years to accomplish there.

It is not so stated, but the presumption is that the bark sent Mr. Maiden was from wild, bush, or uncultivated specimens, and it should be borne in mind that ours were reared under precisely these conditions, and have had neither care nor cultivation, nor irrigation from the day of their planting out.

Were these proportions to continue and be general, we might reasonably expect to obtain a crop in three to four years that should equal the yield requiring seven or eight years to obtain in Australia.

I have measured *Acacia pycnantha* grown in various parts of the State measuring twenty-four to twenty-eight feet in height, and with butt diameters of seven to eight inches, but no official or accurate record of their age is obtainable, nor the extent of care or cultivation they may have received. The authorities cited by Mr. Maiden all concur in agreeing that, with cultivation, a size and maturity can be obtained in five years that they will require seven to eight to reach in an uncultivated state, and if the profits alleged are as great as represented, growers here would be justified in giving them the highest possible tilth.

Some of the tables of profits and expenses figured out by him date back as far as 1878,† while as recent figures as Mr. J. Ednie Brown's report to the South Australian Legislative Council in 1884 are given as well as those of Mr. Perrin, Conservator of Victorian Forests for the year 1889.

All of these tables, though compiled by specialists of the highest standing, are nevertheless only estimates, but seem to have inspired the full-

* See Report University of California for 1884, p. 73.
† Report of the Victorian Board of Inquiry into Wattle Barks, p. 27.

est confidence, as the correspondence of this Board has brought us in communication with many individuals in both New Zealand and Victoria, who have undertaken recent plantations upon scales ranging from four hundred to one thousand two hundred acres.

The net profits per annum per acre, as figured out in the earliest report, amount to $16 40, the product being estimated on the bark of *Acacia decurrens*. Mr. Brown's, upon the Golden Wattle, only reaches $8 per acre, and the most recent amounts to about $23 50 per acre from the same bark. Mr. Brown's estimates, it should be stated, include cost of the land at $15 per acre; others only include a charge for rental; all make allowance for every possible contingency, and incomes are based upon market quotations of bark, ranging from $25 to $37 50 per ton.

Conservative enough in every particular for our purpose, as the California product, if holding up to the analysis of barks grown here, would readily command a higher price than the greatest figure quoted.

Returns are expected to come in the fourth year, and to continue over the fifth, sixth, and seventh; the crop, during these four years, amounting on an average estimate of one thousand to twelve hundred trees per acre, to furnish a total of six and one half tons per acre during the seven years; and the estimated profits named are not upon the three to four yielding years, but distributed over the whole seven, from the time when operations begin.

No account is taken of the yield of fire wood obtained, which in California, where if plantations were not too remote from market would be a very important element in the results.

The fuel rating of many of the wattles is excellent; that of the Golden being of the very highest, and on a conservative estimate of ten cords per acre, and at the lowest price at which any standing fuel of poorest quality is rated in Southern California, to wit: $2 50 per cord, the revenues from this source would probably alone cover all outlay, leaving the bark as the profit resulting from the enterprise. The only objection that seems to be raised against the Golden Wattle is its small size when compared with other species, and a consequent diminished yield per acre of bark. Now the examples we have mentioned show that upon good soils, and with probably a little care, it will develop to a tree of more than medium size, and a consequently large yield of bark.

Again, upon these lowest and most conservative estimates, which unfairly include the cost of the land, the net income of only $8 per acre, excluding value of fuel as well, would justify the conversion of the best grain lands of our valleys into wattle plantations; for it is a notorious fact that the net income per annum, per acre, from grain farming does not reach that figure throughout this State.

It is a moot question if irrigation could be expediently resorted to, it being claimed that excess of moisture stimulates foliage growth at the expense of the bark, which becomes thin, flabby, and deficient in tannin.

We would compromise upon this point by stimulating with water and cultivation, and every means available during the first two years, for the sake of the ground shelter by the shade quickly afforded, leaving the trees subsequently to develop their maturity and bark properties more slowly and naturally.

Other points which commend this tree to our attention and perhaps more than compensate for its smaller size are:

First—Its wider climatic range, enduring more cold and heat than either of the two species previously named, and thereby extending the area of its successful growth in California.*

Second—Its undisputed adaptability to *all* lands not strongly alkaline. Have seen it growing in so called "adobe" lands, stiff clays, alluvial sediments, loams, gravelly barrens and loose sands, with greater thrift and vigor than shown by the other species under like conditions.

Where the climate suits, and rich lands are devoted to this purpose, *cæteris paribus*, better returns may be anticipated from the larger trees of the Black Wattles, but upon so called waste and arid lands, growths made by the Golden Wattles are far superior to the others.

Character of soil is alleged to exercise great influence on growth and yield of tannin. The report of the Victorian Board of Inquiry discriminates against limestone soils as inimical to such results. Our own observations, so far as the species under consideration is concerned, contradict this somewhat strongly in the former particular, and apparently in the latter as well, according to Mr. Maiden's numerous analyses.

The excellent growths made at our station in two years or less, to which we have heretofore referred, were made upon limestone soils, equal success resulting upon soils where the lime was either in the form of chalk or gypsum; while the excess of ferric oxide in the soil, and which prevails in so much of our foothill lands, at least serves to keep the soil in a state of disintegration beneficial for the absorption and retention of moisture.

In "ferruginous loam soil," Mr. Goyer, of Adelaide, analyzed bark from seven-year old trees that produced one hundred and twenty-eight pounds of bark, yielding 31.4 per cent of tannin, and of tree of same age grown in calcareous sand, 31.7 per cent of tannin was had, which would seem not to indicate anything very detrimental from the presence of lime.†

From a tree estimated at thirty years of age and producing no less than three hundred and seven pounds of bark and grown upon deep sand, only 25.8 per cent of tannin was obtained, seeming to prove that no gain in tanning properties result from leaving the crop ungathered till a great age is reached.

The dimensions of this tree unfortunately are not given, but as the bark was less than one fifth of an inch in diameter (0.18), it proves conclusively that the tree sometimes attains to considerable magnitude.

Still another point remains in favor of the Golden Wattle, to wit: its free fruiting qualities, which makes the seed at all times cheap, abundant, and easy to obtain.

Summing up briefly, we find to its credit: A greater resistance to cold than the others; a greater percentage of tannic acid; adaptability to more varied soils; greater cheapness and facility of obtaining seed; probable maturity of its crop one or two years earlier than the others.

To its discredit: Smaller size and consequent smaller yield of bark and fuel per acre.

This brings us to the consideration of the other two species, and before we make any suggestions as to cultivation or propagation, the treatment

* From a letter, learn that small plants of *Acacia decurrens* sent out by us last winter to the Cholame Valley were killed by frost (temperature not stated); the *A. pycnantha* escaped unhurt.

† Mr. Maiden, l. c., seems to think these analyses do not give full yield of tannin—errors in the right direction.

for one being applicable to all, will speak of the confusion attending the identity of three distinct species of so called Black Wattles, to wit: the *Acacia decurrens*, *A. mollissima*, and *A. dealbata*.

That this confusion is not confined to California is well proved by the fact that the greatest authority* on the genus, goes into exhaustive details to illustrate the difference in the three. Mr. Maiden devotes a chapter to their mutual similitude and dissimilarities, and the Report on Wattles from the University of California† promptly disposes of the whole subject by stating that the two (*A. decurrens* and *A. mollissima*) are "easily distinguished when in fruit."

True enough, yet as they are not always in fruit, and never so in the young state, it becomes at times somewhat perplexing for the trained observer to separate them. Even the silvery color of *A. dealbata*, except it be in juxtaposition with the others, will not declare it, as all are more or less whitish canescent.

The differences in fruit (pod) are striking enough, but the seeds as offered in the market are almost indistinguishable, except in minutest botanical details and inconsiderable differences in size, a feature, we need not add, so apt to be variable that fullest confidence in the source of supply rather than the dealer's knowledge or good intentions, becomes a point of interest to the general planter, who may not be educated up to these critical points of difference. Mr. Maiden sums up the situation strongly in the following words:‡

> Careful examination of the subjoined comparative table will show that there are no sharp lines of demarkation between the three species, and those botanists who look upon *A. mollissima* and *A. dealbata* as varieties of *A. decurrens* take up a position which is apparently as strong as those who divide them into separate species.

Here in California this confusion has overrun all necessary bounds, and resulted in the widespread distribution of such a comparatively worthless tree as *Albizzia lophantha*§ as the "Black Wattle." I am unable to ascertain the sources of this distribution, but during the past summer, in answer to numerous appeals for samples of bark made by this Board in order to secure enough to furnish practical tanner's tests, in the majority of instances I received bark of this tree; fortunately, I had bespoken specimens of foliage, flowers, or fruit, and thus discovered the error in time to avert imposition upon the tanners, and discredit upon the business of wattle growing in California.

Of course such errors as these are inexcusable, but that the confusion of these three allied species is not always to be avoided, we quote upon the authority of Messrs. Blackley, Young & Co., of Rangiriri, New Zealand, who have a three thousand-acre plantation of *A. decurrens*, that the Tasmanian Government have large plantations of *A. dealbata*, the seed of which was originally purchased for *A. decurrens*.

Upon the authority of Mr. Maiden, we may say that the mischief which might be supposed to follow the planting of this tree for tan

* Baron F. von Mueller in "Extra-tropical Plants."
† For 1882, p. 110.
‡ For 1882, p. 34.
§ *Albizzia lophantha* has no tanning value; the root is reputed to have saponaceous virtues, but the tree is short lived, of little or no value for fuel—in fact, its only merit lies in its surprisingly rapid growth, and we cultivate it extensively for shelter purposes, expecting to plant it out largely among young pineries as a quick and effective means of affording protection from sun and wind.

bark has been greatly exaggerated, and that the Tasmanian Government or any other planter will be amply rewarded with excellent returns.

True, he excludes it from the best list and classifies it with barks of second value, and his analyses accredit it with an average of nearly 22 per cent of tannic acid, as against a general average of 32 per cent for all his determinations of both *A. decurrens* and *A. mollissima*.

These results as obtained by him are far superior to the records published by von Mueller, who only rates the product of *A. dealbata* at about one half the returns had with the others, while he also avers the bark to be much thinner, a very serious consideration if sustained; although Mr. Maiden cannot discover a "pin's difference" in this particular. Samples of bark of both *A. dealbata* and *A. decurrens*, California grown, examined by the writer were of uniform thickness, but only from three-year old trees, and hence not conclusive upon this point.

The Silver Wattle (*A. dealbata*) is reputed to make the largest tree, in moist bottom lands frequently exceeding a height of one hundred feet and having a stem diameter of two feet.

All are of surprisingly rapid growth, and where they grow here, seem like the Golden Wattle to break the records obtained at home.

Mr. Brown mentions trees of *A. decurrens* in South Australia of five years, thirty feet in height and eight inches diameter. Trees which, until they fruit, we must provisionally call *A. mollissima* or *A. decurrens*, may be seen at Colgrove, in Los Angeles County, and in San Bernardino, not yet four years old, which now exceed these dimensions in both instances; however, they are growing in soils of great richness.

At our Santa Monica station some two-year old specimens of *A. mollissima* are twenty-one feet in height, but with the disproportionately narrow diameters of only three and one half inches.*

Authors are agreed in all of these species requiring more moisture than demanded by the Golden Wattle. Our observations confirm this so far as *A. mollissima* goes, which has died out on dry hills where *A. pycnantha* has survived. They also state, however, that sixteen to twenty inches of rainfall are ample to bring it to perfection.

It is also claimed they (these species) will thrive on land absolutely sterile, upon which no other vegetation will thrive; which point we cannot corroborate as yet for California, as reports from Newport Landing, where we are testing this point, are not yet received, and sand reclamations in the Golden Gate Park, San Francisco, have not been made with these species.

The yield of bark is great, being averaged for plantations at seven years to eighty-four pounds per tree. Von Mueller quotes Mr. Dickinson as authority for a yield of one thousand pounds from a single tree in Queensland of *A. mollissima;* and this species, he adds, "is content with the poorest, driest, and sandiest soils."

All of these species will prove valuable, but so long as conflicting opinions exist as to the value of *A. dealbata*—and even its most ardent advocate relegates it to a secondary place—we will dismiss it from further consideration and recommend that initial plantings be made of the other species.

Seed of the *A. decurrens* in small supply can be had by application to this Board during the coming season, and will be distributed over the widest possible limits in which the tree may be expected to flourish.

* Due to close planting.

REARING.

Our experiments with the various methods of planting recommended by foreign planters, have, we regret to say, proved unqualified failures. Not even directions followed, as per recommendation of United States Department of Agriculture in its distribution of wattle seed, have proved much better, and where success has followed, I am of opinion that this success is the result of a fortuitous sequence of favorable conditions that cannot be depended upon for most seasons and most localities in California.

Any ordinary sowing that does not contemplate a partial roasting or boiling of the seed, as is well known, will result in failure to germinate. The roasting, if carefully done, it is claimed only destroys the outer integument of the seed, and it can then be sown without covering of earth, lying dormant and springing up, as in the case of many other forest products, after the first rainfall. Boiling or soaking the seed in hot water induces speedy germination, which makes immediate sowing and covering with soil an indispensable necessity.

Sowing seed broadcast thus prepared, in this State, implies for success a high degree of cultivation, a continuance of night temperatures not much below 50 degrees Fahrenheit and moisture close to the surface.

These conditions are seldom coincident here. At the time of year when we have sufficient warmth of soil (March–April), our rainfall in Southern and Central California is not sufficiently assured to warrant moisture enough near the surface to insure their growth. Seed sprouted previously to sowing will not endure drying out to any extent; its vitality is quickly gone unless conditions are favorable to its immediate growth.

Planting early, with the first winter rains, say December, offers no better alternative; the ground is chilly and cold, and these extra-tropical seeds, stimulated by heat to a condition for immediate growth, are checked, and chiefly decay.

All these wattles, furthermore, though of subsequently vigorous growth, are very slow to "start" during their infancy, and, in one of the rare seasons that occur that might be favorable to broadcast sowing, does and always will result in a spontaneous growth of native weeds and grasses that would quickly exterminate the wattles.

Success with this method, as stated heretofore, granting proper atmospheric conditions, requires careful preparation of the soil; and as our desideratum is to cover non-arable hillsides with these trees, we are necessarily compelled to leave the matter of cultivation out of the question, and abandon altogether the broadcast plan so highly commended for the Australian colonies.

The "hill" system, to wit: the planting of two or three seeds in a hill, like corn, as recommended by the Department of Agriculture, has great advantage over the broadcast or drilled-in Australian plans; it at least admits of sufficient cultivation around each tree to arrest weeds, and, even on steep hillsides, this can to a certain extent be accomplished by manual labor; still success is in the main dependent on the same conditions as in the other, and the little success that we achieved in a few localities last winter (1889–90) was due not to our skill as planters, but to early and evenly distributed rainfall, accompanied, until the plants were well established, with exceptionally high temperatures.

Rearing the plants both in boxes and nursery rows, and then transplanting them to permanent locations, we have tried with varying success, with the record showing a greater percentage of failure than otherwise.

This plan, that acts so satisfactorily with most eucalypts, does not comply with the requirements of the wattles; our own observations indicate that, except when very small seedlings, most species are restive of any root disturbance.

To this end we conclude that the only thoroughly satisfactory means at command is, to raise them in pots or some equally serviceable substitute. A little more trouble and expense are involved, but if the final results are to be had from wattle growing which we anticipate, surely this will not weigh as against the possible loss of time and seed incurred in two or three or more seasons of planting by other methods in expectation of an auspicious year.

Our system is to boil or soak our seed in hot water and then, keeping it still moist with wet moss, as fast as germinated to put one seed only into the smallest two-inch flower pot; preferably we use rich soil, as our planting is made June to August, and we aim to stimulate all the growth and size possible before cold weather. At the season of the year named the seedlings grow rapidly, and are, though still small, well established, and may be set out at once in the permanent plantation without disturbance at any time in the winter subsequent to the first considerable rainfall. If the winter be cold, they will grow but slowly, and may be overcome by weeds, unless cultivated; but they will in any case receive a start and impetus that will carry them through the ensuing summer's drought where the winter-sown seed will, even where it sprouts, perish in the early summer from incomplete establishment.

Plants reared in pots will of course exact nursery treatment, frequent waterings, weedings and occasional moving, in order that the plants do not root through into the soil.

The pots may be used the succeeding summer to rear another supply in, and the operation may be thus continued indefinitely.

Still another advantage from this method results from the economy of seed. Its lifelong vitality is well known, and when properly developed by swelling with applications of heat and moisture nearly every seed will produce a plant, each one as fast as germinating being picked out and planted singly in the pot of prepared soil. As these various species we have had under consideration contain from twenty-five thousand to fifty thousand seeds to the pound, and as above 95 per cent of good seed can be expected to produce plants, it will be readily seen that a pound of seed will furnish the making of a considerable plantation—but of numbers planted per acre will speak hereafter.

Rearing in seed boxes, or beds, then "pricking out" or transplanting into boxes, to be there grown until required for setting out in the permanent grove—as is the general practice in this country in rearing eucalyptus—has the advantage of cheapness over the pot method, and is frequently followed by nurserymen; but, as we have already pointed out, owing to the impatience of most species to root, disturbance cannot be recommended to the general public; expert skill and coincident favorable weather must operate to produce a good "stand."

Still we rate the risks *far less* than in any system of broadcast, drill, or hill sowing. The very serious item of investment in pots, amounting from $8 to $12 per acre, according to the market where bought, would prove a fatal handicap to many planters. That brings us to the consideration of still another method which presents a substitute for pots; has most of its advantages—indeed, in some particulars greater merits—is highly commended by Mr. J. Ednie Brown, Conservator of South Australian Forests; and, in fact, is the only method proposed for rearing trees there, which I am prepared to indorse fully as meeting all the requirements for California planting, and as coming within the probable means and reach of all.

His plan is to cut the hollow shoots of bamboos into four-inch lengths, fill with soil, plant the germinated seed in each, set them closely together in boxes, give them ordinary nursery care, and when of sufficient size to set, plant bamboo and all in the place where the tree is to grow.

When the bamboo or "tube" does not sufficiently decompose at the time of planting, a single blow of knife or sharp trowel splits it down without disturbance of the ball, and affords immediate opportunity for root expansion.

These tubes are of no value for ordinary nursery operations in which pots are used; the conical form of the latter permitting the plant to be removed without injury to ball or pot, and the "shifting" of the former into a larger size pot for further continued growth. Plants cannot be so shaken from the tubes without that complete root disturbance we are so anxious to avoid.

There are so few plantations of bamboos in California, and these so highly prized for ornamental purposes, that our recommendation would fall very flat and impracticable had not the complete adaptation of the common cane (*Arundinaria macrosperma*) as a substitute proved in every way satisfactory. It is abundant along many watercourses in the State, being most prolific along the waterways of the older towns and cities.

In the vicinity of San Bernardino and of Los Angeles alone, enough could be cut to make many millions of these tubes.

One of our correspondents has cut up into lengths and made nearly one thousand of these in one working day, while the operation of filling and seeding occupies no more time than would be consumed in the same work with pots.

Most of the wattles make an extensive and early tap-root, which is quickly checked in a shallow two-inch pot with a corresponding restraint to growth of top, which from experiments in vessels identical in shape and size to these tubes does not occur. So fully satisfied with the promise of this method is our Board, that our own planting the coming season (to the extent of fifty thousand trees) will be exclusively made in them.

PLANTING

In California may be carried on through the winter, and in the interior valleys, where heavier and later frosts may be expected, until as late into the spring as moisture remains in the ground, and where tube or pot planting is followed, and where facilities for irrigation exist, throughout the hottest portion of the summer.

CULTIVATION.

We have succeeded in obtaining a good growth of wattles upon hillsides, where only one hand cultivation with a hoe to kill the first crop

of weeds was had; in fact, horse or machine cultivation would have been impracticable, but are well satisfied that where the nature of the land will permit that one or more plowings, harrowings, or scarifying of the entire surface of the land during the first two years can be had, it will more than repay in accelerated growth, vigor, and earlier maturity of the crop all the expenses incident thereto. Those who have ever practiced spring or summer irrigation, and resort to this as a means to promote growth, will understand that subsequent tillage is a prime necessity.

In order to facilitate this cultivation we recommend planting in rows, not necessarily with orchard-like precision, but with care enough to permit of horse cultivation for two seasons.

The United States Department of Agriculture's recommendation is for planting four by four feet, about two thousand seven hundred trees to the acre. Some Australian planters, who broadcast, or line out, recommend thinning out, some to six by six feet, or say, one thousand two hundred trees to the acre. Still others, ten by ten feet, or four hundred and thirty-five to the acre. The dense planting where no cultivation whatsoever is permissible, is perhaps the best, as a complete shade is most quickly effected, otherwise, we condemn it, our own tests showing a disproportionately whip-like growth of stock or trunk. The six by six feet planting has the disadvantage of not allowing for cultivation after the first year, and ten by ten feet permits of too extensive a growth of top and lateral branches, always a disadvantage, if either bark or fuel, or both, be the desideratum to be obtained.

Our future plantings will be four feet apart in the rows, and rows ten feet distant. This will readily admit of cultivating one way for two or more years, if desired; permits of the entrance of teams or wagons for removal of bark, fuel, or other purposes; and it furthermore allows of planting nearly one thousand one hundred trees to the acre, sufficient for a proportionate development of top, and yet close enough to secure the straight, spar-like growth so helpful to future operations.

The stripping, curing, and marketing of the bark are simple enough, and will offer no serious obstacles to the planter; and as they will form the subject for a future memoir, need not be dwelt upon now, or till such time as a harvest is imminent.

In review, we repeat once more, that for lands not susceptible of much or any other than initial cultivation; for lands of such sterility that they are unproductive of native vegetation, or for localities where the mercury may be expected to register as low a temperature as —6 degrees Centigrade (21 degrees Fahrenheit), or where the annual rainfall falls under sixteen inches, we commend the *Acacia pycnantha*, or Golden Wattle, as an easy first. In all other cases, we think the weight of advantage lies with either of the Black Wattles—the *Acacia decurrens* or the *A. mollissima*. Any of the three, we are satisfied, will yield returns to the planter commensurate to the labor and capital employed, and from their rapidity of growth all will contribute largely towards the beneficial effects which must accrue to every locality that prosecutes the planting of forests to any considerable extent.

PART V.

REPORT ON CHICO EXPERIMENTAL STATION.

The property of the Board at this point embraces a great diversity of soils—in fact, illustrates nearly all that are found in either valley or foothill of the upper Sacramento—and results in tree planting finally attained here will prove typical of the requirements, or rather the possibilities of a very large region.

Tests made with a number of species of eucalyptus have not to date furnished gratifying results. Three species, to wit: the *Eucalyptus rostrata*, *E. viminalis*, and *E. obliqua*, have during two years withstood the normal winter temperature with perfect success, but have failed to make as satisfactory an annual growth as the same species in the southern half of the State.

Remarkable success has attended the planting of nearly all coniferous species, the Redwood and Lawson Cypress alone proving unmanageable under the summer temperature.

Pinus pinaster (Cluster Pine) has here fully demonstrated its cosmopolitan character, making so excellent a showing upon the various soils where we have tested it that we shall undertake the rearing of it here during the coming season on a large scale, with a view not only to making this station a distributing point for this tree along the Sierra foothills, but in the belief that the State will turn over to this Board the control of some of its depleted school lands, upon which we may make extensive plantations of this prolific and invaluable yielder of turpentine and allied products.

Most of our native conifers have made reasonable growth, but have been excelled in general vigor by exotic species—notably, both the Austrian and Scotch Pines, which seem to conform themselves more readily to the low elevation than the natives.

Herewith we append a list of such species as we now have growing at this station, with general notes or observations where pertinent:

No.	Name.	Country.	Remarks.
2,463	Eucalyptus viminalis—"Manna Gum"	Southeastern Australia	Most satisfactory gum tried.
1,188	Catalpa speciosa	Western United States	Largely planted over clay hardpan—results poor.
1,652	Pinus Austriaca—Austrian Pine	Europe	Results excellent; better than at southern station.
1,558	Cupressus sempervirens—Evergreen Cypress	South Europe	Rapid growth with minimum of care.
974	Negundo Californicum—"Box Elder"	California	Better growth upon cement or clay hardpan than made by Catalpas.
763	Acer rubrum—Soft Maple	Eastern and Northern United States	Not able to resist summer drought.
708	Pinus pinaster—Cluster or Maritime Pine	South Europe	Results on all soils excellent.
550	Eucalyptus obliqua—"Stringy bark"	Tasmania, Victoria	Growth inferior; even upon deep good soils.
470	Pseudotsuga Douglasi—"Douglas Spruce"	Western United States and Pacific Coast	Better growth than any "native" conifer.
420	Eucalyptus rostrata—"Red Gum"	Australia	Not as good returns as from "Manna Gum."
372	Chamæcyparis Lawsoniana—Lawson Cypress	Northwest Coast	Sunburns here.
306	Acer dasycarpum—White Silver Maple	Eastern United States	Far better tree for this locality than the Red Maple.
280	Salix alba var. vitellina—"Golden Osier"	Europe-Asia	Planted on our dampest land, but without summer moisture, made a growth of ten feet in a season.
228	Thuya Occidentalis—"Arbor Vitæ"	Eastern United States	So far stands dry exposures well.
210	Juglans Nigra—Eastern Black Walnut	Central United States	Good results had with both walnuts upon varied soils; nearly failing, however, on shallow soils.
201	Juglans rupestris—California Walnut	Western United States and California	
174	Sequoia sempervirens—California Redwood	California	Promises poorly.
160	Populus monolifera—Carolina Poplar	United States	Better growth upon dry sites than we have had with other poplars.
984	Pinus strobus—White Pine	Eastern United States	Progress satisfactory.
159	Pinus sylvestris—Scotch Pine	Europe	Growth better than at southern station.
150	Paulonia imperialis	Japan	Vigorous everywhere.
123	Pinus insignis—Monterey Pine	California	Rates under like conditions below the Cluster Pine.
100	Sequoia gigantea—"Big Tree"	California	General results good.
73	Pinus pinea—Stone Pine	Europe	General results excellent.
70	Pinus Torreyana—Torrey Pine	Southern California	Growth better at southern station.
57	Fraxinus quadrangulata—Blue Ash	United States	Stands dry exposures fairly well.
55	Betula alba—White Birch	Eastern United States	Practically a failure.
47	Morus alba—White Mulberry	Asia	Results good.
38	Melia Azederach—Pride of China	Asia	Results good.
24	Japan maples varieties	Japan	Unsatisfactory.
151	Abies concolor—California Fir	West Coast	Exceptionally good growth.
9	English Hawthorn	Europe	Planted for ornament.
6	Weeping Elm		Planted for ornament.
4	Magnolia fœtida	Southern United States	Planted for ornament.
2	Arucaria Bidwelli—Australian Pine	Queensland	Planted for ornament.
4	Picea pungens—Blue Spruce	Western United States	Results poor.
4	Tilia Americana—Basswood	United States	Results poor.

Total in plantations at Chico Station, 15,437.

In addition to the foregoing list, we have about thirty thousand seedlings of the above varieties for distribution from this station for the approaching season, it being the intention of the Board to make this a distributing point for the northern portion of the State.

While sacrificing nothing from a forestry standpoint, an effort has been made to dispose of plantations at this point with regard to ornamental effects. Its proximity to the town of Chico makes it desirable that park-like results shall be attained. It will thus not only subserve all the uses of an experimental forest station, but in the immediate future become a place of resort, amusement, and instruction for the people of that part of the State.

W. S. LYON, Forester.

PART VI.

APPENDIX.

SANTA BARBARA, September 29, 1890.

To Mr. WM. S. LYON, *Forester, Los Angeles, California:*

DEAR SIR: I planted the eucalypti the Board kindly sent me last spring upon a south-hill slope. "Sewell's Red Gum" first, and on best soil; then Red Gum, and highest up the *Eucalyptus diversicolor.*

Sewell's Gum are all dead except one or two, and these have not made any perceptible growth.

Red Gum have made a wonderful growth, some of them seven or eight feet high; *E. diversicolor* nearly as great a growth, and all are very thrifty.

No cultivation or water; the holes were barely digged big enough to crowd in the roots. The growth surpasses belief. * * *

Respectfully,

S. S. PRICE.

SHASTA, November 5, 1890.

To State Board of Forestry:

GENTLEMEN: I have to write to you concerning the cutting of Government timber. * * * I have to say there is a wholesale steal going on at Iron Mountain, Shasta County. There have been Government (United States) agents at that place, but they have failed to put a stop to it. * * * What I want to know is, how to proceed to inform against the company. Please send me the desired information, and oblige,

Yours, respectfully,

(Name withheld.)

ROSAMOND, KERN COUNTY,
November 5, 1890.

To W. S. LYON, *Forester:*

DEAR SIR: I would like your opinion as to the trees best adapted to the following situations:

First—Rocky hills, indefinite depth to water, and no facilities for irrigation; 108 to 115 degrees Fahrenheit in summer in the shade, and ice forms about one half inch thick in winter.

Would the tree best adapted to the above conditions do equally well if watered, or if planted on ground where surface water is not more than twenty feet below surface?

Second—What tree would do best on heavy clay soil, thirty inches to four feet to water; the surface of the ground occasionally submerged—probably every winter—from six inches to two feet; other conditions, as concerns climate, same as above; submerged condition of this land would perhaps continue three or four months.

Can seeds of the varieties best suited to the above conditions be obtained of the State Board of Forestry, and upon what conditions? I have charge of a quantity of hilly land which is of no value, unless I can get some kind of forest trees to grow upon it. It goes without saying that I want a tree which will be commercially profitable.

Hoping to hear from you soon, yours truly,

CHAS. W. McMASTER.

SAN MIGUEL, SAN LUIS OBISPO COUNTY,
November 3, 1889.

WM. S. LYON, *State Board Forestry:*

I write for information in regard to tree planting on timber culture claim, which is situated in Fresno County, near the foothills, on the west side of the valley. No system of irrigation in the vicinity; will have to plant something that rabbits and gophers will not destroy; have been advised to plant the eucalyptus, and some recommended putting in the seed and dragging it as you would for grain, then thinning out the trees after a year's growth. What is your experience with the seed, and could it be made to grow in that way by putting in early in the fall so as to have the benefit of all the rain of the season? Would like an answer soon.

Very respectfully,

I. JANETTE COYLE.

SANTA ROSA, November 14, 1889.

W. S. LYON, *Forester, Los Angeles:*

DEAR SIR: I have about one and one half acres of land on which the water is inclined to stand in winter, and it gets baked rather hard in summer. It is slightly alkali, and the soil not very deep.

What tree would grow on it that would make the best wood in the shortest time, and can you send me seed of the same?

Have heard a species of eucalyptus called the "Iron Bark" highly recommended.

Yours respectfully,

GEO. S. THURSTON,
Santa Rosa, Sonoma County, Cal.

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35 CORTLAND STREET, CHICAGO,
September 10, 1889.

To California State Board Forestry:

GENTLEMEN: I am in need of certain information, which it has occurred to me you will be able to furnish. This is my apology for troubling you.

I have taken a Government tree culture of a quarter section in Kern County, Cal., in the immediate vicinity of Lake Buena Vista, between that and the mountains of the coast. The soil is rich and deep, and, I think, very well adapted to my purpose—which is to raise English Walnut trees, if they are allowed by Government as coming within the requirements of the law as forest trees. If they do not, I hope you will inform me.

Second—May I reasonably expect to raise from seed that kind of trees upon that land as it is without irrigation, depending only on the rainfall and natural moisture of the atmosphere?

Third—Is it best to propagate from seed on the spot where the tree is wanted, avoiding transplanting, or to obtain seedlings and have them planted where wanted?

Fourth—Is a fence necessary to keep out rabbits and gophers or will they, if permitted to get at the young plants, destroy them?

Fifth—If these are destructive, what is the best means to rid the land of them?

Sixth—If, in your judgment and knowledge of this location referred to, you are of opinion that English Walnuts cannot with good hopes of success be raised, will you kindly mention the kind of tree that is best adapted to the land? And in so doing confer a great favor on

Yours truly,

THOS. COYNE.

HESPERIA, SAN BERNARDINO COUNTY,
March 28, 1890.

W. S. LYON, *Esq.:*

DEAR SIR: I have ten acres of land that I wish to set in forest trees in the future, but I would rather experiment on some varieties to see which kind would do best. The land is a sandy loam—and the Juniper grows in it—three thousand feet above the sea level, and situated two miles north of Hesperia.

I would appreciate very much if you would send me some trees of varieties you may think advisable.

Respectfully yours,

ED. DOLCH.

PASADENA, CAL., November 6, 1889.

To Chairman State Board Forestry:

DEAR SIR: I have a timber culture claim in Antelope Valley, and as you know the law requires ten acres to be planted to timber, I would like to ask your advice as to the *kinds* of timber that are most likely to live and do well in that region during the hot summers.

I thought you would be able to give me the desired information, and also where I could procure Maple and Mesquite seed, as I am desirous of trying those two varieties.

Grateful for such information as you can give,

I am, yours respectfully,

G. F. MILES.

COMPTCHE, MENDOCINO COUNTY, July 21, 1890.

State Board of Forestry:

GENTLEMEN: I herewith acknowledge receipt of, and thank you for the fire notices, which I deem highly instrumental in preventing reckless parties from burning our forests. I will put them in the most favorable positions possible. * * *

Sincerely yours,

G. F. MEDDOCK.

UNITED STATES INDIAN SERVICE, MISSION AGENCY,
COLTON, CAL., July 22, 1890.

Mr. WILLIAM S. LYON:

DEAR SIR: Am pleased to receive the fire notices, and will endeavor to keep them posted within the district which I cover in caring for the Indians.

There is a cañon east of San Jacinto full of beautiful fan palms, very large.

The Indians, for no known reasons, are destroying them, and I have tried in vain to stop it, but see no way but to put a man there to watch, and get one severely punished. This, I believe, may save them. Can you employ a man for this purpose?

Truly yours,

HORATIO RUST,
United States Indian Agent.

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140 NASSAU STREET, NEW YORK,
June 23, 1890.

To State Board of Forestry:

GENTLEMEN: Mr. B. E. Fernow, Chief of Forestry Division of United States, Department of Agriculture, suggests that you might kindly forward copies of 1887–89, Reports of California State Board of Forestry, of which he has none at present. Can you do so? If you could also point me to any published statistics of the prices of White and Yellow Pine in San Francisco, and the markets sought by the northwest lumber output, you would confer great obligations on yours,

Very respectfully,

WALTER S. CHURCH.

GALT, SACRAMENTO COUNTY,
January 27, 1890.

Mr. WILLIAM S. LYON:

DEAR SIR: The trees, some sixty in number, arrived in due time and in fine shape. I will report next season. Can you give me something of their history; are they all of Australian origin?

Yours truly,

J. B. DUFFY.

NUNACH, CAL., November 19, 1889.

To Commissioners of Forestry:

SIRS: We, the undersigned, citizens of Antelope Valley, in Los Angeles County, State of California, and members of the La Liebre Farmers' Club, desire you to send us as many trees as are allowed by the Commissioners, and of kinds best suited to our valley.

And we hereby agree to plant, cultivate, and otherwise care for the same, in accordance with such instructions as may be given by said Commissioners of Forestry.

(Signed:)

F. M. SPEER,
ELLIS FAY,
GEO. A. OWENS,
FRANK TRY,
And sixteen others.

REDLANDS, CAL., January 18, 1890.

To WM. S. LYON, *State Board Forestry:*

DEAR SIR: I am about to plant out thirty acres with ornamental trees and shrubs, and greatly desire information about trees and shrubs suitable to our climate here at Redlands. * * *

Yours, very truly,

ALBERT K. SMILEY.

BIG DRY CREEK, FRESNO COUNTY, CAL.,
January 31, 1890.

WM. S. LYON, *Esq.:*

MY DEAR SIR: Can you direct me where to obtain the seed of the *true* Golden Wattle? Is this the ordinary acacia? [Here follows descriptions.] I am informed they grow in dry soils without any irrigation, and have a bark of great commercial value, and make excellent firewood. * *

Truly yours,

H. C. CONE.

REDLANDS, CAL., July 9, 1890.

To Mr. WM. S. LYON, *Forester:*

DEAR SIR: I want to plant some Sugar Gums on a dry hillside, but where I can water occasionally, if it is best—of course I expect to water them the first year. Now, will it be necessary to water them the second year, and would you advise me to plant Sugar Gums instead of *Eucalyptus globulus?* Also, how high will they grow?

An answer to these queries will greatly oblige.

Yours, very truly,

E. G. JUDSON.

SISSON, SISKIYOU COUNTY, CAL.,
February 28, 1890.

To State Board of Forestry:

GENTLEMEN: I shall esteem it a great favor if you will give me information as to the best trees to plant for ornament and shade to surround my town property. I desire rapid growths with a broad leaf. Soil is deep, red loam, diffused with lime, gravel, and sand. It forms a fine cement. Water is abundant. Trusting that I am not encroaching, etc.,

I am, most respectfully yours,

PETER MUGLER.

FAIRFIELD, SOLANO COUNTY, CAL.,
March 6, 1890.

To W. S. LYON, *State Board of Forestry:*

DEAR SIR: I desire to set shade trees on the streets of our town. The soil is a heavy adobe; can you advise me as to the trees best suited for this purpose? Would Horse Chestnut, California or English Walnut, or Silver-Leaf Maple grow in our soil, or would some other kinds be more suitable? * * *

I am yours truly,

REV. D. M. BIRMINGHAM.

PASADENA, CAL., November 20, 1889.

To State Board of Forestry:

GENTLEMEN: Please inform me what varieties of quick-growing trees are best adapted for fuel and windbreaks. How far apart should the seed be placed, and what preparation of the ground and cultivation afterwards are required? Also, any other suggestions as to planting and attention. About how much seed will be required to the acre for a fuel plantation? * * *

Yours respectfully,

H. A. THACKER.

SAN BERNARDINO, CAL., February 27, 1890.

WM. S. LYON, *Esq., State Board of Forestry:*

DEAR SIR: Yours was duly received, and also the acacia seed. Many thanks for them, and for the information you gave me concerning the tree. Still, I desire to learn more, and will ask a few more questions. What is the general form of the tree? Is it tall and straight, or does it branch out? Is the foliage dense enough to make a good windbreak? We need a tree more for that purpose than any other, and a tree that would fill that bill and take care of itself would be a great boon to this section of the country. Will it bear transplanting? What is the bark used for?

Which of the two cuttings you find inclosed is *Acacia pycnantha?* They were sent to me as *A. pycnantha* and *A. floribunda.*

Have you ever tried the *Acacia lophantha;* if so, with what result?

Have you ever tried the *Eucalyptus rostrata?* So far it has given me the best satisfaction on dry sandy soil of any of the eucalyptus I have tried.

Respectfully yours,

O. P. ROBERTS.

SAN DIEGO, CAL., February 20, 1890.

To WM. S. LYON, *Esq., Santa Monica Forest Station:*

DEAR SIR: I am referred to you for information in regard to the best trees to plant in Southern California for park purposes. Am improving a hundred-acre tract of the park which I dedicated to the city of San Diego for charitable uses, and upon which will be established an orphans' home, industrial home, school of technology, etc., and I desire to adorn and beautify it in the best way possible. * * * I write for the purpose of asking your counsel and advice as to the best trees to plant, and suggestions as to the best methods by which to accomplish my purpose. * * *

Yours very truly,

BRYANT HOWARD.

GRASS VALLEY, NEVADA COUNTY,
November 7, 1889.

To Chairman State Board of Forestry:

DEAR SIR: We desire information relative to the varieties of trees, and method of obtaining some from the State nurseries suitable for the foothills of Nevada County, at two thousand feet altitude, where there is now a scattering growth of Manzanita, Digger Pine, Sugar Pine, Cedar, White Oak, Yerba Santa, and Red Bud. Soil, red gravelly loam, alternating with lighter loam and frequent float rock. This season (unusually dry) two dug wells struck water, respectively, at ten and twenty feet. Any particulars thankfully received by

Yours truly,

EQUITABLE COÖPERATIVE HOME BUILDERS.

DELANO, KERN COUNTY, CAL.,
February 17, 1890.

To WALTER S. MOORE, *Esq., State Board of Forestry:*

DEAR SIR: Having been informed that you have for distribution varieties of forest trees for experimental purposes, I ask if you would kindly furnish me with a few that you think suitable for our county. We have a supply of water for promoting their growth, and will, if required, report at proper periods as to their success in our station. The soil is a gravelly sand.

Respectfully yours,

GEO. A. TILTON.

SUTTER CREEK, AMADOR COUNTY, CAL.,
February 15, 1890.

To Chairman State Board of Forestry:

DEAR SIR: Can I obtain a few shade or ornamental trees of you for cemetery planting? Should like them properly labeled, and promise, in the future, to give all the information possible as to their growth, progress, etc.

Yours very respectfully,

WM. MOLONEY.

BURSON, CALAVERAS COUNTY, CAL.,
December 19, 1889.

Mr. WM. S. LYON, *State Board of Forestry:*

DEAR SIR: I am located in the western part of Calaveras County, between Burson and Valley Springs, on the line of the S. J. & S. N. R. R., and within what is known as the thermal belt of the foothills of the Sierra Nevada. Land is hilly and rolling; soil variable, from dark sandy loam to red soil and adobe; frosts very light; seasons early; rainfall ten to twenty inches; have no irrigation yet; oranges do well in the vicinity, and fruits mature early.

Would like to try a few trees, perhaps a dozen varieties of the kinds the Board is distributing, and such as you think adapted to my locality.

If you are so kind as to send a few such specimens to my address, I will endeavor to make a careful test of them, and report as required.

Hoping to hear from you soon, am respectfully,

W. C. DAY.

CHOLAME, SAN LUIS OBISPO COUNTY, CAL.,
January 28, 1890.

DEAR Sir: I would be most pleased to receive some varieties of trees if the Board has any for distribution, as I am trying every kind to see which does the best. I have a quarter section of land—some of it valley and some a little hilly. In the valley the soil is somewhat adobe, and the hills are black loam over a red sandy gravel. Now, I would like to set out five acres in valley and five acres in hills, and would like such information concerning the care and planting of the trees as you can give.

By answering the above you will greatly oblige.

MRS. MARY KELLY.

RIVERSIDE, CAL., November 9, 1889.

State Forestry Commission:

GENTLEMEN: Have you any seeds of the "Camphor Tree" and of the "Giant Bamboo?" * * * If you have none, can you tell me where they may be obtained?

Yours truly,

THOS. P. EDWARDS.

LOS ANGELES, le 11 Février, 1890.

M. LYON: Voudriez-vous être assez bon de m' énvoyer un paquet de graines de eucalyptus ficifolia si vous en avez?

Adressez "Station B," Los Angeles.

Dan cet espoir je vous prie d'accepter mes bien sincère salutations,

TH. ROUSSINET.

LODI, SAN JOAQUIN COUNTY, CAL., December 16, 1889.

W. S. LYON:

DEAR SIR: Please let me have as many kinds of forest tree seeds as the Board can spare, and oblige.

J. B. MERRILL.

RIVERSIDE, CAL., November 2, 1889.

State Forestry Commission:

GENTLEMEN: Have you any seeds of the "Camphor Tree" and of the "Giant Bamboo?" * * *

Yours truly,

THOS. P. EDWARDS.

SARATOGA, CAL., December 13, 1889.

W. S. LYON, *Esq., State Board of Forestry:*

DEAR SIR: I am a newcomer here, and am trying to improve an eighty-acre ranch in the Santa Cruz Mountains, and would be thankful for such trees or seeds as are suited to this locality, and which would help me in producing shelter quickly. * * *

Respectfully yours,

N. W. SCOTT.

PALMDALE, CAL., February 16, 1890.

W. S. LYON, *Esq., care State Board of Forestry*:

SIR: Referring to inclosed notice with signatures, I inform you that the Palmdale Improvement Society has organized to-day, and elected for its President John F. Fintel, and Secretary, John Muns. The society has instructed me to ask you if the State Board of Forestry could furnish us with an assortment of forest and shade trees for trial in our colony? We shall leave to your judgment what is most suitable for our climate, the temperature going down here to 12 degrees above zero, and the air in summer very dry, and free from fogs. * * * It shall be our endeavor to give all trees the best of care, and report in time the growth made, etc. * * *

Very respectfully yours,

JOHN MUNS,
Secretary Palmdale Improvement Society.

ESCONDIDO, SAN DIEGO COUNTY, CAL., March 3, 1890.

State Board of Forestry:

GENTLEMEN: Desiring to plant out some forest trees in our school grounds, we apply to you. Can you send us any trees desirable for such purposes? We could use forty, probably more.

Yours respectfully,

BOARD OF TRUSTEES,
Oakdale School District,
W. W. HORINE, Clerk.

PERRIS, SAN DIEGO COUNTY, CAL.,
December 12, 1889.

W. S. LYON, *State Board of Forestry:*

DEAR SIR: If you have any tree seeds or plants that you would like to know the results of in this locality, I shall be only too pleased to try them. Have a good place, water in abundance (if needed). Altitude, one thousand five hundred feet; thermometer ranges from 40 to 80 degrees from October to May, and from 70 to 105 degrees in summer. Four kinds of soil: sand, loam, red-land, and adobe.

Respectfully yours,

THOMAS ROSE.

WAUKENA, TULARE COUNTY, CAL.,
December 23, 1889.

DEAR SIR: On what terms can seed be had from the State Board of Forestry, for use in this portion of the State?

Respectfully yours,

A. D. EDGERLY.

INDIO, COLORADO DESERT, January 15, 1890.

Mr. W. S. LYON:

Received the trees all right, but will not set them till all the danger from frost is over; but I fear it is too cold here even for the hardy eucalyptus, but will do all I can for them. Last February three eighths of an inch of ice formed, and it froze one quarter inch thick every night from the seventeenth to twenty-fourth. * * *

Yours respectfully,

P. H. GALE.

PLEASANTON, ALAMEDA COUNTY, February 12, 1890.

The State Board of Forestry:

GENTLEMEN: The trees received of you last spring (eucalyptus variety) have made an excellent growth, considering the meager rainfall of last winter. They have had no irrigation, some of the varieties doing as well as *Eucalyptus globulus*, which is considered the quickest in growth in this county. As to hardiness it is yet too early to say, but I think if we had one or two mild seasons the trees would attain sufficient size to resist such frosts as we had in 1887. The *Eucalyptus marginata* planted last March has made the least headway of any of the varieties sent, with the exception of *Eucalyptus obliqua*. Average height now only ten inches, but *Eucalyptus obliqua* was tried, and though of slow growth at first, it did very well the second year. * * *

Yours very truly,

JOHN C. MOHR.

ALPINE, SAN DIEGO COUNTY, CAL.,
February 18, 1890.

To State Board of Forestry:

GENTLEMEN: Two years ago you kindly sent me seeds of the Manna and Sugar Gums. I set these out in boxes till they were three inches high; then set some in decomposed granite soil entirely, in which they have done finely, varying now from six to twenty feet in height. I also set some at same time in red soil, in which none are now over three feet, some only two feet.

All were placed on rolling hillsides, without any irrigation. The Sugar Gums are far superior as shade trees, being oval, symmetrical, and beautiful in form. The Manna Gums are too straggling and ragged to make a fine shade tree, but as I have not seen any fully grown cannot judge of them in their fullness. * * * We have a rain belt in this district that gives us more rainfall than in El Cajon, only twelve miles distant. * * * I think your Commission is doing a power of good for this State, and hope it may continue to extend the good work.

Respectfully yours,

DR. H. M. BAILEY.

LOS ANGELES, CAL., November 10, 1890.

W. S. LYON, *Esq., State Board Forestry:*

DEAR SIR: On the twenty-seventh of June last you sent me some young trees, mainly eucalyptus varieties from the station of the Board at Santa Monica, and I now send a short report of progress in accordance with the desire expressed in your letter accompanying them. I received twelve varieties [here follows list].

I planted them out in the form of a small grove after sending about one half to a friend living at some distance from me.

I planted them in sandy loam nine feet apart. Average height of trees when received about nine inches. My place is situated at Glendale, six miles north of Los Angeles. Two each of the *Eucalyptus obliqua*, *E. marginata*, and *E. Stuartiana*, I lost at once. I also regret to say I lost *Eucalyptus eugenioides* and *E. Leuhmani*, of which I received only one each.

The other varieties, however, have done well. At the time of writing and taking the best trees the measurements are as follows: * * * The best growth has been achieved by the *Eucalyptus punctata*, * * * five feet six inches.

I am, also, in receipt from another source of a different gum from any you send.

It is a short, thick-set tree, forming one straight trunk with divided top and throwing out nearly horizontal branches, not drooping, with nearly circular opposite leaves; I inclose herewith a small branch for your inspection, and if you can identify it and name it for me I should be much obliged.

In September I took the opportunity to pay the station of the Board at Santa Monica a visit, and was extremely pleased with the appearance of everything. The foreman (Mr. Southmayd) courteously showed and explained everything to me, and let me have a few more trees to replace those I lost, and I shall have the pleasure of telling you how this second batch fared in a later report. * * * I shall be greatly obliged to you for any bulletins or reports issued by your office on this most interesting subject of forestry. * * *

Yours very truly,

J. L. WHITTAKER.

PART VII.

FORESTRY BULLETIN NO. 6.

A REPORT ON THE GROWTH OF SOME SPECIES OF EUCALYPTUS IN SOUTHERN CALIFORNIA.

The plantations at the Santa Monica Station, from which the concurrent notes were made, are growing upon a steep hillside having a direct eastern exposure.

The "pitch" is sharp enough to form an angle of 45 degrees to 50 degrees with the plane of the valley beneath, through which runs a small rivulet; the whole plantation, by its location, is protected from strong winds, and is distant from the seacoast about one half mile.

The soil, which is typical of many hillsides in Southern California (and of which analyses are herewith appended), is of two characters: one a grayish clay-like material, thinly overlaid with three to fifteen inches of broken shale, some loam, and a little humus, washed down from a higher plateau or mesa; the other, a reddish mass, bearing a large amount (nearly one fifth) of decomposed iron, and is entirely bare and denuded of any superincumbent covering whatsoever.

For convenience of future reference we will designate the former of these as tract A; the latter, tract B.

The area of both is about the same; tract A was planted January fifth; tract B on January eleventh, of the present year. Neither received any plowing or cultivation of the soil whatsoever.*

Neither has received any water from any source since planting, except rainfall, of which the latest, and then a fair precipitation, occurred March sixteenth.

Growth made between the dates of planting and this rainfall was too inconsiderable for measurement; and at the time of planting the trees measured ten to fifteen inches in height. *Practically*, all the growth noted has occurred between March sixteenth and July thirty-first—a period of four and one half months. The lowest temperature recorded during this time was on February eighteenth, when the thermometer registered 1 degree below zero (30 degrees Fahrenheit). None of the species seem to have suffered from this exposure, although it should be stated that no long-continued low temperatures occurred, 1.10 (about 34 degrees Fahrenheit) being the coldest weather enduring longer, or more continuously, than one night. In many instances such exceptionally good results have followed, and some of the measurements obtainable were so phenomenal, that I feel constrained to record the details above set forth, in order that due consideration may be given to the possible benefits arising from the greater or less atmospheric humidity incident

* A scattered growth of weeds was once cut down; neglect of cultivation was intentional.

to the contiguity of the streamlet and the ocean—the favoring temperature and kindly shelter of the hills from strong winds.

Not only do the analyses show it, but Professor Hilgard, who has kindly interested himself in the matter, assures me that these soils are not anyway deficient in the elemental requisites to successful tree growth. Still, the complete failure of some species, and pronounced success of others under identical external conditions, and adverse ones at that, seems to indicate that where it is not practical to furnish cultivation or irrigation, that by conforming our plantations of forest trees to meet the controlling chemical characters of the soil for which certain species may show assimilative traits, as happy results may ensue as where we can furnish those artificial stimulants to tree growth considered of such vital import to plant life in a dry climate.

The statement of the principle involved, *i. e.*, that plants thrive best where furnished with congenial food, is a bald truism known to every cultivator of the soil, who, if successful, endeavors to fulfill those very conditions in the growing of general or special crops; yet I am unaware that in forest growing its value has ever been suggested, or if so, the suggestion utilized to take practical advantage of conditions as we find them, and without reference to supplying those deficient elements of fertility, either organic or mechanical, essential to general agriculture, and which, applied to forest plantations upon rough and precipitous hillsides, would be expensive, inexpedient, almost impracticable, and probably unremunerative.

Analyses of the soils in question are as follows:

	Tract A.	Tract B.
Insoluble matter	49.948	48.570
Soluble silica	20.730	8.245
Potash (K_2O)	1.093	1.537
Soda (Na_2O)	.658	.853
Lime (CaO)	3.227	8.143
Magnesia (MgO)	2.855	2.450
Br. ox. manganese (Mr_2O_4)	.048	.020
Peroxide of iron (Fe_2O_3)	8.109	18.193
Alumina (Al_2O_3)	6.774	1.509
Phosphoric acid (P_2O_5)	.228	.280
Sulphuric acid (SO_3)	2.648	.733
Carbonic acid (CO_2)	-----	3.180
Water and organic matter	3.597	6.376
Totals	99.913	100.89

Broadly classified, the soil of A is rich in lime in the form of sulphate (gypsum), with a larger amount of readily soluble salts than that of B; and, as compared with the latter, about evenly supplied with potash and phosphates. B, strongly ferruginous, with less of plastic clay than A and its abundant lime in the form of chalk (carbonate).

Digging upon both tracts, July thirty-first, at depths of fifteen to thirty inches, failed to reveal any moisture readily appreciable to touch or sight. Measurements of, and notes of growth of different species upon that date, are herewith given. Heights are expressed in feet and inches, and "average" obtained by measurements "as they ran"—not the mean of the extremes of best and poorest specimens.

NAMES.	Tract A.		Tract B.		Remarks.
	Best.	Average.	Best.	Average.	
1. Eucalyptus polyanthema (Many-Flowered Gum)	9.6	7	4.2	3.6	Growth in B small but thrifty.
2. Eucalyptus globulus (Tasmanian Blue Gum)	4.6	4	-----	-----	None planted in B.
3. Eucalyptus cornuta	7	6	4.6	4	Sent out last year as the "Tooart Gum," remarkably thrifty in both plantations.
4. Eucalyptus obliqua (Stringy Bark or Messmate)	6	5.6	2	0	Moribund in B. Lacks good color in A.
5. Eucalyptus leucoxylon (Victorian Iron Bark)	5	4.6	5.6	4.6	Richer, better color in the iron soil.
6. Eucalyptus rostrata (Red Gum)	-----	-----	5.6	5	Not planted in A.
7. Eucalyptus corynocalyx (Sugar Gum)	6	5.6	-----	-----	Not planted in B.
8. Eucalyptus viminalis (Manna Gum)	6.6	5.6	4.6	4.6	"Off" color in B.
9. Eucalyptus Stuartiana (Apple-Scented Gum)	6.6	4.6	-----	-----	Not planted in B.
10. Acacia mollissima (Soft Leaf Wattle)	6	5	-----	-----	Not planted in B.
11. Acacia pycnantha (Golden Wattle)	3.6	3	3	2.6	Strongly vigorous in both.
12. Acacia melanoxylon (Blackwood)	2	0	0	0	Sickly in A. Dead in B.

From this tabulation will be noted:

1. That the common Tasmanian Blue Gum, widely recognized as the typical exponent of all that is rapid among forest trees, has (under like conditions) been exceeded by all other species.

2. The general inferiority of all species upon B (as compared with A), with the single exception of the Victorian Iron Bark.

3. The remarkable growth of the Many-Flowered Gum in A, and its *apparent* preference for the gypsum form of lime, rather than the chalk and excessive iron-charged soil of B.

4. The complete adaptability of the Iron Bark to the latter.

5. The utter failure of the Stringy Bark upon B. In this instance—the Stringy Bark—it is not wise to formulate any hasty conclusions, implying want of water or proper nutrition. It is one of the few species making a distinctive tap-root and elaborating few superficial rootlets.

Both of these soils are, in their uncultivated states, strongly impermeable to even water, and the fair success of the same upon A may be due to the slender "top dressing" thereon, and that so soon as its tap-root reaches the densely impacted underlying soil, it may succumb as completely as it has upon B. Despite good growth upon A, it seems to show, in deficient leaf coloring, already an early expenditure of stamina and vitality. Whatever be the cause, its failure is the more regrettable, as in view of the recent tests of the wood of this species made by Mr. Allen Ransome at Chelsea, England. His report* accredits it with the highest value for great strength, toughness, and durability—characters not ascribed to it by previous authors, and, according to von Mueller, it "quickly yields an immense bulk of wood on the very poorest soils."

* Kew Bulletin for May, 1889.

Its adaptability to the poorest soils of California, I think, must obviously be sought upon lands of more porous nature, and hope to continue further experimentation to this end.

All the acacias develop an extensive tap-root, and we are measurably compensated for the failure of the Blackwood by the good showing made by the Golden Wattle. It seems to have found congenial organic conditions that counterbalance the bad physical situation that the Blackwood could not overcome. While the latter makes one of the most serviceable shade trees we know of, the former must come into more general use for forest planting, on account of its pronounced economic value.

To promote an interest in forest growing upon waste lands, where the risks and drawbacks are so considerable, where the initial cost is great, where water nor cultivation is available, vermin destructive and inroads from stock, mountain fires, and other perils imminent, and where final benefits are long delayed; demands that, though we may not assure the planter of any royal road to success, we can at least contribute our quota to minimizing these risks.

None recognize more forcibly than the writer the danger of formulating conclusions from results obtained within circumscribed areas and extending over so brief a time; yet, making due allowance for the value of all climatic appurtenants, I am of opinion that a more careful study of soils and species adapted to them will measurably neutralize these evils.

Not alone do the results here tabulated justify this view, but it is emphasized by noting the unparalleled vigor with which the native evergreen shrubbery grows upon the most arid, forbidding, and inaccessible of our California mountains. Beneath the fiercest of August suns, amongst naked bowlders, and upon almost vertical acclivities, and where the little soil obtainable at any depth accessible to tree roots is practically anhydrous dust, *Prunus ilicifolia*, *Heteromeles arbutifolia*, and various *Rhus* will be found to expand in generous profusion their wealth of luxuriant flowers and foliage—an ever present lesson that fundamental elements of success with other trees are not lacking if we well and wisely utilize the material at command.

WM. S. LYON,
Forester.

LOS ANGELES, CAL., September 1, 1889.

PART VIII.

MEMORIAL.

California State Board of Forestry to the Congress of the United States:

To the people of that portion of the United States inhabiting the so called arid districts, or those States and Territories visited either with scanty or only periodical rainfall, there is no single question that so profoundly affects their material welfare and future prosperity as that of a copious and enduring water supply for domestic, mining, and irrigation uses. Any conditions which result in impairing even slightly the supply now obtained in these districts, must be viewed with apprehension—any MATERIAL decrease in some of the affected localities would imply a shrinkage of millions of dollars in taxable values; while FAILURE of present supply would involve in business paralysis and financial bankruptcy some of the fairest and most thriving sections of the great Southwest. The continued progress and future development of large portions of Colorado, New Mexico, Nevada, Arizona, and, above all, California, seems to be only limited by this question of water supply, and it would appear to be a fair field for Congressional action to inquire into causes threatening its diminution, and by wise remedial measures preserve the integrity of such as we have, and promote wherever possible its further increase and usefulness.

Recent investigations of the Senatorial Arid Lands Committee have shown that irrigation, wherever practiced, has resulted in phenomenal benefits to people fortunate enough to come within the scope of its operations.

In California the vast area of the Sacramento-San Joaquin Valley (greater than the State of New York) is rapidly becoming opened up to settlement and profitable occupation, chiefly through the agency of elaborate and costly systems of irrigating canals. The more southern end of the State owes its surprising industrial advances more to the successful artificial distribution of a naturally limited water supply rather than to especial climatic or geographical advantages.

River bar and placer mining, as is generally known, can only be profitably prosecuted where water is abundant, and great numbers of paying properties throughout the west coast are unoperated and rendered unproductive during many months of the year, not so much from the inadequacy of the supply as from the existence of partially remediable conditions which prevail to quickly exhaust the fountain head.

The source of the water now enjoyed by the miners and agriculturists of this coast is found in rivers, streams, and springs having their inception in the timber-covered slopes and crests of the Sierra Nevada Mountains and its spurs.

Upon credible information, we believe that at points upon Kings, Fresno, and the Merced Rivers, above where any waters are withdrawn for irrigation or mining purposes, that in so called "dry years" there is already a marked diminution in the volume of their waters over past "dry years," and prior to the wanton deforestation of the brush and timber-covered slopes of their watersheds.

From personal observation we know this to be true of the Feather River, and believe that the same causes that threaten the mining, agricultural, and horticultural interests of this State are insidiously, but unerringly, at work to imperil and undermine the inland river commerce of our navigable streams, the Sacramento and San Joaquin Rivers. Unfortunately, the ownership of much of these timbered lands has passed into private or corporate hands; and we say *unfortunately* advisedly, as it seems impossible to impose any forcible restraints that shall altogether do away with wanton and wasteful destruction of timber by fire and the ax, or the pasturing out of their forest reproductive character by persons unmindful of the future and heedful only of considerations of immediate gain to themselves.

Nevertheless, there still remains of the brush and timber-covered watersheds of the Sierra Nevadas, and comprising those portions upon which the very life blood of the industries mentioned depend, millions of acres of surveyed and unsurveyed lands the ownership of and fee simple to which lies in the Government of the United States alone.

The custody of these lands at present is in the Department of the Interior, and, as part of the nation's heritage, and of incalculable value to the people of this country, they demand as careful stewardship and wise management as do the moneys in the public treasury.

A circular of the General Land Office of date of March 8, 1883, calls for the posting on the public domain of notices warning against the setting out of fires; yet such notices over eight hundred miles of this State are not posted, nor can records be found of arrests or prosecutions within this State by Federal officials for such offenses. All such action has heretofore been carried out by State authorities, hampered by feeble laws, limited means, and a territory to supervise nearly as vast as the whole Atlantic seaboard.

No further effort seems to have been made to arrest the obliteration of our forests from mountain fires, or to check the still more blighting and disastrous spoliation of their young growth by nomadic flocks of sheep.

Conscientious and rigorous measures have been fully carried out by the department to bring to justice trespassers upon these domains, who have cut and stolen timber and fuel therefrom; yet the value and volume of all the timber and fuel that has been stolen from the public domain in California for twenty years past, is insignificant as compared with the standing timber and young forest that is annually swept away by the combined evil agencies of fire and sheep.

If a tithe of the money and energy applied to the abatement of the lesser ill had been brought to bear upon the suppression of the greater one, the evil of which we now complain would not have grown to such monstrous and appalling proportions. The unprotected and unguarded condition of the nation's forest is a constant menace to freeholders and occupants of adjacent lands, and the newspaper press of the whole country during recent months has recorded innumerable disasters to both life and property from fires having their origination upon the public domain; and even if no considerations of self-interest intervene, the sovereign

ought not to be held unaccountable for its own laches when they result in death and disaster to the subject.

It is here assumed that the water-storing character of forests is too well known and conceded to admit of either elaboration or argument upon that point; and that the danger from flood and freshet incident to their indiscriminate removal is as generally known as it is freely recognized; nevertheless, to the people of the Pacific Coast, forest preservation has another aspect of the gravest import to them, and not necessarily a factor of equal moment in all forestal questions.

Environed on the south and southeast by an arid, treeless district, almost uninhabitable by reason of its torrid summer heats, the people of the adjacent territory can only look upon the possible enlargement and encroachment of this inhospitable region with profoundest apprehension. Their immunity from invasion by this hostile climate depends upon the great forests of the northwest coast, whose benign, ameliorating, and far-reaching influences alone enable them to maintain the unequal contest with greater forces. The diminution, recession, and final and threatened extinction of these forests must only result in the expansion and aggression of elements inimical to our well-being, fatal to our prosperity.

II.

Recognizing the difficulties of formulating forest protection laws that offer a solution of all objections that can be framed, the California State Board of Forestry tenders some suggestions in this direction that it is believed will meet the exigent demands of the mining and agricultural classes, nor yet be antagonistic to the great lumbering or live stock industries of this State.

First—Extreme urgency demands the temporary repeal of the timber entry law in California, and the absolute withdrawal from sale of all Federal timber lands in this State, until future surveys have determined the areas and boundaries of such tracts as are contained within the natural watersheds of our streams and waterways. For obvious reasons, the restrictive feature of the Act must operate prior, not subsequently, to the making of the surveys; otherwise the door is still open for some years for the perpetuation of the injury we would have abated.

Timber lands not so situated could ultimately be reopened for sale or occupancy, though no really valid reason can be adduced to show why this repeal should not be in perpetuity, and that *all* Federal forest lands, irrespective of their watershed or non-watershed character, should not be alienated to the people at large and from the individual forever.

Such a course will conduce not only to the benefit of the individual, but to the Government as well. A forest, or timber, like any other crop, when mature is fit to harvest, and when not subject to wasteful abuses may with propriety and benefit be cut; when, however, to facilitate access to a tract, vast quantities of intervening lands are laid waste and valuable timber is left to decay and destruction, then such methods become improvident and should be rigorously suppressed. In most instances these outrages are perpetrated upon the public domain, and are as defensible as would be the acts of a farmer in burning the fields and breaking down the fences of another for the purpose of securing a more expeditious route to market.

Second—The timber on such lands, when fit to harvest should be sold, not the land.

The lumberman, as a rule, cares nothing for the land; in buying forest he is only influenced by the number of feet or saw logs to the acre, and consequently will pay as much for the timber alone as he will for the land and the timber; hence, in selling the timber alone there is no loss of revenue to the department, while the fee remaining in the United States, they can impose such reasonable regulations for the preservation of young growth and the prevention of fires as will not alone insure the perpetual forest character of these lands, but yield in the future further returns of revenue.

Young growth forest lands for some years after the timber has been cut affords the best of pasturage, and, when the trees are of sufficient size, can be pastured to cattle, and even sheep, without injury; and the rentals derived from the same would, in a few years, more than meet the charges of guarding them from vandals and freebooters.

Accident of ownership by the United States seems to have operated to cause owners of errant flocks and herds of sheep and cattle to think they have some rights to pillage and plunder the public domain, reserved to themselves and denied to those engaged in other pursuits.

The successful prosecution and conviction of a few timber thieves has operated to almost abate the once thriving enterprise of lumber stealing. The same process, vigorously enforced, would doubtless mitigate the theft of pasture, and the far worse and almost invariable sequel of forest fires.

These lands, to be preserved to the interests of agriculture, mining, and lumbering, will require a systematic supervision and minute attention to executive detail not necessarily pertinent to the rest of the public lands, and which would tend to embarrass the already overloaded and complicated machinery of the General Land Office.

Hence, the propriety of assigning the custody of them to the Department of Agriculture under a competent Commissioner or Commissioners—to a department already equipped with a Division of Forestry, and under which they could be so administered as to become a source of national pride and wealth. If it be contended that the retirement of so much of the public domain is not in accord with the policy of our Government, we suggest that this loss can be offset by wise efforts to expand the benefits of the Timber Culture Act; the time for "proving up" can be extended, and to those who plant timber upon otherwise unproductive grounds, immunity from taxation for all time upon lands consecrated to this purpose.

The principle which would justify such legislation lies in the fact that the planter becomes a public benefactor, and that long before any direct profit can accrue to him benefit has inured to the whole commonwealth by his act.

Aside from persons who have availed themselves of the Timber Culture Act of 1878, are many individuals and corporate owners of large tracts of mountain and upper foothill lands unsusceptible of irrigation or cultivation; hence, unsuitable for agricultural uses and only available for grazing or forest plantation.

Would-be planters of such tracts are largely deterred from so doing through want of authoritative information as to the character of timber best qualified to thrive thereon, and under such conditions to yield the

best final returns. All legitimate encouragement should be tendered those willing to engage their time and means in enterprises calculated to so largely redeem the arid character of much of this country.

This encouragement is best promoted by the establishment of forest experiment stations in the most arid districts of Colorado, California, Nevada, and Arizona, and while their educational value be indisputable wherever established, the practical and material necessity for their existence is most strikingly emphasized in those States and Territories dependent upon seasonal rains, or subject to periods of long protracted drought.

Properly belonging in the jurisdiction of the Department of Agriculture, such stations obviously must be independent of, and remote from, agricultural experiment stations. These latter are (and properly) conducted upon lands fitted for cultivation. The former must be upon grounds typical of the millions of acres of to-day waste lands of the arid Southwest.

Public-minded citizens tender ample lands for such purposes free of cost to the Government. The initial cost of planting them out will not be great, and the subsequent cost of maintenance will be in a constantly diminishing ratio until they ultimately become self-supporting or a source of revenue to the State.

The present administration, or rather want of administration, of the Federal timber lands of this coast, is an arraignment of the best intelligence and patriotism of the general Government, which a disregard of the enlightened methods of other nations might not alone challenge, but which a due regard to ourselves and posterity does, and which strenuously and exigently calls for reformation and remedial measures that shall check the impending menace to our immediate and future prosperity.

The active and earnest coöperation of the California State Board of Forestry can at all times be relied upon to supplement and forward such action as Congress may take.

WALTER S. MOORE, Chairman.
JOHN D. SPRECKELS.
FRANK J. MOFFITT.

WM. S. LYON, Forester.

VALUE AND DESCRIPTION OF LUMBER EXPORTED FROM JULY 1, 1887, TO NOVEMBER, 1890.

The annexed table, condensed from the records in the Custom House, shows the value and kind of all lumber exported from the port of San Francisco for forty-six months ending October 31, 1890:

Date.	Laths.		Shingles.		Shooks—Value.
	Thousands.	Value.	Thousands.	Value.	
July 1, 1887, to June 30, 1888	519	$2,616	12,667	$25,498	$13,434
July 1, 1888, to June 30, 1889	380	1,511	9,132	15,562	15,732
July 1, 1889, to June 30, 1890	-----	-----	7,728	12,464	29,770
July 1, 1890, to Nov. 30, 1890	152	690	3,461	5,193	9,783

Date.	Staves—Value.	Lumber O.—Value.	Lumber Sawed.		Lumber Hewed—Cubic Feet.
			Thousand Feet.	Value.	
July 1, 1887, to June 30, 1888	$244	$17,491	15,911	$428,008	-----
July 1, 1888, to June 30, 1889	1,306	80,107	20,148	487,387	130,355
July 1, 1889, to June 30, 1890	-----	60,682	18,944	430,782	113,218
July 1, 1890, to Nov. 30, 1890	-----	18,973	7,399	116,313	1,847

Date.	Lumber Hewed—Value.	Doors, Sash, etc., and Stock—Value.	Moldings—Value.	Furniture—Value.	Wood Used—Value.
July 1, 1887, to June 30, 1888	-----	$136,879	$19,014	$152,249	$66,159
July 1, 1888, to June 30, 1889	$43,900	97,788	14,168	163,579	53,117
July 1, 1889, to June 30, 1890	27,270	90,239	11,135	180,608	63,529
July 1, 1890, to Nov. 30, 1890	650	40,119	2,927	63,709	21,368

Of the foregoing quantity there was exported:

To Australia	37 per cent.
To Mexico	15⅔ per cent.
To England	13 per cent.
To Ireland	9 per cent.
To Hawaii	8 per cent.
To Guatemala	7 per cent.
Total	89⅔ per cent.

The remaining 10⅓ per cent was exported to Brazil, Costa Rica, Peru, Honduras, San Salvador, Chili, China, Ecuador, France, British Columbia, Hong Kong, Japan, U. S. of Colombia, and other countries.

San Salvador stands next in order below Guatemala, and took approximately 3 per cent, leaving 7⅓ per cent for the remaining countries.

The sawed lumber for England and Ireland goes as dunnage in wheat ships. Each vessel taking any, receiving about twenty thousand feet.

England is the largest importer of hewn logs from the port of San Francisco.

REPORT OF THE BOTANIST

OF THE

CALIFORNIA STATE BOARD OF FORESTRY,

J. G. LEMMON.

LETTER OF TRANSMITTAL.

LEMMON HERBARIUM,
1015 Clay St., Oakland, Cal.

To the California State Board of Forestry: Walter S. Moore, Chairman; John D. Spreckels, Treasurer; Frank J. Moffitt; Sands W. Forman, Secretary.

GENTLEMEN: Herewith I have the honor to submit my Second Biennial Botanical Report upon the Forest Trees of the Northwest, particularly of California; this report treating exclusively of the Coniferæ, or Cone-bearers.

My report embraces four principal parts: First, introductory papers upon the origin, development, distribution, and extinction of species; the dominance, completeness, analogies, and fundamental characters of surviving species, concluding with classification, general and special, and classified lists showing the present locality and strength of the Cone-bearers, especially of the Northwest development.

The second part contains extended descriptions of the Cone-bearers wherever distributed, for the benefit of comparison, leading up to the particular discussion of those in the Northwest forests, treating the widest distributed, strongest species first in each group or genera, concluding with the most local, limited, and perhaps expiring species. This division necessarily comprises the greater part of the report.

The third part contains papers on forestal subjects of a general character, forests and rainfall, usefulness of snowdrifts, etc.

The fourth part comprises six map schemes of vegetable development and classification. Attention is called to this new method of presenting to the eye the correct position of the Cone-bearers in the cyclical impulsions of the vegetable development, the characters upon which they subsequently divide into classes, and eventually into genera and species; the strongest, best fitted strains in each case becoming uppermost and farthest advanced, with the related currents or lines of development halting behind on either hand, at unequal distances.

Finally, the whole is accompanied by ten full-page illustrations of mostly entire trees characteristic of California Cone-bearers, and twenty illustrations of branches, cones, scales, seeds, leaves, etc.—being thirty illustrations in all—copied from Mrs. Lemmon's paintings or from elaborated botanical specimens mounted and displayed upon large exhibition cards, for the purpose of supplying the means of certainly identifying species and varieties discussed in this report; the artotypes are by Britton & Rey, San Francisco.

Thus it has been the desire of the writer, and his associate, to present a treatise upon our noble forest trees that shall be scientifically correct, and measurably exhaustive of the subject treated, while it may be, at the same time, free enough of technical, unexplained botanical terms, to become easily comprehended by the general public, and paramountly, to enable Californians to become better acquainted with, and properly appreciate our numerous and magnificent forest trees—most of which are evergreen Cone-bearers.

ACKNOWLEDGMENTS OF AID.

Important assistance has been rendered us by a large number of persons and corporations in the prosecution of our researches and the collection of specimens, materials, statistics, determinations, etc.

Foremost of all is the acknowledgment of paramount indebtedness to the Directors and other officials of the Southern Pacific Company, who have given every facility for transportation over their numerous lines of railway; for it is freely admitted that little could have been done without their signal aid to persons of limited means while attempting to explore so vast a region as the Pacific Slope, with its many special forest headquarters so widely and peculiarly separated.

Similar assistance has been given us by the California and Oregon Railway Company; the Oregon Railway and Navigation Company; the Northern Pacific Railway Company; the San Francisco and North Pacific Coast Railway Company; the Atchison, Topeka, and Santa Fe Railway Company; the California Southern and the California Central Companies; also, by the Pacific Coast Steamship Company; the Pacific Improvement Company, and by the proprietors of several stage and transportation companies.

Important assistance in the discussion of certain mooted questions concerning the *Sequoia gigantea* has been rendered by the distinguished Old World authorities in botany, Prof. Alfonse De Candolle, Sir Joseph D. Hooker, and Dr. Maxwell T. Masters, extracts from whose letters are freely quoted in the discussion; also, by the American botanists, Prof. Thomas Meehan, Dr. J. S. Newberry, Prof. C. S. Sargent, Prof. Sereno Watson, and Prof. L. F. Ward, whose several thoughtful publications have elucidated many of our forest problems.

Important assistance has been received from our eminent geologist and philosopher, Prof. Joseph Le Conte, especially in questions of evolution and classification; and from the distinguished botanist, Prof. E. L. Greene, upon questions of authority and precedence, determined by reference to rare old books in his library and that of the State University.

The late Dr. C. C. Parry, the noted explorers John Muir and Dr. Edward Palmer, also President Harkness and T. S. Brandegee, of the California Academy of Sciences, together with the following other noted botanists, have rendered important assistance:

Dr. C. L. Anderson	Santa Cruz, Cal.
Prof. H. N. Bolander	Portland, Oregon.
Prof. L. F. Henderson	Portland, Oregon.
Dr. O. P. S. Plummer	Portland, Oregon.
Rev. Ernest C. Smith	Seattle, Washington.
Charles V. Piper	Seattle, Washington.
S. B. Parish	San Bernardino, Cal.
R. L. Fulton	Reno, Nevada.
C. F. Sonne	Truckee, Cal.
Daniel Cleveland	San Diego, Cal.
Mrs. Jennie N. Hughes	San José, Cal.
Mrs. Mary E. P. Ames	Auburn, Cal.
Mrs. R. M. Austin	Davis Creek, Cal.

Special acknowledgments of assistance are hereby tendered to the following enterprising citizens of the Pacific Slope, who have aided us in

various ways during the arduous field work of the last season, or of preceding seasons' explorations:

Kimball Bros.	San Diego, Cal.
J. S. Taylor and family	Del Mar, Cal.
Gov. R. W. Waterman	Waterman Station, San Diego County, Cal.
Mrs. Jeannie C. Carr	Pasadena, Cal.
H. B. Muscott and family	San Bernardino, Cal.
John Nelson	Tehachapi, Cal.
Ellwood Cooper and family	Santa Barbara, Cal.
H. C. Ford and family	Santa Barbara, Cal.
John Spence and family	Santa Barbara, Cal.
Mrs. R. F. Bingham and family	Santa Barbara, Cal.
Dr. Lorenzo G. Yates	Santa Barbara, Cal.
E. W. Steele and family	San Luis Obispo, Cal.
P. W. Murphy	Santa Marguerita, Cal.
S. M. Dyer and family	Starkey, Cal.
W. R. Rockwell and family	Starkey, Cal.
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Mrs. M. H. Field and family	San José, Cal.
F. M. Gomez and family	Monterey, Cal.
John Myers	Monterey, Cal.
Mrs. E. H. Thomas	Pacific Grove, Cal.
Dr. J. G. Cooper	Haywards, Cal.
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W. C. Lemmon	Sierra Valley, Cal.
Peter Oleson and family	Sierra Valley, Cal.
Prof. E. L. Case	Downieville, Cal.
W. F. Peters and family	Tahoe City, Cal.
J. H. Moody	Truckee, Cal.
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L. C. Tefft and family	Quincy, Cal.
J. H. Sisson and family	Sisson, Cal.
J. M. Hutchings	Yosemite, Cal.
Mr. and Mrs. E. C. Williams	Oakland, Cal.
Rev. Robert McLean and fami--ly	Grant's Pass, Oregon.
Malon W. Wheeler and family	Grant's Pass, Oregon.

The field work and collections were supplemented by historical data and determinations derived from latest botanical publications, from extensive correspondence, and in part from the use of the libraries of the State University, the State Library at Sacramento, the Mercantile, Mechanics', Odd Fellows', and Public Libraries of San Francisco, Oakland, and several private libraries, in short, wherever information could be found of value as bearing upon the subject-matter of the accompanying report.

All of which is respectfully submitted.

JOHN GILL LEMMON,
Botanist California State Board of Forestry.

AUGUST 30, 1890.

CONE-BEARERS OF CALIFORNIA.

PART I.—INTRODUCTORY PAPERS.

INTRODUCTION.

In the Second Biennial Report of the California State Board of Forestry, for the years 1887 and 1888, I discussed in a general way the Pacific Cone-bearers, giving the climatic conditions that cause the growth of forests generally. It was shown that most of our forests depend primarily upon the two great warm ocean currents that bathe the northwest coasts of Europe and of America, supplemented by the direction given to the atmospheric currents crossing them and then striking against the land surface, especially of mountain ranges.

It was shown that the American forests were the larger of the two regions, and that the interrupted coast and archipelago of the Northwest, by receiving and delaying the *Ku-ro-Si-wa*, or Japan current, had located the headquarters of this great forest development in the vicinity of Puget Sound, while the higher moisture-bearing winds escaped farther inland, and produced the magnificent forests of the Cascade and Sierra Nevada Ranges.

It was shown that the principal part of these forests was composed of cone-bearing trees, comprising fourteen genera of seventy-eight species, all told. A brief synopsis was given of these, and a table showing their distribution.

The leading and large family of Pines was then selected for description in that report, and its eighteen California species were classified upon their fruit characters, and then described in detail, with illustrations of the principal species, their diverse cones, flowers, leaves, seeds, etc.

The discussion embraced a special investigation of the two most important lumber Pines—Sugar and Yellow Pines—with short papers upon "Renewal of Pines," "Pines in Literature," "Pines of America," etc., concluding with the "Diagnosis of the Genus Pinus," for the closer student of the subject.

Readers interested in the "Pines of the Pacific Slope" are respectfully referred to the report cited above.

REPORT FOR 1889 AND 1890.

In the present report descriptions of all the Cone-bearers—excepting Pines—will be attempted, and it is to be regretted that the localities where some of them grow at their best could not be visited last season for fresh facts, owing to the unprecedented early summer fires, followed soon after by much earlier autumn rains than usual. Added to these obstacles to effective exploration was the further misfortune that most of the annual-fruited Cone-bearers failed to bear fruit the past season, including most of the Spruces and Firs.

The description of our California conifers involves a deeper, more extensive discussion of their origin, development, distribution, persistence, and relations than was at first contemplated. The California flora at once is seen to be not alone and distinct, but as part of an extensive and prodigious development peculiar to the Northwest, and with which it must be considered.

An idea of any given species, to be intelligible, must be compared with that of its relatives, and these may be now—most of them—removed from the earth, or they are separated by space, it may be half the circuit of the earth, or by longitude in the same region, or again, by altitude in the same mountain.

Lastly, several species may be associated in precisely the same locality, yet be separated by cross-sterility resulting in wide differentiation.

In the presentation of species, origin and development are of first importance. Lines of development are early instituted, and they are conceived to be upward and onward, like vapor rising from the earth, a bird taking its flight, or a strong man commencing a journey.

This development is interrupted by great changes in the temperature of the earth, a cold one, called the Glacial Age, causing universal migration from the north; a subsequent warm one causing an attempt to return, resulting in separation, dispersion, isolation, and wholesale destruction.

Present species are then seen to be but remnants of extensive families, the surviving members more or less dispersed over the earth.

In discussing present forms of plants—existing species—the farthest removed will, for convenience, be briefly considered first, leading up to the western development, and when the great West is reached, the widest distributed, strongest species first, ending with the most local, weak, and, perhaps, expiring species.

In descriptions an attempt is made to give the characters correctly, but in familiar language. The nomenclature necessarily engages much attention, and an attempt is made to keep abreast with the times and the latest discoveries both of species and of the earliest descriptions of them. The law of priority is recognized and rigidly enforced, although, in some instances, it causes the dropping to a synonym (inclosed in parentheses) of a name endeared by long familiarity, and the substitution of one not new to science but to the general reader.

The determination of some of these "new names" is often brought about by consultation with eminent authorities, extracts from their recent letters being freely quoted, especially in the settlement of the botanical name of our Redwoods. In other instances, names are revived and given to forms that once bore them, on the principle that different things are entitled to different names, provided the difference is fundamental, or comprising several important particulars. Lastly, new names are coined for genera, species, and varieties newly elaborated.

POPULARIZING SCIENTIFIC NAMES.

In the preceding report the statement was made that the Board of Forestry had commenced the great work of popularizing scientific descriptions of our forest trees, illustrating them also, so that even an amateur is enabled to recognize the species. Correspondents from abroad and at home assure the writer that this has been accomplished in the case of the Pine family, so we are encouraged to continue the work with the rest of the Cone-bearers.

Unlike the inhabitants of northern Europe, whose veneration for Linnæus causes them to readily learn the accurate scientific names he

gave to plants, the average American rarely tries to learn the Latin names, scouting them, perhaps, as too pedantic, and often persisting in manufacturing misnomers.

This practice leads to ignorance or worse—gross error from the use of a name loosely applied to a dozen different species. In descriptions following, as few technical terms are used as possible consistent with accuracy, and they are defined by familiar words when first used.

The reader is earnestly requested not to skip or hesitate when encountering an unfamiliar word, *but to at once pronounce it and make it familiar*, remembering that in the Latin there are no silent letters—every one has its proper sound. So, in reality, the botanical names are easily pronounced, and thus a correct knowledge of our trees may be readily gained by the largest class of readers through the exercise of a little resolution and perseverance.

Already many citizens find no difficulty in saying *Sequoia gigantea*, when alluding to the Sierra Big Tree; or, *Pinus ponderosa*, for one of our lumber pines; or, *Quercus agrifolia*, for a certain field oak, etc. A little attention to propriety and clearness would rectify much misnaming of trees, and would result, at last, in uniform usage of suitable vernacular names (as given in connection with the trees in following pages), and soon would follow the gradual adoption of the only really distinctive appellation, the term of last resort when one wishes to be sure of avoiding ambiguity, *i. e.*, the technical, usually euphonious, easily pronounced botanical name.

CONIFERÆ, OR CONE-BEARERS.

The cone-bearing trees comprise the families of Pine, Fir, Spruce, Larch, Cedar, Redwood, Cypress, Arbor-vitæ, Juniper, and the allied small families of Yew and False Nutmeg, embracing fourteen genera (omitting the Cedar) and forty-six species within the limits of California.

In order to discuss such a large number of species intelligently, and to retain the impressions sought to be conveyed of them, it will be helpful to resort to methods of presentation that become object lessons to the eye.

Conceiving that the natural development of vegetable growth is upward and onward, and that we are chiefly concerned with the surviving, ultimate families, in the order of their prominence, we shall have frequent occasion to refer to the accompanying "schemes," designed to assist in presenting the development, first, of the whole vegetable kingdom, thus showing the place of the Cone-bearers and their relative importance, then taking such lines of development as concern us, and presenting them anew with their ramifications.

It will be noticed that the *Coniferæ* lead in the great class of GYMNOSPERMÆ, and that the Pines are the chief family of these, so we have commenced aright in describing these Pines first in the former report.

The history of the group of "Pitch Trees," including the Pines, must be briefly touched upon again, as it leads up to the special descriptions of Spruces, Firs, etc.—the especial burden of this report.

ANCIENT HISTORY OF THE PITCH TREES.

The many references in the writings of the ancients to the pitch tree, as in the Psalms of David, doubtless allude to the trees of the Bible countries, now known to be members of the Spruce and Fir families.

Pliny, the Roman naturalist, living in the early years of the first century of the Christian era, had good knowledge of the pitch trees of his vicinity, and wrote of them:

"Whereas, in Asia there are several trees that produce pitch, in Europe there are but six."

In one of his thirty-six books on Natural History, he names and describes these six pitch trees substantially as follows:

1. *Pinus*. Pine, *i. e.*, the true Pine (*P. pinea*). Even in Pliny's time much cultivated in Europe.
2. *Pinaster*. Literally, "pine-like;" afterwards known as a True Pine (*P. sylvestris*), but then called "Wild Pine."
3. "Torch Tree." "Gives out more pitch than either of the others." (*P. Cembra*); not then known as a kind of Pine.
4. "Pitch Tree." Trees believed to be species of Spruce, as we now limit the term.
5. "Fir Tree." Trees "with full branches." Doubtless a species of Fir, and quite accessible to Pliny.
6. *Larix*. "Casting its leaves before winter." A species of Larch, or, as it is called in America, "Tamarack."

"All these trees," Pliny states, "are evergreen" [not so the Larch] "and not easily distinguished."

The ancients, for want of systematic methods of classification, which came on later, were unable to detect the groups of characters that are now well known as separating the pitch trees into their families; so in the Greek and Roman classics they are all included in the reference to *Pitys* or *Pinus*, and usually refer to the most common pitch trees known to the people.

Those trees heard of in the mountains, and reported by hunters or devotees to the shrines of the mountain deities, were merely called by some name meaning "Wild Pitch Tree." It happens that it is of these wild, little known trees, then, that we shall have most to do, and their western relatives to describe in these papers.

Tournefort, in 1700, was the first to clearly describe the pitch trees and to distinguish them into the five following genera as they stand to-day: *Pinus*, *Picea*, *Abies*, *Larix*, and *Cedrus*.

Linnæus, fifty-three years later, in his SYSTEMÆ NATURÆ, crowded these genera all back into one genus as *Pinus*, while other families of *Gymnospermæ* found other places in his artificial system along with euphorbias, sterculias, and others.

Nearly a hundred years later, Bongard in 1834, Don 1835, Link 1841, Spach 1842, Loudon 1842, Endlicher 1847, Carriere 1855, Gordon 1858, and Parlatore in 1868, reclassified and redescribed the pitch trees, or Cone-bearers, each scientist doing something at eliminating the Pines from the rest, and each from the others, arriving ultimately at the same classification, substantially, that Tournefort had reached a hundred years previous.

The ante-Linnæan botanists clearly distinguished the genera *Picea* and *Abies*, placing Spruce in the former and Fir in the latter genus, but

by some inadvertence, perhaps, Linnæus, the great law-giver in botany, reversed the terms, and the confusion thereby created in botanical nomenclature has continued to the present time, and to-day the most distinguished authorities on both continents are opposed in the use of these two terms.

Chief of those who apply the name *Abies* to the Fir family are all the older botanists, including Pliny and Tournefort, with the moderns, Link, Spach, Carriere, Michaux, Nuttall, etc.

Chief of those applying the name *Picea* to the Fir family are, first of all, Linnæus, then Don, Loudon, Gordon, Emerson, etc.

As late as 1847, that close student of *Coniferæ*, Endlicher, still classed both the Spruces and Firs with the Pines, and as late as 1856, Dr. Asa Gray, in his "Flora of the Northern United States," arranged the Spruces as a sub-genus of *Abies*, under the name *Picea*.

And this confusion of the botanical names was communicated to the popular names as well, and still continues—well informed persons calling a tree a Spruce, which another calls Fir, according to their training.

Dr. George Engelmann, than whom no one in recent times has devoted more labor to the study of our trees, in his exhaustive publications in 1880 wrote: "I follow Link in his definition and limitation of the genus *Abies*, which seems to be a very natural one, comprising the Silver and Balsam Firs. The name *Picea* enjoys the Linnæan prestige, but is contrary to Pliny's and to classical usage. *Picea* is the Pitch Tree, and properly designates the Spruces. Tournefort, the elder De Candolle, Gray, and others comprised under the name *Abies* both the Spruces and Firs, "but," the doctor declares emphatically, "the generic distinctions between them are abundant and based upon floral and fruit characters as well as upon the leaf anatomy."

NOTE.—The leaf anatomy, the peculiarities of which as distinguishing genera and species of the Cone-bearers, is the discovery of Dr. Engelmann, was largely relied upon by him for his primary classifications; but as the leaves are small and their organs microscopic, their study must be relegated to the close observer; hence, these leaf-characters, however constant and distinguishing, must be neglected in a treatise designed for the general reader.

We offer, instead, classifications based upon plainly evident characters—chiefly the fruit, or, as it is commonly called, the cone or bur. In the illustrations, however, cross-sections of the leaves of certain species are shown, where the characters are important.

DEVELOPMENT THE BASIS OF CLASSIFICATION.

DIVERSITY AND WARFARE.

If the earth were a flat, plane, smooth, stable surface, and if it were equally illuminated at all points from the same direction, and further, if it were evenly watered throughout, then there could be but one form, or at most but a few forms of plant or animal existence upon it.

But as we have a globular, swift-revolving, much-inclined, far-traveling, and withal, a slow-maturing and turbulent planet, the conditions are vastly different from the first supposed case.

Our little globe was condensed out of the attenuated matter of universal space ages upon ages ago, and commenced whirling through space while it condensed, solidified on the surface, cooled down to a low temperature, became wrinkled and old, blistered and erupted long before it was fitted for the production of living individual objects as we now know them.

All we comprehend of the infinite productions of the earth, all we experience of intricate relations, of diverse conditions, results from the modification of a few primitive types of being that originated when the world was young, smooth-faced, and mild-tempered, not as now—old, shriveled, sculptured by glaciers, upheaved in sections by confined vapors, while other portions are being submerged by oceans, etc.

The vicissitudes incident to world growing, to planet development, compelled changes in the forms, the aims, the habits of its inhabitants, that each type of being might live, thrive, and perhaps survive others, until each type in its turn was overcome and borne down by the hardships of its environment, or the superior power of its enemies, yet not before each type had acted his part on the stage of being; each fulfilled his mission—that of giving expression or embodiment to a certain principle or divine idea that in some degree has advanced a line of development toward a to be perfected state.

The individual expressions of these lines of development, these plants and animals, so called, introduced at first under favorable conditions in an open field, while the earth was smoother-faced, have later been jostled and huddled together, so to speak, by upheavals and lapses, by alternations of heat and cold, by migrations and dispersions, while each retains its instinctive determination to exist.

Here begins the warring phenomenon, the contention, fierce unto death, that pervades all animated nature. The individual expressions of every line of development thrust into the pasture fields of other types, at once begins the warfare; each must battle or suffer, must conquer or yield, contending constantly, with eternal vigilance, for standing room, for vantage ground.

And this conflict, begun with the birth of organic life, must continue down to the end of time, as we say, that is, until the globe has completed its growth, has become, as it were, a cinder, its vital forces exhausted and all its expressions of life departed.

This warfare, pro and con, is waged by means of implements of attack and defense innumerable, and when we, intellectual, conscious beings, begin to think about our neighbors, and try to classify them, we are often greatly confused. We find all manner of strategical measures resorted to, all kinds of disguises, similitudes, compromises, innovations—anything to obviate a surrender or to conquer a foe in order to adapt one's self to circumstances for one's own betterment.

When we are examining an object or a group of objects, seemingly separated from or united with others by important characters, either in respect to their degree or their number, it often happens that the separation or union is one of appearance only, owing to our ignorance of related objects—those being discovered in time perhaps, after diligent research.

Also, it often happens that so called very distinct species or genera appear so simply because their relatives have been withdrawn from the earth, have gone down in the struggle and become extinct.

For example: within the limits of the United States there are now but about one hundred and sixty recognized species of Ferns; but the coal-measures of the same region—the rocky albums of Nature—when

opened reveal over three hundred and eighty extinct species. The same remarks may extend to other natural objects, notably the insects, three or four times as many of which have been withdrawn from the earth as are now flourishing upon it.

WITHDRAWAL OF SPECIES.

Among the most notable examples of the withdrawal of species are some that especially concern us in this discussion of forest trees.

The Redwoods, as we know them, are colossal giants of the vegetable kingdom limited to the narrow confines of California, but in two very different climatic regions; the one on the low, moist coast, the other in the high, cool Sierra region.

The researches of the geologist, revealing the paleo-botany of the earth, have detected some twenty-four more species of Redwood in the rock albums of the earth, while nearly as many more forms of *Magnolia*, *Taxodium*, and of *Libocedrus* are known to have existed abundantly in Miocene times, and in extremely northern latitudes (notably Greenland and Alaska), the earth then being very warm, with no polar ice.

All but a few solitary remnants of these species are now extinct.

THE GLACIAL EPOCH, CAUSING PLANT DISTRIBUTION AND EXTINCTION.

The last, most important, and comparatively recent event that followed the changes in the temperature of the earth, resulting in the general migration of species, the extinction of most of them, and the dispersion of the rest, is known as the Glacial Epoch, or Era of Ice, which occurred in Pliocene times (*i. e.*, the last age of the world), just before the present Era of Mind, or Age of Man.

The researches of scientists during the present half of the nineteenth century have shown that during Miocene times (*i. e.*, the middle, and very hot age of mammalian predominance just preceding the correspondingly cold, Pliocene age), various large animals and trees, similar to those now found in warm countries, inhabited abundantly Greenland and other Arctic regions, even as far north as 75 degrees. At that time there could not have been any perpetual polar ice, unless on high mountains in polar regions.

During the next age—the Pliocene—the heat of the earth abated, polar ice appeared, and doubtless with it Arctic species, while those requiring a warm climate retreated southward, or they were overtaken and exterminated. As the cold of the Glacial Epoch came on and increased in severity, the polar ice became extended southward as a general sheet or stratum of ice along the continents until it reached 40 degrees north latitude in Europe, and 10 degrees less, or about 50 degrees in America. Its margin can be traced by the remnants of a moraine stretching across the United States, from Long Island through middle New Jersey, middle Pennsylvania, thence less distinctly following the Ohio River, crossing the Mississippi, thence following along the south side of the Missouri into Montana. In the far West the moraine is not easily traced, owing to interruptions by the great cross-mountain ranges.

By the increasing cold Arctic species were driven slowly southward, generation after generation, until they occupied the whole of the United States to the Gulf of Mexico, and the whole of Europe to the Mediterranean Sea. As these species came from a common home in the polar regions, they were similar to each other, except such slight modifications as would result from a long journey occupying a vast era of time.

When the rigor of the Glacial Epoch declined, and the sheet of ice gradually retreated to its present position (which occurred not less than eighty thousand or one hundred thousand years ago), Arctic species, following the snow edge, went also northward on both continents to their present home in the polar regions.

But Arctic *conditions* exist as well on *high* elevations of *low* latitudes as on *low* elevations of *high* latitudes; therefore, two ways of escape were open to the retreating Arctic species. When a mountain was encountered, some of them ascended it, following the snow line into the very peaks, and many of them remain stranded there to this day. Others, finding the mountains too low for their constitution, were overtaken on the several heights by the increasing heat, and there exterminated. Other lines of migration on the general plain met with obstacles of wide seas or sterile deserts, where they crouched upon the borders, hemmed in on all sides by other plants, all struggling for the same place, each becoming the ruthless enemy of the others, and all becoming slowly exterminated by the rising temperature.

In time the temperature of the earth assumed its present state of nearly uniform heat in similar latitudes, and the flora and fauna were found dispersed from equator to pole, and from level plain to mountain top, each form where it could best maintain existence.

Then was ushered in the Age of Man, of Stability and Conflict. Then commenced anew the struggle for existence and supremacy on favored localities. Not emigration, but establishment; not tramping, but grounding. There were millions of contestants for only thousands of places.

Only the individual plants and animals best adapted to the circumstances could survive and perpetuate their kind; and this could be accomplished only by means indescribable, and involved the extinction of species innumerable—withdrawn by millions in the conflict waged through ages of years—and all this in addition to the wholesale destruction of species described as consequent upon the vicissitudes of the great Northern Retreat.

The Northern Retreat before the rising heat of the tropics, in its results was vastly different from the exodus of the plants and animals from the north ages previous.

The conditions were not only exactly reversed, but the effect was immeasurably more disastrous. The hegira from the north being caused by the lowering of the earth's temperature, which took effect as well on the mountain tops as in the Arctic region, the flight was simultaneous from both localities.

The alpine refugees arrived at the base of the mountains coeval with the arrival of the northerners, and all together, those that could do so made detours around the bases, and so escaped to the plains to pursue their flight.

Those individuals that were squarely overtaken on the northern bulwarks were slaughtered there and then; hence, these northern slopes of the earth's cross-ranges of mountains are the sacrificial altars of the ante-Pliocene plants, but no special dispersion and slaughter by detail marked their southern movement.

On the contrary, the northern retreat was most disastrous. The

plants which arrived at the bases of the mountains, range after range, commenced to ascend them, separating from the great mass that passed along the plains. Climbing the acclivities as the snow disappeared, if the summits were reached before the temperature abated, the rising heat caught them there and then; and here on the mountain summits of all climes and regions are the up-lifted sacrificial altars of the most of the Pleistocene plants.

CREATIVE ENERGY AND DEVELOPMENT.

A profound scrutiny of Nature and her phenomena reveals the simple grand truth that every object, every body, in existence, be it a plant, an animal, an orb, or a universe, is the result of an impulse or propulsion of creative energy, the universal spirit of life pervading, controlling, and shaping all forms of matter. These impulses of creative energy are approximately typified by the life-history of a tree struggling against its enemies and environment; those branches best endowed with staying qualities and meeting with least resistance outstrip the others, and eventually occupy the field, leaving behind branches that radiate from the course and are overcome and aborted, the helpful elements of the latter being absorbed by and surrendered up to the dominant currents of life as they swirl upward and onward in the leading stems.

The three main currents or impulses creating the vegetable kingdom have been named SPERMOPHYTA, SPOROPHYTA, and PROTOPHYTA. Of these, the first one is the dominant one, the leading current exhibiting the highest and most elaborated development, and it should be placed in the center of the list where it belongs, and this should be the rule in all classifications.

This leads me to make an announcement: For some time past I have meditated an innovation in scientific classifications. I would place all objects in groups, with the dominant types in their midst, not as now presented in our books, *all in a line at one end of a list!*

The usual way of presenting objects in this lineal order, when they belong unequally on the right and left of a central, advanced point, has long been lamented, but no one that I am aware of has devised a better way.

I submit the following Conception and Schemes of Development:

"UPWARD AND ONWARD."

I conceive Plant Development to be upward and onward along curving lines or impulses of creative energy. These impulses divide and subdivide, as refinement or improvement is gained; when dividing into two branches they are seldom equal, one, the stronger, becomes the farthest advanced; if separating into three or more currents, the central one or ones will have the lead, with the side currents halting behind at unequal distances.

This conception of development suggests the accompanying map schemes of classification. (See Part IV.)

FUNDAMENTAL DISTINCTIONS—DOMINANCE OF CERTAIN LINES.

Even a brief examination of the forest development of the earth, reveals the fact that some lines are much more represented by individuals, at the present age, than others. Some species have a wide range every way, in latitude, longitude, and altitude, as in the Western Yellow Pine and the Douglas Spruce. Others are more or less limited, some to a coast line, others to a narrow belt along a mountain range only a few miles wide at any point; others, still, may cling only to a few protuberances or be lodged in a few depressions at a given altitude of a mountain range; while, lastly, a lone remnant of a species may be found "corralled," as we Westerners say, on a little space of a few acres, as in the newly discovered Brewer Spruce and the rare Bristle-cone Fir.

Certainly those species which are widest dispersed are the stronger; are best qualified to resist encroachments and hold their ground; those of limited range are weaker, their existence depending upon a nice adjustment of the environment, as they are, perhaps, expiring.

DEGREE OF COMPLETENESS.

In the treatment of forest trees in the following pages, the degree of their development (that is, the perfection, more or less, of their reproductive organs primarily) will be the leading thought upon which they will be presented (as they perforce must be presented), in lineal order, though, of course, reference to the "schemes" show that no *lineal order is observed in Nature*, but rather nearly coeval groups in nearly parallel lines.

So the *Pines*, with their fascicled leaves and scaled cones, each a plainly modified and condensed branchlet, is presented first; following are the *Cedars*, with less differentiated fruit organs; then *Larix*, dropping its leaves early; then *Spruce* of many kinds, all with small depending cones; next the *Firs*, with erect cones and deciduous scales, closing the pitch tree tribe of Cone-bearers.

The *Cypresses* and their allies begin with the spiral-coned *Sequoia;* continue with the true Cypresses having cone scales opposite—*opposition* always being an indication of lower development than spiral *alternation*—and closes with the close-fruited *Junipers*, their cones reduced to a berry-like cone, almost devoid of the vestiges of scales. Lastly, the *Yews* close the list of Cone-bearers, their fruit reduced in the true Yew to a shallow, acorn-like cup and its solitary seed, while the Torreya, or False Nutmeg, has a plum-like fruit composed of a single large seed in a closed husk.

ANALOGIES OF THE CONE-BEARERS.

As regards the Cone-bearers of North America and their distribution, we may profit by a consideration of several facts. The species of the eastern slope, fostered by the Atlantic Ocean and the Great Lakes, are, many of them, closely related to certain species of the western slope, fostered by the Pacific Ocean.

Some shrewd observers are convinced that the Atlantic species are what they call the "typical" ones, and the others are merely their western "representatives." Others as reasonably insist that the Pacific species are the typical ones. We have shown that neither one nor the

other is correct; that while families may be divided and their members separated widely, being represented in different, even distant countries, no *species* is "represented" elsewhere. Each is a remnant of a given mass of individuals journeying along the earth, and becoming separated, has been forced into a swamp, driven out onto the plains, or stranded upon a mountain side, just where we find them to-day, by the combined effect of a double migration and its disastrous vicissitudes.

The external, visible facts are that certain species in both regions are so much alike as to indicate recent separation, or the separated portions become subject to similar conditions that cause them to *appear* almost identical.

Scarce an Atlantic species of Conifer is found without a similar species (its analogue) on the Pacific Slope; while others in each region are alone, the greater number of these being in the Northwest.

So the comparison of both species—when there is a pair—will be instructive, and this will be the method pursued in these papers, the Atlantic one, of course, being but briefly described.

ANALOGOUS SPECIES.

Pacific.	*Atlantic.*
Pinus monticola	Pinus strobus.
Pinus ponderosa	Pinus rigida.
Pinus Murrayana	Pinus serotina.
Pinus contorta	Pinus Banksiana.
Pinus Sabiniana	Pinus pungens.
Larix occidentalis	Larix larcina.
Picea Sitchensis	Picea mariana.
Tsuga Mertensiana	Tsuga Canadensis.
Abies grandis	Abies balsamea.
Thuya gigantea	Thuya occidentalis.
Chamæcyparis Lawsoniana	Chamæcyparis sphæroidea.
Juniperus occidentalis	Juniperus Virginiana.
Taxus brevifolia	Taxus Canadensis.

VEGETATIVE AND CARPOLOGICAL CHARACTERS.

The life-history of a plant, for instance of a tree, is a record of two kinds of growth: the first, a building up of framework or scaffolding by means of annual extensions of fibro-vascular or wood bundles and expansions of leaf tissue, until maturity is reached, when suddenly a reverse process is instituted, a condensation of organs and concentration of energies ensues for the production of flower and seed. This process involves two stages of procedure: first, the production of pollen cells and ovule cells, these later, uniting two by two and becoming single seeds, each a plantlet arrested in its development, waiting the time of its entrance upon the stage of activity—the time of sprouting.

The first up-building process is purely vegetable growth, and the characters exhibited thereby are called the vegetative characters, much used for primary distinctions in classification; the second process evolves the pericarp and seed, unitedly called *the fruit*, and its characters may be called the carpological characters (from the Greek *Karpos*, fruit), and these characters are determinative of many distinctions in all the classes, orders, and genera.

These two classes of characters will be much alluded to in the general descriptions. In some groups of plants the vegetative characters will differ most from other groups; in others the carpological are most diverse.

CLASSIFICATION BY FRUIT CHARACTERS.

There being, as shown, a concentration of all energies and strategies for the one purpose—the endowment of seeds with properties or furnishings whereby they may preserve and tide over their contained life-germs—there results an endless variety of appearances, of qualities, etc., in the seeds of plants, implying and proclaiming that after ages of trial and contest, of adaptation and confirmation, a certain *kind* of seed best preserves the integrity of a certain *type* of being.

Over three hundred years ago (1583) the Italian Cæsalpinus enunciated the principle that in the characters of the seed and fruit of plants are to be found the best indices of affinity, the basic principles of classification, though this view was not adopted by following botanists generally until newly presented by Tournefort, nearly two hundred years later, in 1700, and by Jussieu, in 1789.

It follows, then, that characters of the seeds, the spore, the micro-germs of life, being generally uniform throughout the race, are of first importance, and it is corroborative to note that in the latest publications these very terms—seed, spore, and micro-germ—give origin to the names of the three grand divisions of the vegetable kingdom:

1. *Spermophyta*—the seed-bearing plants.
2. *Sporophyta*—the spore-bearing plants.
3. *Protophyta*—first, or germ-bearing plants.

The division of the principal sub-kingdom—the *Spermophyta*—into *Angiospermæ* and *Gymnospermæ*; and the subdivision of the class *Angiospermæ* into *Dicotyledonæ* and *Monocotyledonæ*, proceed also upon the consideration of carpological characters.

FOREIGN TYPES CONSIDERED FIRST.

When a family has representatives distributed well over the earth, the farther ones, for convenience, will be considered first. This order of procedure, connected with that of first considering the strongest species, virtually leads to a description of the common, best known species first; for instance in the treatment of the large families of Spruce and Fir, the Eurasian species are first considered; next, those of Eastern America; lastly, those of the Northwest, beginning with the widest dispersed, and concluding with the extremely local, and perhaps expiring species—the Weeping Spruce, the Bristle-cone Fir, etc.

CLASSIFICATIONS.

General View. (See Scheme I.)

The development of the vegetable kingdom is first presented to the eye in a general scheme designed to show the direction of progress—upward and onward—the relative importance of the various branches, the item of development upon which they divide, and lastly which strains of vigor achieve the highest or best results.

The plant world divides first into three sub-kingdoms, upon the pos-

session or non-possession of sex, and the kind of propagating organs, distinguished as: (1) Germs, microscopic, sexless, first-forms of plants; (2) Spores, simple cells of protoplasm, capable of producing plants sexually; (3) Seeds, usually conspicuous plantlets arrested in their development and mostly encased in two envelopes, often with special endowments to aid in dissemination—as wings, hooks, gums, odors, edible qualities, and the like.

It will be seen that the conspicuous flower and seed-bearing plants lead the grand march with the spore-bearing sub-kingdom next below, while the micro-germs are perhaps lowest and far in the rear—though they may be the fixed condition of higher forms of life continuing to the present epoch.

Neglecting the lower branches we find that the Spermophyta, or seed-bearing plants, divide into two classes upon the possession or non-possession of an ovary, or seed-vessel—the *Angiospermæ* being analogous in this respect to the Mammals in the animal world and the *Gymnospermæ* to the Reptiles.

The *Angiospermæ* separate into two divisions upon the possession of one or two cotyledons, or seed-lobes, etc.

It will be seen by reference to the terminals of each line or impulse of development that the great order of *Leguminosæ*, or pod-bearing plants, leads all others as the crowning effort of vegetable energy, with the allied *Compositæ* not far in the rear on the one hand, and the *Cupuliferæ* (oaks, etc.), on the other, much farther behind.

The Palms are seen leading the *Monocotyledonæ*, flanked by the Lilies, and Grasses, while the Pines lead off in their great class of naked-seeded plants, just as the *Lycopods*, or club-moss tribe—which, though diminutive plants at present, embraced tree-like growths in past ages—lead in their great sub-kingdom of spore-bearers. Below and behind all are the mysterious Protophyta, perhaps statical and continued stages of the forms of primeval vegetable impulse.

The pod-bearers, *Leguminosæ*, are the crowning product of vegetable impulse for many reasons, principal of which are, that in this noble order is carried out to the farthest extent the special development of perfect exalbuminous seeds and special one-celled seed cases. The fruit is a single, terminal, free legume, or pod; the flower is the perfection of amplitude in most particulars, and includes the unique papilonaceous, or butterfly corolla; the leaves are spirally arranged, and accompanied by stipules, or lateral appendages, and they are usually compounded, often to the last degree of differentiation, being subdivided and attenuated often to mere filaments or fleshless nerves; also in many species of pod-plants the leaves are visibly sensitive to the touch, or to light and shade. These considerations, added to the general distribution and persistence of the pod-bearers, royally distinguish the order as the leading, as it is one of the largest families extant.

Similarly, but subordinately, in the great side division of Gamopetalæ stand the immense order of *Compositæ*, with its carpological characters highly developed indeed, each seed being especially invested with a pericarp, or overcoat, and surmounted by its own floret, yet suffering the degradation of having its originally elongated spike of axillary flowers condensed to a head, or even to a flat disk; also to having one of its floral envelopes—the calyx—reduced to mere pappus, or, as often happens, to be wanting altogether.

The corresponding side division, the APETALÆ, are led by the important trees and shrubs of the anemophilous, or wind-fertilized orders, including the *Cupuliferæ*, or cup-bearing trees, chief of which is the Oak family, this being the most conspicuous arboreous vegetation of the *Angiospermæ*, or seed-vessel-bearing plants.

Class 2. GYMNOSPERMÆ. (See Scheme II.)

NAKED—SEEDED PLANTS.

These are trees and shrubs with wood composed mainly of disk-bearing tissue without proper vessels, flowers always diclinous (*i. e.*, never perfect), but the two sexes separated upon different plants (diœcious), or upon different branchlets of the same plant (monœcious), the ovules straight, either erect or inverted and borne upon flat scales, or in a more or less open perianth. They are fertilized by the direct action of the pollen upon the nucleus, the GYMNOSPERMÆ being thus the analogue of the REPTILIA in the animal kingdom. They are widely distributed, chiefly in the northern hemisphere, and divide into three orders:

2. *Gnetaceæ*—Joint stems.
1. *Coniferæ*—Cone-bearers.
3. *Cycadaceæ*—Palm-like plants.

The highest developed, the leading order of the GYMNOSPERMÆ, as shown, is the paramountly important one of the *Coniferæ*, or Cone-bearers, and properly that order should be analyzed, and its ramifications briefly presented in this place, but as the Cone-bearers comprise the most of the trees of our California forests, we shall have to elaborate the order in detail later on; so for the sake of avoiding repetition we will omit them now, and proceed briefly with the two other flanking and closely related orders.

Order 2. GNETACEÆ.

JOINT—STEM AND ALLIES.

These joint-stemmed plants are found in the hot interiors of both continents. They are comprised in two small tribes, one with but two genera, the other with but a monotypic genus of a most peculiar character.

Tribe 1. GNETINEÆ.

EPHEDRA AND ITS ALLIES.

The genus *Ephedra* is the only one represented on this slope, and is of peculiar interest on account of the medicinal value of all its species.

They are rush-like shrubs, of only three to six feet in height, with yellowish, staminate flowers, in great profusion on a part of the bushes, and little elongated greenish cones upon the others.

The two species of this coast are *Ephedra Californca* and *E. Nevadensis*. The first species is abundant on the plains of San Diego, the other, as its name implies, is found in Nevada, reaching to the foothills of the Sierra Nevada Mountains, and following the arms of the Great Basin, wherever they extend into the California mountains.

Tribe 2. WELWITCHIEÆ.

Welwitchia, the only genus of the second tribe, is represented by a single species, so far discovered—*W. mirabilis*, a truly wonderful plant of South Africa. The stem is short, scarcely rising above the ground, though quite thick, with a broad furrow across the top; the roots are tuberous and very large; the leaves are two only (apparently the original cotyledons), and of immense size, six to seven feet long, by half as wide, thick, strong, leathery, and are spread out flat upon the ground, or divided into strips by the driving winds, in age.

NOTE.—This most curious plant, so unlike a Sierra "Big Tree," with which, however, it is distantly related, is a recent discovery, and though transplanted to the botanical gardens of Europe, is not yet fully understood. Other species may be expected to be revealed by the Stanley discoveries in the arid interior of the dark continent.

Order 3. CYCADACEÆ.

PALM—LIKE PLANTS.

The other side branch of naked-seeded plants form the order *Cycadaceæ*.

These peculiar plants resemble Palms in their thick, short stems, and their large, spreading, spirally disposed leaves. All of them have two kinds of leaves, in alternate sets, one of dry, brown, leathery scales, the other conspicuous, stalked, pinnate leaves, most of these being circinate in vernation, like the fronds of ferns, *i. e.*, unfolding from base to tip, like a crosier.

The male and female flowers are borne on separate plants, and a peculiarity of the male flower is seen in the stamens, which are the largest known, being often one to one and one half feet long. Also, they do not die and fall away soon, but persist for years, and become hardened to woody rods or clubs.

None of these plants are native north of Mexico. Several, notably *Cycas revoluta*, are highly prized plants of greenhouse cultivation.

Order 1. CONIFERÆ. (See Scheme III.)

THE CONE—BEARERS.

The Cone-bearers are resinous, mostly evergreen trees and shrubs, widely distributed, mostly in cool regions of the northern hemisphere. The leaves are either needle-shaped or scale-like; the flowers are *diclinous* (*i. e.*, of two sorts, male, or pollen-bearing, and female, or fruit-bearing); these separated and borne upon the same trees (*monœcious*), or upon different trees (*diœcious*). The male flowers are reduced to stamens only, usually spike-like; the female flowers (aments), a much modified branchlet of leaves having the form of scales or bracts, or they are more or less consolidated, becoming a dry cone or bur, or drupe-like; the seeds in a bony, crustaceous, or papery shell, and naked or winged; embryo straight in an oily albumen; cotyledons often several in a whorl.

The Cone-bearers comprise three sub-orders:

2. *Cupressaceæ*—Cypresses and their allies.
1. *Pinaceæ*—Pines and their allies.
3. *Taxaceæ*—Yews and their allies.

The first and second tribes of CONIFERÆ—*Pinaceæ* and *Cupressaceæ*—must be fully elaborated farther on, so they may be omitted for the present, but the order of their treatment should be mentioned as stated.

Sub-Order 3. TAXACEÆ.

YEWS AND THEIR ALLIES.

The *Taxaceæ* are evergreen, slightly resinous trees and shrubs, with scattered leaves; flowers diœcious, axillary, and solitary, with a single envelope, and naked or surrounded by opposed, over-lapping scales; male flowers, a column of stamens, each filament surmounted by several adnate, pendent, anther-cells; pollen, globose; female flower of a solitary straight ovule, which in fruit becomes a bony-coated seed, surrounded by a fleshy disk or cup or other coating. Embryo in fleshy or flour-like albumen, cotyledons only two, nearly terete.

They are widely distributed, mostly in foreign countries, and are embraced in four sub-tribes of thirteen species. Only one tribe of two genera is represented in America. *Torreya*, the noted genus commemorating Dr. John Torrey, comprises only three species—one in Japan, one in Florida, and the third sparsely found on both the Coast and Sierra Mountains of California, notably in the Yosemite Valley.

The other genus, *Taxus*, the true Yew, has a species in the Eastern States, and a second species—*Taxus brevifolia*—sparsely distributed from southern Alaska along the mountain streams to Southern California.

Sub-Order 1. PINACEÆ. (See Scheme IV.)

PINES AND THEIR ALLIES.

We will now take up the neglected sub-orders of *Coniferæ*, to wit: the *Pinaceæ* and *Cupressaceæ*, to elaborate them briefly, giving the tribes, sub-tribes, and genera.

This sub-order comprises the greater part of the resinous trees of temperate climates. Fruit conical or globose, of woody or leathery scales spirally arranged and imbricated or over-lapping upon an elongated axis. Ovules, one to seven under each scale, inverted, becoming mostly winged seeds. Comprises three tribes:

2. *Araucarieæ*—Austral Pitch Trees.
1. *Abietineæ*—True Pitch Trees.
3. *Cunninghamiæ*—Oriental Pitch Trees.

Tribe I. ABIETINEÆ. (See Scheme V.)

TRUE PITCH TREES.

The very resinous or distinctively pitch-bearing trees are always found in northern or elevated regions, as elsewhere stated, and the head-quarters of best development on the western continent is the peculiarly favored northwest coast of the United States and British America.

Here, scattered along the many ranges of mountains, and often filling the plains and valleys, creeping close to the line of perpetual snow, either on the alpine peaks or along the edge of the frozen tundras of the Arctic regions, the numerous species are found, different species requiring, or mayhap, submitting to different degrees of temperature or conditions of environment.

They divide into two sub-tribes upon vegetative characters, to wit: the possession or non-possession of secondary, conspicuous leaves in fascicles.

Sub-Tribe 1. FASCICULARES.

Trees of this sub-tribe have their secondary leaves conspicuous, and in fascicles or bundles. They include three undoubted genera:

2. *Cedrus*—True Cedar, with fruit erect.
1. *Pinus*—True Pine; fruit diverse.
3. *Larix*—Larch and False Larch; leaves deciduous.

Sub-Tribe 2. SOLITARES.

This sub-tribe have all the leaves small, solitary, and scattered. They comprise two groups formerly considered as types of two genera; lately, the first of them divided into three genera.

These last, for purposes of classification, may receive the name *Penderes* (Lat. *pendeo*, to hang), alluding to the pendent cones.

1. *Penderes*—Cones dependent, scales persistent. Spruce.
2. *Abies*—Cones erect, scales deciduous. True Fir.

RELATION OF THE ABIETINEÆ OR PITCH TREES TO EACH OTHER.

The degree of development to which the several genera have attained is indicated by Scheme V, the Pines with their sheathed leaves and greatly diversified fruit, leading all; the Hemlock Spruces with their fine, fern-like sprays of foliage, last and in the rear.

They all agree in having similar fruit, a woody or leathery cone or bur of imbricated or over-lapping scales arranged on an elongated axis, each scale bearing two inverted ovules becoming the seeds, which are usually long-winged.

They agree also in the vegetative characters of conspicuous acicular or needle-shaped, mostly persistent leaves—the principal exception being the Larch with deciduous leaves—but this has similar male flowers.

GENERA AND GROUPS OF THE ABIETINEÆ.

The advanced and most conspicuous of them all—the Pines—are very numerous, widely distributed over northern temperate regions, often divided into two sub-genera:

1. *Pinaster*—Cones armed with spines or prickles.
2. *Strobus*—Cones smooth, devoid of spines.

The nearest tree to the Pines in certain characters is *Cedrus*, the historical Cedar, dividing into two forms:

1. *Deciduæ*—Cone scales deciduous.
2. *Permanens*—Cone scales persistent.

The Larches differ from the other trees of the great tribe of ABIETINEÆ in having deciduous leaves. There are two genera:

1. *Pseudo-larix*—Cones pendent. False Larch.
2. *Larix*—Cones erect. True Larch.

The most advanced group of the solitary-leaved genera, which is conveniently named PENDERES, divides into four genera:

3. *Tsuga*—Seeds resin-bearing.
    1. *Picea*—Leaves quadrangular.
    2. *Hesperopeuce*—Cone scales becoming reflexed.
4. *Pseudo-tsuga*—Cone bracts exserted.

The remaining genus of the tribe of Pitch Trees is the noble genus of True Fir (*Abies*), dividing upon important characters into two groups:

Group 1. MEGACARPÆ—Cones large, bark red within.
Group 2. MICROCARPÆ—Cones smaller, bark white within.

Tribe II. ARAUCARIEÆ. (See Scheme IV.)

AUSTRAL PITCH TREES.

These trees of Australasia and the southern part of South America are usually large and very symmetrical plants of low development, but often of great size and usefulness. Plants diœcious.

They divide into two sections:

Section 1. *Dammaræ*—Wax Pines.
Section 2. *Araucariæ*—Araucarias.

The Wax Pines comprise two sorts, one with leaves alternate and scattered, the other with leaves opposite, all of the East Indies, and extensively cultivated.

The Araucarias comprise two distinct sections:

Section 1. *Eutacta*, or False Araucarias.—All large trees of Australia with small terminal, globular cones, and subulate or awl-shaped leaves.

This section includes our commonly cultivated and exquisitely beautiful Norfolk Island Pines, matchless in the symmetry of their branches, in regular whorls, and in their broad sprays of foliage and the profusion of their long, finger-like twigs, bristling with the green, awl-shaped leaves.

Section 2. *Columbea*, or True Araucarias.—All very large trees in their native homes, with very large, oblate, close-scaled cones. Leaves scale-like, or stalked.

The name Araucaria is derived from that of a tribe of natives inhabiting the mountains of Chili, where the *Araucaria imbricata* (common in cultivation and known as "Monkey Puzzle") grows abundantly, bearing cones six to eight inches long, producing two to three hundred seeds, each an inch or an inch and a half long, very nutritious and affording the inhabitants a never failing supply of food.

Tribe III. CUNNINGHAMIEÆ. (See Scheme IV.)

ORIENTAL PITCH TREES.

This tribe comprises three genera of the East Indies, Japan, and the near continental region of China. Principal of these trees in cultiva-

tion are the "Parasol Pine," with its long and large leaves in whorls or tufts on the ends of the branches, and the so called "Joint-stem Yew," with its curious stems ringed as if jointed, and the little, often artificially dwarfed, pot-plants from China and Japan—the *Cunninghamia*.

Sub-Order 2. CUPRESSACEÆ. (See Scheme VI.)

CYPRESSES AND THEIR ALLIES.

These important trees are widely distributed, and include some of the largest trees known, and they were particularly abundant in former ages of the earth. The leaf and fruit characters (opposed scales, etc.) are not so far advanced as in the central branch of the Cone-bearers, being more or less consolidated. Leaves opposite or ternate, usually scale-like.

They divide into three tribes:

2. *Cupressineæ*—Cone-scales verticillate, or opposite.
    1. *Taxodineæ*—Scales spiral and peltate.
3. *Juniperineæ*—Fruit berry-like, with vestiges of scales.

Tribe 1. TAXODINEÆ.

Taxodineæ, the leading tribe, have cones with the scales spirally arranged, and ob-pyramidal, terminating in rounded bosses, or flat, shield-like heads.

They divide into two groups:

Group 1. TAXODIEÆ—Cone-axis elongated, comprising two genera; one on the Pacific Slope, the other in the Eastern States.
Group 2. GLYPTOSTROBI—Cone-axis depressed, comprising two genera; neither of them found on the Pacific Slope.

The TAXODIEÆ include the two genera:

1. *Sequoia*—Redwood, Big Tree.
2. *Taxodium*—Eastern Bald Cypress.

Tribe 2. CUPRESSINEÆ.

This tribe comprises a large number of groups and genera, most of which are not found in North America.

Four important genera are indigenous to this country, and all found in the great Northwest forests. We will only deal with these. They are embraced in two groups:

Group 1. ARBOR-VITÆ—Fruit elongated, with the scales valvate.
Includes two important genera:

1. *Thuya*—American Cedar, or Arbor-vitæ.
2. *Libocedrus*—Incense, or Post Cedar.

Group 2. CUPRESSI—Fruit globose, with ob-pyramidal, peltate scales.
Includes two large genera:

1. *Chamæcyparis*—Ground Cypress.
2. *Cupressus*—True Cypress.

Tribe 3. JUNIPERINEÆ.

This, the last tribe of cypress-like trees, the Juniper, is peculiar in having consolidated fruit and a wide range of habitat, from sea level to alpine heights. They are divided by some authors into two, and by others into three sub-genera, upon slight differences of the fruit, and upon the arrangement of their small, scale-like leaves.

1. *Juniperus vera*—True Juniper.
2. *Sabina*—Savin Juniper.

Of the true Junipers, with leaves ternate and pungent, there are two species in California.

Of the Savin Junipers, with leaves opposite and scale-like, there are two, or perhaps three, in California.

CLASSIFIED LIST OF CONE-BEARERS.

Described by J. G. Lemmon in this (Third) Biennial Report of the California State Board of Forestry.

Tribe 1. ABIETINEÆ. Pitch Trees.

(Twenty-nine species. Eleven in California.)

Pinus—True Pine.

(Eighteen species in California; described in previous report.)

Cedrus—True Cedar.

C. Deodara, Loudon .... "Tree of God," Indian Cedar.
C. Libani, Barrelier .... Cedar of Lebanon.

Larix—Larch, or Tamarack.

L. Europeæ, De Candolle .... European Larch.
L. larcina, Koch .... American Larch.
L. occidentalis, Nuttall .... Western Larch.
L. Lyallii, Parlatore .... Lyall's, or Woolly Larch.

Picea—True Spruce.

P. excelsa, Link .... Norway Spruce.
P. laxa, Sargent .... White Spruce.
P. Mariana, Miller .... Black Spruce.
P. Engelmanni, Engelmann .... Engelmann's Spruce.
P. pungens, Engelmann .... Prickly, or Blue Spruce.
P. Sitchensis, Carrière .... Tide-land Spruce.
P. Breweriana, S. Watson .... Brewer's, or Weeping Spruce.

Tsuga—Hemlock Spruce.

T. Canadensis, Carrière .... Canadian Hemlock.
T. Caroliniana, Engelmann .... Carolinian Hemlock.
T. Mertensiana, Carrière .... Western Hemlock.

Hesperopeuce—Western Spruce.

H. Pattoniana, Lemmon .... Alpine Western Spruce.

Pseudotsuga—False Spruce.

P. taxifolia, Britton .... Douglas Spruce.
P. macrocarpa, Lemmon .... Big-coue Spruce.

Abies—True Fir, or Silver Fir.

A. taxifolia, Desfontaine .... European Silver Fir.
A. balsamifera, Michaux .... Atlantic Silver Fir.
A. religiosa, Lindley .... Mexican Sacred Fir.

A. amabilis, Forbes .... Lovely, or Oregon Red Fir.
A. nobilis, Lindley .... Noble, or Bracted Red Fir.
A. magnifica, Murray .... Magnificent, or California Red Fir.
A. grandis, Lindley .... Grand, or Oregon White Fir.
A. Lowiana, Murray .... Low's, or California White Fir.
A. Concolor, Lindley .... Colorado White Fir.
A. venusta, Sargent .... Bristle-cone Fir.
A. lasiocarpa, Nuttall .... Downy, or Sub-Alpine Fir.

Tribe 2. CUPRESSACEÆ. Cypresses and their allies.

(Sixteen species. Eleven in California.)

Sub-Tribe A. TAXODINEÆ.

Sequoia—Redwood.

S. sempervirens, Endlicher .... Coast Redwood.
S. gigantea, Decaisne .... Big Tree, or Giant Sequoia.

Sub-Tribe B. CUPRESSEÆ.

Thuya—American Cedar.

T. occidentalis, Linnæus .... Atlantic White Cedar.
T. gigantea, Nuttall .... Gigantic Red Cedar.

Libocedrus—Incense Cedar.

L. decurrens, Torrey .... California Post Cedar.

Chamæcyparis—Ground Cypress.

C. sphæroidea, Spach .... Swamp Cypress.
C. Nutkaensis, Spach .... Sitka Cypress.
C. Lawsoniana, Parlatore .... Lawson's Cypress.

Cupressus—True Cypress.

C. Arizonica, Greene .... Arizona Red Bark Cypress.
C. macrocarpa, Hartweg .... Monterey Cypress.
C. Goveniana, Gordon .... North Coast Cypress.
C. Macnabiana, Murray .... Shasta Cypress.

Sub-Tribe C. JUNIPERINÆ.

Juniperus—Juniper.

J. pachyphlœa, Torrey .... Thick-bark Juniper.
J. Utahensis, Lemmon .... Great Basin Juniper.
J. occidentalis, Hooker .... Western Juniper.
J. Californica, Carrière .... California Juniper.
J. communis, Linn, var. *alpina*, Engel. .... Creeping or Alpine Juniper.

Sub-Order. TAXACEÆ. Yews and their allies.

(Six species. Two in California.)

Torreya—False Nutmeg.

T. taxifolia, Arnott .... Florida Nutmeg.
T. Californica, Torrey .... California Nutmeg.

Taxus—True Yew.

T. baccata, Linnæus .... Common European Yew.
T. Canadensis, Willdenow .... Canadian Yew.
T. Floridana, Nuttall .... Florida Yew.
T. brevifolia, Nuttall .... Western Yew.

DISTRIBUTION OF CONE-BEARERS.

The table includes only those genera represented by species in North America north of Mexico.

Genera.	No. of Species in—			
	Whole World.	North America.	Pacific Slope.	California.
Abietineæ. *True Pitch Trees.*				
1. Pinus—True Pine	77	35	24	18
2. Larix—Larch, or Tamarack	8	3	2	-------
3. Picea—True, or Typical Spruce	11	6	5	2
4. Tsuga—Hemlock Spruce	7	4	2	2
5. Pseudotsuga—False Spruce	2	2	2	2
6. Hesperopeuce—Western Spruce	1	1	1	1
7. Abies—True Fir	25	12	9	7
Cupressaceæ. *Cypresses and their Allies.*				
1. Sequoia—Redwood, Big Tree	2	2	2	2
2. Thuya—Red Cedar	6	2	1	1
3. Libocedrus—Incense Cedar	4	1	1	1
4. Chamæcyparis—Ground Cypress	2	2	2	1
5. Cupressus—True Cypress	14	8	4	3
6. Juniperus—Juniper	25	8	6	4
Taxaceæ. *Yews and their Allies.*				
1. Torreya—False Nutmeg	4	2	1	1
2. Taxus—True Yew	7	3	1	1
Total number of species	195	91	63	46

PART II.—DESCRIPTION OF GENERA AND SPECIES.

PINUS, Tournefort.

TRUE PINE.

The True Pines are found in northern and elevated regions of North America, Europe, and Asia, with one species in northern Africa.

They are usually readily distinguished as resin-producing, cone-bearing, evergreen trees; the principal foliage consisting of secondary, conspicuous leaves, which are needle-shaped, usually rigid, produced in fascicles or bundles of two to five (one species with solitary leaves) from the axils of linear, scale-like, primary leaves, and surrounded at base by a sheath of membranous scales—these secondary, conspicuous leaves, being compressed into fascicles, are either semi-terete, or triangular, according to the number of leaves in a fascicle.

True Pines are *monœcious* (*i. e.*, the flowers are on the same tree but separated), the male or pollen-bearing flowers on one branchlet and the female or fruit-bearing flowers on another. The fruit becoming a bur or cone, is either sub-terminal (*i. e.*, produced near the terminal leaf-bud) or lateral (*i. e.*, among the leaves along the growing shoot of the season). The cone is composed of numerous spirally over-lapping, woody scales, each bearing upon the free exposed surface a terminal or dorsal protuberance, which is either unarmed or else is furnished with a prickle, spine, or strong hook.

The cone-bracts, arrested in their development, and concealed at maturity by the scales, become thickened and corky, and they assist in forming cavities for the two inverted ovules becoming the seeds. The seeds are invested by a leathery or bony testa or shell, which is usually surrounded by the rim-like base of the wing. Cotyledons normally five to fifteen, in a whorl or verticil.

The male flowers are oblong or cylindrical columns of peculiar stamens, with double anthers opening longitudinally. Pollen abundant, bilobed, carried on the wind by two air sacs.

The fruit of the Pine requires two years to complete its growth (one European and one American species require three years).

The word "pine" is by some writers asserted to be derived from the Greek "*pion*," meaning fat, from the abundance of pitch or resin with which the family abounds; others declare that the word is derived from the word "pin," in allusion to its needle-like leaves, while still others trace its origin from the Celtic "pen," a rock or mountain, in allusion to the localities where the Pine is principally found.

The Pines compose the largest genus of the *Coniferæ*, or Cone-bearers, and comprise seventy-seven species; most of them are very valuable, of surpassing use to man.

The discussion of the species of the Pine family, especially of those inhabiting the Pacific Slope, was taken up in the Second Biennial Report of the California State Board of Forestry, to which the reader is referred.

CEDRUS, Tournefort.

TRUE CEDAR—NOTED TREES OF HISTORY AND SENTIMENT.

The True Cedars constitute a small but celebrated genus of trees comprised in three species. One of them is found sparsely growing upon Mount Lebanon, of Palestine; another is abundant upon the Himalaya Mountains, and the third species upon the Atlas Mountains of northern Africa.

The Cedars are so often seen in cultivation, and are so renowned in history, poetry, and prophecy, that their discussion is always full of interest.

1. CEDRUS LIBANI, Barrelier.

CEDAR OF LEBANON.

Palestine being the home of modern religious thought, and the Cedar of Lebanon being the most conspicuous tree of all the region, its characters of long, spreading limbs waving and beckoning in the winds upon the lofty heights of the sacred mountain, naturally afforded many a simile and image to poet and patriarch.

Lamartine, who visited the Cedars of Lebanon in 1838, wrote of them: "These trees are the most celebrated natural wonders in the world."

The ancients thought they grew nowhere else than upon Mount Lebanon, above all other vegetation—thus being peculiarly set apart—a belief which powerfully affected their religious ideas and at once excited veneration.

The Arabs, of all sects, to this day attribute to these trees not only vegetative force which enables them to live forever, but also a soul having the power to express consciousness and feeling similar to animals, and approaching the intelligence of man; in fact, in the Arab mind they are divine beings in the form of trees.

Solomon desired to use some of this Cedar in the construction of interior parts of his temples, so Hiram, King of Tyre, history states, destroyed his forest to oblige him.

The original forests on the Lebanon Mountains, the only trees known to the ancients, were once quite extensive, but this sacred grove was always small and the number is steadily decreasing. In 1550 there were thirty, in 1600 but twenty-four were left. In 1650 the number was reduced to twenty-two, and fifty years thereafter (1700) there remained but seven of the majestic, long-armed relics of past centuries.

The largest of these was thirty feet in diameter. None are remarkable for height, but rather for their large and long limbs. If planted in forests they might become lofty, but here alone on the plateau of Lebanon, they give point to the Hebrew poet's simile: "They shall spread out their branches like the Cedar."

The Maronite Christians inhabiting Lebanon are scarcely less pronounced in their regard for this tree than the Moslem Arabs, for annually the Patriarch of that sect, attended by scores of bishops, priests, monks, and five or six thousand of devotees, ascend to the Cedar grove and there celebrate in their shade the "Feast of the Transfiguration," and ecclesiastical censures are denounced against those who shall injure these consecrated trees in any manner.

These seven old trees are, to-day, the only living witnesses of biblical events. "What prayers have ascended from beneath them," writes the historian, "and where is there on earth a more beautiful temple than this one so near Heaven itself?" "What dias more appropriate than this upper plateau of Lebanon upon which so many generations of different nations, tongues, and creeds have worshiped the same God."

In a delightful article published in the "Pacific Rural Press," by Mrs. Jeannie C. Carr, of Pasadena, Cal., she states:

"The oldest Cedar of Lebanon in Europe is growing in the *Jardin de Plantes*, in Paris, where it was planted by the elder De Candolle, who brought it from Palestine over a century ago. It is related that the vessel in which he crossed the Mediterranean was unseaworthy, and during the prolonged voyage the sailors and passengers suffered greatly from the scarcity of water, but De Candolle resolutely denied himself, and gave his scanty portion to the little tree, which, thus saved from perishing, has become the living monument of the great botanist."

The oldest Cedar of Lebanon in America is in Philadelphia, raised from seed planted by the veteran American botanist, Bartram, in his now famous garden.

Until 1770, when Pallas discovered a grove of trees of this species in the north of Russia, the *Cedrus Libani* was supposed to be confined to the single consecrated grove mentioned. Recently other groves in the vicinity of the first one have been detected.

Dr. George E. Post, of the Syrian College, at Beirut, in 1887 made a careful botanical exploration of Syria and Palestine. From a copy of his report to the Victoria Institute in 1888, kindly sent me by Dr. Maxwell T. Masters, editor of the "Gardener's Chronicle," I am enabled to give the latest information concerning these preëminently historic and interesting trees.

"Lebanon and Anti-Lebanon were once heavily timbered," he writes. The many allusions in Scripture indicate that at least at the time of Joshua, Lebanon was a forest-clothed range. Of its Cedar forests only a few groves remain. They are as follows: The northernmost thus far noted is that of Besherri, the famous "Cedars of the Lord," with about four hundred and fifty trees. A few miles south are the forests of the Maronite Patriarch at "El Hadeth." Farther south are groves at four other stations, and, all told, they comprise a not inconsiderable forest development, not at all liable to soon become extinct.

From another explorer, H. Christ, in "Garden and Forest," for May 1, 1890, we learn that the headquarters of the Cedar of Lebanon are upon the lofty range of Cilicia, to the northward, and that the station on Mount Lebanon is the most southern locality known for the species. Also, that the "Cedar" used by Solomon in building his temple, and subsequently by Ezra in rebuilding it, could not have been the True Cedar at all, but was doubtless a Cypress—the *Cupressus sempervirens*—this tree being still found abundant in the valleys of Palestine. This tree furnishes a resinous, fragrant, hard, and durable timber of a beautiful brown color—all eminently qualifying it for building purposes, while that of the True Cedar of Lebanon is whitish, soft, and not durable—all very poor qualities for the uses ascribed to the Cedar of history.

2. Cedrus Deodara, Loudon.

DEODAR CEDAR ("TREE OF GOD").

This tree is a still more renowned and historical one, if possible, than the Cedar of Lebanon; and, because it is greatly prized and is often met with in our lawns and parks, it should be briefly sketched. The Deodar Cedar grows abundantly at high elevations upon several mountain ranges of Upper India, particularly forming dense forests on the high southern slopes of the great Himalaya Range, where they receive an annual rainfall of one hundred and twenty inches, and assume magnificent proportions.

The mountain-inhabiting Hindoos, during ages for which chronology has no complete record, have been known to venerate and protect these trees with religious care, their name for the tree, "Deva-daru," meaning Tree of God.

The Deodar Cedar becomes a large tree of twenty to thirty feet in circuit, with few long, spreading limbs; the cone is much larger than that of the other species—some four or five inches in length, and half as thick; the leaves are whitish—"silvery," as it is called—instead of dark green, as in the other species.

A third species, but little known, is on the Atlas Mountains of Algeria, in Africa, and is a small tree, with small cones and short, silvery leaves.

From a critical study of the Cedar by Sir Joseph Hooker, he concludes that the three so called species are but varieties of one species, differing mainly in the dimensions. rather than essential characters, but so radical a conclusion as that, in face of the fact that these forms are widely separated from each other on distant mountain ranges, would reduce a host of our botanical names to synonyms and introduce great confusion into our nomenclature, besides ignoring one of the principal factors in the production of species, to wit: the separation of forms of a common original type by the disturbances in Pliocene times (as described), and their subsequent divergence under the pressure of environment, compelling more or less of modification in the course of vast ages of development.

The two forms or species of True Cedar—*Cedrus Libani* and *C. Deodara*—are largely cultivated in California, and may be distinguished by the following characters:

The Cedar of Lebanon has very dense, grass-green leaves in alternate tufts or fascicles of about thirty leaves each; they are rigid, partially quadrangular, acute, pointed, about an inch long. Branchlets are disposed in a flat, fan-like manner on the long, weeping limbs.

The Great India Cedar, or "Tree of God," has very glaucous, slender, longer leaves, one to two inches long; those on the principal branchlets collected into fascicles of thirty to sixty each; those upon young shoots, solitary and alternate.

The leaves of both species, when they fall away, leave a stout, persistent leaf-base on the branchlet similar to this character of the Spruce and Hemlock families.

LARIX, Tournefort.

LARCH OR TAMARACK—RARE TREES OF EXCEEDING DURABILITY.

Beautiful and useful as is the Larch tree, it has no prominent place in history, neither poets nor historians having much to say about it. This may be owing to its deciduous foliage, the ancients being enthusiastic in praise of the evergreen inhabitants of their mountain heights.

Also, the importance of the durable Larch wood in naval architecture is a modern discovery, as well as the value of its bark in tanning.

Lastly, the Larch has obtained wide appreciation as an ornamental tree, being particularly acceptable where shade is not desirable in winter; but it has been principally prized in all ages for its imperishable timber.

3. Larix Europæa, De Candolle.

EUROPEAN LARCH.

The native home of the Common Larch of Europe is the two distinct ranges of the Alps and the Apennines, but it is not found on the Pyrenees or the other western ranges. It thrives in higher regions than any other tree, often hanging over rocks and precipices which have never been trodden by human foot.

In favorable situations the trees arrive at maturity and excellence of timber in forty years—much less time than most timber trees. Its durability is most remarkable and without parallel, either when exposed to water, to underground conditions, or in the atmosphere.

It is well known that the log cottages of the peasantry in Switzerland endure for centuries without change. The timber is invaluable for shingles, weather boarding, props, and fence posts. For vine supports the Larch wood is much used, the props and trellises remaining as first constructed for an indefinite period—generations of vines succeeding each other with no visible decay of their support.

In most cases the propriètors of vineyards are ignorant of the epoch when their vine props were first planted; they received them from their fathers, and in the same state they will transmit them to posterity.

Supports made of Pine, Spruce, or Fir for the same purposes would not endure more than ten or twelve years.

The endurance of the Larch wood is due to its resinous character. A cubic foot weighs seventy pounds when green and thirty-six pounds when dry.

The Venice turpentine of commerce is derived from the Larch, and a full grown tree yields annually seven or eight pounds for forty or fifty years in succession.

The bark of the Larch is highly prized for its tannin, and is equal to that of the Birch so much used in northern Europe, particularly Scandinavia and Russia. The fine grain of the Larch wood fits it for being made into panels for painting, and several of the prized relics by the old masters are painted on prepared Larch.

4. Larix Larcina (Koch.), Americana (Michx.).

AMERICAN LARCH OR TAMARACK.

The American Larch, under many local names for its marked varieties, is distributed well over the northern part of the Eastern States and provinces, extending to within the Arctic Circle near the mouth of the Mackenzie River. Unlike its European relative, and also unlike its western congeners (next to be described), the American Larch does not affect rocky, alpine heights, but rather loves the wet swamps of low lands and mountain intervale. Around Hudson's Bay it occupies the broad open plains in its best estate.

One variety, *microcarpa*, the Red Larch, has small red or violet cones only half an inch long. Variety *pendula*, inhabiting the coldest and gloomiest exposures of the Alleghany Mountains, is distinguished by having few, remote, long, slender, pendulous branches with cones three fourths of an inch long, easily detached from the branchlets; the cones of most other Larches are remarkable for their persistence for an indefinite period.

The bark is smooth, and polished on the trunk and large limbs, but rough on the smaller branches and twigs.

The male flowers appear before the leaves, and are small, oblong clusters of yellow flowers.

The wood of the American Larch is superior to any species of the other Pitch Trees, being exceedingly strong and durable. In Canada East it is much esteemed for building timber, and in the maritime regions it is much in demand for ship knees and other articles where strength and durability are desired.

PACIFIC LARCHES.

There are two species of *Larix* inhabiting the great Northwest forests, both in cross-ranges connecting the Rocky Mountains with the Cascade Mountains of the Sound region, but neither of them are certainly known to reach the boundary of California; though one of the species has lately been detected in the Coast Ranges of Oregon within two hundred miles of the boundary of California, and may well be suspected of occupying secluded stations in the Siskiyou and Trinity Mountains.

5. Larix occidentalis, Nuttall. The Great Western Larch or Tamarack.

This splendid, symmetrical tree, attaining one hundred and twenty to one hundred and fifty feet with the form of a perfect pyramid, is quite widely distributed along the mountains of the Northwest, from the western slopes of the Rocky Mountains to the Selkirk and Gold Ranges of British Columbia and the eastern slopes of the Oregon Cascades. It is scattered among other trees at elevations of two thousand five hundred to five thousand feet.

The trunks are tall and straight, the lower branches being nearly horizontal, or slightly declining, the upper more or less ascending; the young shoots blackish, and terminating in numerous globular, blackish buds.

Cones solitary, erect, ovate-globose, three fourths of an inch long, orbicular, loosely imbricated, sub-cartilaginous, convex, and shining on the back, reflexed and entire on the margins; the bracts elliptic, acutely

pointed, and long exserted beyond the scales, giving the cones a decidedly bristly appearance.

The seeds are white, with short, pale wings.

Citizens of the Eastern States, who visit the Northwest, are surprised to find Tamarack trees occupying dry, exposed ridges on mountain sides, instead of in the low swamps that the eastern species affect, and still more to find the timber of the western species so valuable and popular for all purposes of building, such as the manufacture of bridges, railroad ties, fence posts, and all other uses where durability is desired.

A peculiarity of the tree is the thick, coarse bark that has the protective merit of long resisting the action of forest fires.

Recently surveyors for the California and Oregon Railway discovered a grove of Tamarack trees on the upper waters of Luckiamute River, one of the small western branches of the Willamette River, and near the summit of the low range of coast mountains southwest of Dallas, Oregon.

Little could be learned of the trees except that they were tall, straight, and seemed suitable for purposes of bridge building, railroad ties, and perhaps for general lumber. Examination is desirable to determine whether or not this is a distinct species, but the probabilities are that it is an outlying form of *Larix occidentalis*, the Great Western Larch, described.

6. Larix Lyallii, Parlatore. Lyall's Larch, or the Woolly Larch.

This is a remarkable species of Larch, being a low, much branched, straggling tree on alpine situations of six thousand to seven thousand feet altitude; sparsely found on the northern Cascade Mountains and in the central Rocky Mountains, generally upon northern exposures mingled with other conifers, especially the Bristle-Cone and the White-Bark Pines and the Alpine Western Spruce.

The leaves on young shoots are solitary, scattered, about an inch long; the secondary leaves on the ends of very short branchlets are in fascicles, or bundles of forty to fifty leaves, soft, short, about three fourths of an inch long. Branches nearly horizontal with the young shoots, and the buds densely clothed with whitish, cobwebby wool.

The cones are apple-green or purple, and very large—the largest known of its genus—two to two and one half inches long, and one inch in thickness; oblong, with depressed not attenuated apex; scales numerous, loosely overlapping, cartilaginous, nearly orbicular, convex on the back, the thin margins ciliated or fringed with long white hairs; bracts elliptic, wavy-edged, and with the middle nerve prolonged into an awl-shaped point longer than the scale; seeds, small with large wings.

Unlike other species of Larch, the cones are promptly deciduous, reminding one of characters of the Fir family with which the Larches are often associated in classification.

The alpine habit, the peculiar color and large size and deciduous character of the cones, and the woolly branchlets and bud scales, mark this Larch as the most curious and striking of all the species known.

PENDERES, Lemmon.

THE SPRUCES—PENDENT FRUITED TREES.

Under the term *Penderes* (Lat. *pendeo*, to hang), alluding to the pendent cones, I have placed, for convenience of discussion, the pitch trees that bear solitary, scattered leaves, and pendent, persistent-scaled cones—the special characteristics of the Spruce family.

The group comprises four genera: *Picea*, the True or Typical Spruce; *Tsuga*, the Hemlock Spruce; *Pseudo-tsuga*, the False Hemlock-Spruce; and *Hespero-peuce*, the Alpine Western Spruce—each genus represented in California by one or two species.

They are all graceful trees of pyramidal or spire form, growing slowly and forming tough timber. The flowers of both kinds are borne on or near the ends of last year's branchlets; the males are spike-like columns of stamens on a receptacle surrounded at base by several involucral bud-scales. The leaves are scattered, linear or needle-shaped, and persistent from two to several years.

The Spruces are nearest to the Pines in characters of their fruit, and between them and the Firs. They differ from the Pines in maturing their fruit in one year instead of two; the bracts of the cones remain membranous, instead of becoming corky; the leaves are scattered or solitary, instead of fascicled, and with sheaths at the base, mostly entire instead of serrulate, etc.

They differ from the Firs in having the cones pendulous from any of the branchlets instead of erect upon the upper ones, and in having the scales and bracts persistent instead of deciduous; also, the trees have usually scattered instead of verticillate branches, and the timber is tougher and harder with more resin.

The three generally accepted genera first named (and the other which I have just added), divide upon a few minor, yet distinct characters here shown, to wit:

1. *Picea*, Link. True Spruce.

The branchlets of the True Spruce are rough from the presence of prominent leaf bases that become hardened and persistent; the cones are terminal on leafy branchlets; the bracts are smaller than the scales; the leaves are sessile (*i. e.*, not narrowed into stalks at base), keeled on both upper and lower sides and with two lateral resin ducts from end to end; the seeds are without resin vesicles.

2. *Tsuga*, Carrière. Hemlock Spruce.

The branchlets of the Hemlock Spruce are rough like the True Spruce; the cones are also terminal, very small; the bracts are similar; but the leaves are petioled (*i. e.*, narrowed at base into a foot-stalk), and they each have a single resin-duct on the back; the seeds are provided with resin vesicles on the upper surface—in this respect resembling the Fir.

3. *Pseudotsuga*, Carrière. False Hemlock Spruce.

The branchlets of the False Spruce are smooth; the flat leaf-scars transversely oval, the leaves petioled (*i. e.*, narrowed at base); the bracts

of the cones are three-parted and much longer than the scales (*i. e.*, they are exserted from between the scales of the cone), and the seeds are devoid of resin vesicles.

In a few respects this last genus approaches the Firs: they have similar smooth branchlets and exserted bracts; thus justifying their arrangement next to the great family of Firs.

4. *Hesperopeuce*, Lemmon. Alpine Western Spruce.

This genus, newly separated from *Tsuga*, is characterized by its alpine habitat; its cones are larger than any Hemlock Spruce, two to three inches long; oblong-cylindrical; scales numerous, nearly of the same size; reflexed at maturity; broader than long, four to eight lines wide; striate, with thin, wavy, rounded border; bracts small, spatulate, three to four lines long; seeds angular, with resin vesicles; wings elliptical, three to six lines long; leaves linear, scattered, quadrangular keeled above and below; resin duct solitary and large.

This Spruce greatly differs from the Hemlock Spruces in appearance, fruit, and foliage, and equally differs from the False Spruces.

EUROPEAN SPRUCES.

The large, almost unbroken forests of northern Russia and of Siberia are but little known, but the sometime vast forests of western Europe, especially of the Scandinavian Peninsula and the gulf region of the Bothnia, abounded in Firs and Spruces that in all historic times have engaged attention upon many important considerations—their value for ship timbers and spars, house-building lumber, domestic fuel, terebinthine products, their usefulness for ornamentation; and, lately, for reforesting regions that have been denuded by the ruthless hand of man.

Chief of these European trees are the famous *Picea excelsa*, or Norway Spruce, and the *Abies pectinata*, or Common Silver Fir.

These being characteristic of all, the coniferous trees of Europe may well be briefly described (each in its place), for we shall find, also, that in many respects they resemble our own royal trees.

7. PICEA EXCELSA, Link. Common Norway Spruce.

The Norway Spruce is common to the mountains of all northern Europe, as well as the higher Alps, the Carpathian, and the Pyrenees, reaching the elevation of six thousand to seven thousand feet, where it becomes dwarfed to a low shrub. It is wanting in a natural state on the whole chain of Apennines, as also in the warm latitudes of the Mediterranean countries. It is very commonly planted for various purposes, and already has sported into several marked varieties.

In its home or headquarters on the Scandinavian Mountains, the Norway Spruce becomes a fine, lofty tree, one hundred or one hundred and fifty feet high, with a diameter of two to five feet. Its habit of retaining its branches, which spread out regularly on all sides, so as to give the tree a pyramidal appearance, is characteristic of the whole family. These limbs are longest near the base, and extend horizontally; the upper ones are shorter, and at first drooping downward, at length sweeping upward, except the terminal twigs, which again droop downward, bearing their long, pendent, shining cylindrical cones.

The timber is, hence, inferior for boards, because of the many knots and holes, but it is strong, elastic, and not very resinous—in commerce it is called "White Deal."

This is one of the few foreign Spruces extensively cultivated in California, and it proves hardy and ornamental.

OTHER ORIENTAL SPRUCES.

The other Oriental Spruces worthy of brief mention are *Picea Orientalis*, found on the mountains near the Black Sea, *P. Smithiana*, a large tree forming forests on the mountains of Farther India, above the Sacred Deodar Cedar; *P. polita*, the "Tiger's-tail Spruce," of the mountains of Japan, and planted by the Japanese around their temples, at Yokohama; and *P. obovata*, the distinctly Siberian Spruce, that flourishes near the Arctic Circle as a mere shrub.

Other trees often called Hemlock Spruce, or simply Hemlock, have been lately separated from the True Spruces upon abundant characters, and erected into a genus called by a Japanese name—*Tsuga*—from one of its chief species growing on the sacred Fusi-Yama. Representatives of this genus are found on both continents at less elevations, or in more southern latitudes than the True Spruces.

PICEA, Link.

TRUE OR TYPICAL SPRUCE.

True, Typical Spruces are distributed from shore to shore of the American continent and from tide-water pools to alpine peaks—the mountain species predominating.

As we should expect from the discussion in early paragraphs of this report, the three principal mountain ranges of North America—the Rocky and its two flankers, the Alleghany and Pacific Ranges, with their branches and detached outliers—are inhabited by the greater number of species, four climbing to the vicinity of perpetual snows, and five others on middle altitudes mostly in wet localities; while of the two remaining, one extends across the continent from ocean to ocean, and the other is local in the tide land forests of the Northwest coast.

Let us consider the widest distributed species first, as being decidedly typical, since the very fact of its inhabiting so varied and far removed regions argues its inherent strength and adaptedness—always the best evidence of a good species.

8. Picea laxa, Sargent. (*P. alba*, Link.) White Spruce.

This peculiar American Spruce is dispersed all across the northern part of the continent from the coasts of Newfoundland and New England, the northern peninsula of Michigan, and the lake regions of Montana, to the coasts of British Columbia and Alaska, while northward these forests are united and the species dwarfed to low shrubs, extending to the frost-bound shores of the Arctic Sea.

Its headquarters of best development are in the Flathead region of

Montana, where the tree attains a height of one hundred and eighty feet, with a diameter of two to three feet.

The White Spruce is the most important timber tree of the sub-Arctic regions of the continent, where also its closely allied species—*P. Mariana*—divides the occupation, although the White Spruce is always the most numerous and the largest in the same localities; but in the southeastern limits of its range, to wit: New England, the Black Spruce is the larger and more numerous, as should be expected, being on its own ground.

The White Spruce is a much prettier tree than the Black, with its long, drooping limbs, gracefully draped with swaying branchlets, the latter decorated with pendants of green cylindrical cones about two inches long, the scales with entire edges. The leaves are quadrangular, equally distributed all around the branches, and pale, or glaucous, suggesting the popular name. The timber is very valuable and largely manufactured into lumber.

9. Picea Mariana, Sargent. (*P. nigra*, Link.) Black Spruce.

The Black Spruce inhabits regions of lower latitudes, mostly in the Eastern States, and south as far as the peaks of North Carolina and Wisconsin, extending westward to the eastern slope of the Rocky Mountains, and northward, as a diminutive shrub, to the mouth of the Mackenzie River.

The Black Spruce is an important tree (called Double Spruce, by the Canadians, a third part of their forests being exclusively of this species); southward it is limited to wet swamps near the mountain tops of Roan Mountains, North Carolina. The trees seldom attain a height of over seventy feet, but the timber is so firm, elastic, and durable that it is much prized for ship building, fence posts, railway ties, etc. The spruce gum of commerce is derived from this species. In certain northern regions a form is so changed and dwarfed by the environment that it has received another name—the Red Spruce. It is of little value.

The foliage of the *Picea Mariana* is dark green and gloomy in appearance, occasioning the popular appellation of Black Spruce. The cones are ovate, or oblong, one to one and one half inches long, the scales with thin, wavy edges—this last character particularly distinguishing it from the allied White Spruce.

10. Picea Engelmanni, Engelmann. (*Abies Engelmanni*, Parry). Dr. Engelmann's Spruce.

[See Illustration No. 2.]

This species is found in the Rocky Mountains and in a few outlying western localities, at middle stations five thousand to eleven thousand feet altitude, forming extensive forests in Montana, extending westward to the Cascades of Oregon, and southward to northern Arizona, where a few trees are left stranded on the tops of the highest peaks—as on Mount Agassiz and Mount Graham—bordering the craters in their summits.

Engelmann's Spruce in its headquarters on the middle altitudes of the central Rocky Mountains is the largest and most valuable timber tree of the region, and is largely manufactured into lumber and into charcoal and fuel. It is noteworthy that in northern Montana this species and the closely allied White Spruce approach each other on the same latitude, but they never mingle, the Engelmann Spruce growing always at higher and drier elevations.

This royal Spruce approaches the limits of California on the north, within one hundred miles (and is, perhaps, much nearer), being found on the neighboring peaks of the Cascade Range, in Oregon. On the south it approaches within one hundred and fifty miles, being found upon the summits of Mount Graham, in central Arizona, and Mount Agassiz, the highest peak of the San Francisco Mountains, in northern Arizona.

In April of 1879, the writer explored the summit of Mount Graham, and in September, 1884, Mrs. Lemmon and myself twice ascended the lofty Mount Agassiz, finding thereon, bordering the great extinct crater, several fine specimens of this interesting tree, eighty to one hundred feet high, and two to three feet in diameter.

The bark is thin, about an inch thick, scaly, and reddish brown; the limbs are few, large, longest ones at the base, and widely expanded; the numerous secondary branches, with their finer branchlets decorated with the pendent brown cones, and clothed with the dark green, abundant leaves, appear like outstretched plumes of wondrous design.

The male flowers of the Engelmann Spruce appear in the early spring from the ends of the twigs in clusters, each of many stamens on a long receptacle forming a spike-like compound flower one half to one inch long, and half as thick, the whole at maturity raised out of the half dozen large involucral bud scales.

The fruit or cone dependent from the ends of other thick and short branchlets on the same tree (monœcious) is, during growth, royal purple in color, becoming at maturity reddish brown, cylindrical, and two to three inches long; when the scales are expanded, the cone is elliptical and an inch or more in diameter. The scales are rather fleshy, obovate, obtuse, with a minute spatulate, fimbriate bract on the back of each. The upper edges of the scales are scarious, wrinkled, and slightly erose dentate, seed a line long, ruby brown, with comparatively large wings, obliquely obovate, and two to four lines long, convex, and shining.

The leaves are thick set all around the branchlets, six to eighteen lines long, one half to one line wide, linear, obtuse or acute, strongly keeled above and below, making them quadrangular with four to six longitudinal rows of white dots (stomata), in the deep furrows each side of the keels—less below than above.

The leaves—like all the *Piceas* and *Tsugas*—are articulated or jointed upon peculiar foot stalks an eighth of an inch high, and which are so hard and persistent as to give the impression that they are abortive limbs, but upon slicing them with a sharp knife the origin of these foot stalks is found to be in the bark or epidermal fibro-vascular bundles, with no ligneous fibers from within—hence they are analogous to the prickles of a rose; though unlike rose prickles, these Spruce prominences bear each a terminal leaf.

In preparing botanical specimens of the two genera of Spruces—the *Picea* and *Tsuga*—another peculiarity of these leaves is discovered: they speedily separate from the foot stalks and fall away, so one has to preserve them by special effort; scalding the fresh specimens in hot water will cause the leaves to remain slightly connected.

NOTE.—The *Picea Engelmanni* commemorates the services to American botany rendered by the late distinguished Dr. George Engelmann, of St. Louis, Missouri, being so named by its discoverer, Dr. C. C. Parry, lately deceased.

Dr. Engelmann, deceased February 4, 1884, had been a close student of American flora for fifty years, and our literature teems with his ably written articles. Chief of these are his monographs upon its obscure families of Cuscuta, Carex, Cacti, Euphorbia, Mistletoe, and Vitis, with especially his elaborate determinations of our most important forest trees—as the Oaks and Coue-bearers—hence it is most fitting that this Spruce, one of the noblest of them all and crowning the forests of our chief mountain range, should bear the honored name of Engelmann, recalling to men as long as the study of trees occupies their attention, the memory of a profound student and lover of American trees. (See Illustration No. 2.)

11. PICEA PUNGENS, Engelmann. (*Abies pungens*, Parry.) Blue Spruce.

This is a much less distributed species of Spruce than any of the preceding, being found only on the mountains near the source of the Big Horn River, in Wyoming, and neighboring mountains in Colorado and Utah. It affects the borders of streams and wet places, at elevations of six thousand to nine thousand feet, and attains the height of one hundred to one hundred and fifty feet, with a diameter of two to three feet. It never forms forests of itself nor ascends to the elevation of its neighbor, the Engelmann Spruce. It closely resembles the latter, but has acute or pungent leaves, which are less flattened, and bluish green—from the abundance of stomata (suggesting the popular name). The cones are longer, cylindrical, with undulate, retuse or notched scales and minute bracts, with larger, broadly winged seeds.

Discovered and introduced into cultivation, also, by the late Dr. Parry, under the name of *Abies pungens*.

12. PICEA SITCHENSIS, Carrière.

THE GREAT TIDE-LAND SPRUCE.

[See Illustration No. 3.]

This, the first of the Spruces named that undoubtedly reaches within the limits of California, is a remarkable species, with the habit of a Cypress, affecting low, wet, swampy grounds. It is local on the northwest coast, from Alaska southward to Cape Mendocino, California, and extending not more than fifty miles inland. It becomes, in its headquarters, near the mouth of the Columbia, a large tree of great economic value.

It reaches a height of one hundred and fifty to two hundred feet, with a straight, nearly limbless trunk in forests, and is six to eighteen feet in diameter. At its locality of greatest development it forms continuous forests of great density, fifty miles wide, but in the extensions north and south it is narrowed to diminishing points. Being of excellent lumber qualities, and very accessible, it is being speedily removed and manufactured into lumber for many uses, as it is highly prized.

On frequent occasions, during past years, the writer has visited the locality of the Tide-land Spruce, along the coast of California, and last season we made a special pilgrimage to its locality of greatest development, the Columbia River region, and the great forests of Puget Sound. Here this tree may be seen in all its magnificence. Tall, straight, limbless for two thirds of its height, it at once attracts the practical eye of the lumberman, and for that reason would be speedily exterminated were it not for the fact that it seeds readily, and the moist climate constantly promotes renewal.

The bark is thin, black, and scaly; the limbs of trees in open situations are few, long, and large, with persistent branches. The male flowers are axillary, or sometimes terminal, on the ends of last year's branchlets, with an oblong, stamineal column three fourths of an inch long, its short stipe surrounded by numerous large bud-scales; the stamens with the large double anthers, peculiar to the Cone-bearers, are terminated by a large, inflexed, orbicular crest. The female ament becoming the fruit or cone, at maturity, which is in September of the same year, is terminal upon stout, short branchlets, and is varied in size according to locality of the tree; being cylindrical or oval, and one and one half to two and one half, or in favorable situations, even three inches long, and three fourths or more than an inch in diameter, pale yellowish; the oblong scales a half inch long, thin, at maturity divergent from the axis, obtuse, ridged and denticulate, each with a half as long, concealed, lanceolate, denticulate bract on its back, and two small black seeds with narrow wings on its upper side, in deep excavations.

The leaves, five to eight lines long, are closely set all around the branchlets on raised footstalks, from which they separate in age, leaving rough branchlets, as in the other species. They are quadrangular from the presence of keels or ribs above and below, but these ribs are not so prominent as in the Engelmann Spruce and they have more—eight to ten—lines of stomata on the upper side in each of the two furrows. On young trees the leaves are long, narrow, and sharp pointed; on older ones they are shorter and less acute, or even obtuse.

The Tide-land Spruce being so accessible to early voyagers was collected by the first visitors to the northwest coast, and it has received a dozen scientific names, as it was classed in different ways. At last separated from the other Spruces by the French botanist Carrière and named for one of the localities of its first discovery on the island of Sitka.

The light, soft, straight-grained wood of a light brown or reddish color, gives it the name, among lumbermen, of Red Spruce. Large quantities are cut in the accessible regions, and the demand is always brisk at high prices. It has been grown readily from seed and no doubt could be utilized in reforesting our denuded coast regions.

13. Picea Breweriana, S. Watson.

BREWER'S, OR WEEPING SPRUCE.

[See Illustrations Nos. 4, 5, and 6.]

Last and most local and sequestered of the *Picea*, or Spruces, and therefore but recently discovered, is the Brewer's or Weeping Spruce, of the Siskiyou Mountains. Being a peculiar and prospectively a very valuable tree for ornamental purposes, and withal inclosed by the limits of California, several attempts have been made by the writer, in years past, to reach its almost inaccessible home on the bald ridges crowning the summits of the lofty Siskiyou Mountains.

A few paragraphs descriptive of the topography of this region—affect-

ing and governing as it does the whole character of the contiguous forests—will be pertinent at this juncture.

As in the southern part of California there are several steep cross ranges extending from the great Sierra to the Pacific, so in northern California and the contiguous region of Oregon, there are a series of very steep cross ranges, commencing with the Trinity Mountains crossing from Shasta westward, the Siskiyou come next, then the Rogue Mountains, lastly the Umpqua Range, forming the southern rim of the great valley of western Oregon, threaded by the Willamette River.

Such cross ranges, beginning with promontories in the sea and extending into the interior, rising as they proceed, must necessarily separate and conduct currents from the great ocean of western wind and direct them, more or less, successfully upon the high, interior, long ranges parallel with the Pacific Coast. These currents of atmosphere are, of course, on different degrees of latitude as distance is gained northward; and each current, one after the other, will be more and more fitted to receive, and does receive, more moisture from the warm Japan ocean current that bathes the northwest coast. These conditions, added to the more profound factors accounting for the present location of plants where they now are, by their attempt in the past ages to return northward after the retreat of the great ice sheet (described in earlier paragraphs), conspire to locate peculiar, often extremely local, remnants of development impluses upon these fateful cross ranges, stranded there in the last throes of extinction, if so be that the earth continues to increase in warmth through coming ages.

Hence, we find upon nearly every one of these ranges peculiar trees, and numberless other smaller plants of extremely local habitat.

On the Trinity Range, near Shasta, is found the peculiar and extremely local *Pinus Balfouriana*, the original type of Jeffrey's valuable discovery; also, there is found the very peculiar, and perhaps to be separated, typical form of *Pinus Jeffreyi*.

On the Siskiyou is stranded, as stated, the Weeping Spruce, and a peculiar Oak, with no one knows what other solitary and strange plants.

On the Umpqua Range is a remarkable growth of the Great Sugar Pine, the largest trees of its species known, and, fortunately for him, the first discovered by Douglas after his long quest of two years. It should be stated in this connection, that although the Sugar Pine is found elsewhere, particularly from end to end of the Sierra Mountains, yet here, on this outlying cross range, it is treated to an unprecedented amount of moisture, which perhaps accounts for its unwonted development. With an equal amount of moisture, what might the extensive Sierras display in the way of Sugar Pine?

To the causes discovered may also be referred the remarkable presence of the curious and extremely local *Abies venusta* (known as *A. bracteata*), on the Santa Lucia Mountains of Southern California; also, on this, and similar, more southern cross ranges, the presence of the Big-cone Pine and several Oaks.

And the great giants of earth's vegetation, the California "Big Trees," are stranded upon the southwest slope of the southern end of the high Sierra, through the operation of precisely the same laws of development and limitations of environment, to wit: the attempt on the part of a struggling remnant of a great family to return home northward over impassable mountain barriers, these barriers reinforced by forbidding atmospheric conditions.

During the years 1887 and 1888, while undertaking to study the Pine family, it was found necessary to follow some of the species down into Mexico, and others over into Nevada and Utah. So, this season, in order to understand the other families of our noble Cone-bearers, it was necessary to visit them at their headquarters of best development.

Several of our most valuable trees are native to the forests about Shasta and in the Siskiyou Mountains. Others have their headquarters in more northern ranges—the Rogue and the Umpqua Mountains—and especially in the noble forests around Mounts Hood and Tacoma; while the broad, dense, interminable woods, "Where rolls the Oregon," and the primeval forests of Puget Sound, contain colossal growths of Douglas Spruce, of giant Arborvitæ quite as large, majestic Firs of lofty height, magnificent and rare Spruces, lovely Hemlocks and Yews—each species of which drips down with small representatives along both the Coast and Sierra Ranges far within the limits of California.

SEARCH FOR THE NEW SPRUCE.

Determined upon visiting the home of the lately discovered and solitary Spruce, we proceeded to the vicinity of the Siskiyou Mountains, arriving September 26, 1889, at Cole's Station, to find the cañons all ablaze with fire and filled with smoke. There was no alternative but to pass on through the stifling smoke, a blazing tree ever and anon crashing beside the sweeping train.

At Grant's Pass we changed for a freight train that would traverse the Umpqua Mountains by daylight, hoping to find this range explorable, for we wished to leave the line of railroad and visit the region of forest near the headwaters of the Umpqua River, the very locality where the heroic Douglas first "saw with my own eyes the Grand Pine," which he had been seeking for two years (and which he had already named *Pinus Lambertiana*, in honor of his patron and friend, Lambert), upon the meager data offered by a few seeds discovered in the tobacco pouch of an Indian on the Columbia River.

But this long coveted trip was denied us, and we must either return or pass on. We chose the latter alternative and passed on to visit the Fir forests around the base of Mount Hood, of which mention will be made in proper place.

SECOND ATTEMPT.

In October we found the forest fires so far lessened as to warrant the hope for successful examination of the Siskiyou Mountains in detail. As the northern slope is much more densely clothed with timber than the southern, and, also, is much easier of ascent, we proceeded to Grant's Pass, situated amidst groves of Garry's Oak and of the gorgeous Red-fruited Madrona, and there established headquarters for a fortnight.

Short preliminary excursions were made into the range on the east, where some very fine Madrona trees, four to six feet in diameter, were photographed; also, some large Yew trees were seen, but they were too deeply immersed in the forest to be successfully pictured.

The special trip in search of the Weeping Spruce was commenced

October 23d, and was expected to occupy about five days. It involved, first, about sixty miles by private conveyance through the Pine forest covering the whole face of the country westward from Grant's Pass and forming the broad lower valley of the Rogue River.

Passing Applegate and Kirbyville amidst Yellow Pines of especially symmetrical shape, and of the characters most nearly approaching the variety I have indicated in my Pine monograph as *nigricans*, or Brown-bark Pine, we soon reached the locality of the early mining claims near Waldo. The surface of the earth all over several valleys was collected into heaps by the miners, and now these mounds were blossoming with native plants helped by the accidental cultivation to new developments almost disguising their lineaments.

Throughout the valley of the Rogue River the principal arboreal vegetation is confined to the two Pines: the Yellow, with the Sugar Pine on the higher slopes; two Oaks, Kellogg's and Garry's—the latter, a large tree with dense, shining foliage—an Ash of good size, and the ever beautiful Madrona, its bright orange red or madder red trunk and bared limbs, when seen only in sections through other trees, seem the bared body or the out-reaching arms of a human figure, but its great clusters of scarlet berries, generally abundant on every tree, and at the time of year we were among them, half covered by the large, elliptical, shining, parti-colored leaves, gives a character of richness and loveliness to the Madrona that is incomparable in all our forest flora.

Quite unexpectedly, a few fine trees of *Pinus tuberculata*, or "Knob-cone Pine," were met within a moist locality on the general level of the valley; not as is their usual habitat, on a high, sunny ridge. This is nearly the most northern locality noted for this species, the other being the valley of McKenzie's River, in central Oregon.

It is worthy of mention here, that two of our most wonderful California plants—the *Sarcodes* (the snow plant) and *Darlingtonia* (or pitcher plant)—supposed to be limited to the Sierra Nevada Range, are found also on these northern cross ranges, though in but few localities: notably, on Eight Dollar Mountain of the Rogue Range. The *Sarcodes* (or snow plant) is also found on the San Bernardino Mountains, and other high, cool, fir regions southward.

Near Waldo we reach the point where the wagon must be abandoned and the trail taken over the western end of the Siskiyou—looming up, lofty, steep, and forbidding. Knowing this was to be a hard trip—too rough for a lady—Mrs. Lemmon was persuaded to remain at Grant's Pass and sketch a branch of the Regal Madrona, while, with an assistant, I should prosecute this hazardous journey without my almost ever constant sharer in explorations.

Disposing of the wagon in the corral of a pioneer farmer, and saddling our horses, we started out in the gray of the early morning, taking the trail towards "Happy Camp."

Was there ever a good, pleasant mountain trail? Only those constructed with much labor, about Yosemite, that I have ever seen; however, this might have been worse, and yet passable.

By nine o'clock we had reached the shoulder of the first real mountain elevation, and soon after we entered a forest of Red Fir, occupying a valley so hidden as to be totally unsuspected a half hour before. We had been walking, or rather climbing, for some time past, leading our animals, and this stretch of flat land was most welcome. Mounting, we rode leisurely along amidst a young growth of Red Firs (*Abies magnifica*) that is most charming in its wealth of symmetrical trees—always of the same shape and perfection in trees of the same height.

Like the *Araucarias* of our lawns, introduced from South America, the Fir family is distinguished by the regularity of its many whorls or layers of limbs, and the two species of Red Fir have such short and close clasping leaves that the branches even to the last terminal twigs are fully seen in gauzy loveliness, half veiling the sky.

Here, too, bordering the murmuring streams, and rising like pyramids of verdure to mark where repose some Hymadryad, perhaps, is found the most universally accepted ornamental tree of our local forest production—the *Chamæcyparis Lawsoniana*, or Lawson Cypress, everywhere introduced, and always giving satisfaction on account of its habit of forming a broad cone of verdure, and of disposing its branchlets in little fan-like sprays of horizontal, drooping foliage.

Crossing this forested valley and climbing up by zigzag trail over ridge after ridge of splintered rocks, about noon we reach the summit of the Siskiyou (within the limits of California) and look forth over an extended landscape. Northward, over forest and plain, rose unnamed peaks of the Umpqua Range; northeastward, the long line of peaks that told where stretches the Cascade Range, with the near Mount Pitt in ghostly robes following the vanishing procession; westward, a purple bank of haze told where lay the Pacific only eighteen miles away, but its face veiled by the coast forests. We turned our gaze southward.

"There it is, Wheeler; and what a beauty!" I cried.

"Yes," said my companion; "there is Shasta in all his glory!"

But I was looking through a vista of the thin forest and, a moment after, was standing bareheaded before the new Weeping Spruce.

The tree is much taller, slimmer, and much more striking and beautiful than I had expected, having read only a meager botanical description.

Only a few trees were found, and these scattered about among other trees on the rocky crests.

The fallen trunk of the tree felled by Mr. Brandegee to obtain a specimen block for the Jessup Museum at New York was noted, its bare limbs with the rough branchlets plainly proclaiming that a member of the Spruce family, with its peculiar characters, was before us.

No fruit of the season was found, save one cone which a squirrel had cut down and partly denuded of its scales. This piece of a cone I secured, and the four seeds remaining have been put into the hands of a seedsman in Oakland to propagate.

Hastily putting the photographic apparatus in order—for clouds were forming and wind threatening—I selected a pair of graceful trees and exposed the plate, securing the first picture ever taken of this rare Spruce. The remaining plate was used to catch a lone tree of great beauty, with my assistant and his horse standing near it, finishing the exposure just as the gathering storm reached the mountain and the tree tops commenced swaying in the wind.

A new Shrub Oak was found in the same groves with the new Spruce, and specimens secured.

Excellent specimens of the long, slender branchlets of the Spruce, six to eight feet long, and not larger at the butt end than an ordinary lead

pencil, and of the short upper branches of one of the trees loaded with last year's empty cones, were secured.

These trophies were carefully placed in sacks and tied behind the saddles, to be conveyed to headquarters in Grant's Pass, where they arrived in good condition and were successfully photographed.

EXTENDED DESCRIPTION OF PICEA BREWERIANA.

As stated elsewhere, the Siskiyou Mountains extend from the Cascade Range as a divergent spur westward nearly on the boundary of California, ending in a promontory on the Pacific.

The great height, five thousand to seven thousand feet, results especially in separating from the great sheet of western wind coming from the ocean, a distinct current of its warm, moisture-laden atmosphere, and directing it into the interior; also, like the other cross ranges, it opposes a high barrier across the course of plants migrating northward from tropical regions, as we have seen; and for these reasons we find the Weeping Spruce, the undescribed Oak—and no one knows what other solitary remnants of species—stranded upon the sides and summits of the Siskiyou.

There may be other points eastward on this range where this lone Spruce may be detected, as discussed hereafter, but up to date the only locality is a very limited one near the western end of the Siskiyou Mountains and on the southern side of the summits within the California line at an elevation of about five thousand feet.

There are not to exceed a few dozen individuals, all told, and they do not form a grove to themselves, but are scattered among other coniferous trees, such as Fir, Hemlock, Incense Cedar, etc. Search was instituted in vain to discover any sapling or seedling trees—though it is but fair to state they might have been found there had time permitted.

The trees range from one and one half to three feet in diameter and from fifty to one hundred, or rarely one hundred and fifty feet in height. They have the True Spruce characters of outline—tall, slim, tapering; the lower limbs longest and nearly horizontal, the upper ones sloping downward and outward, diminishing in size to the top, which terminate in nodding, swaying, short branches, generally decorated with pendent, finger-like cones.

But with these few points the resemblance to the other Spruces ceases. The primary branches directed outward are thickly set with branchlets that become elongated and pendent—two to eight feet in length—clothed the whole distance with short, divergent leaves. Persons desiring inch ropes of green for festoons or other decorations can find them here, ready made, but as soon as withering began every leaf would drop.

When the atmosphere was stirred—presaging the storm—these long, pendent tassels were swayed and tossed about in graceful undulations that were as surprising as pleasing to see, there upon the bleak mountain tops, amidst rigid limbed, motionless trees, and I could but regret that all my artist friends and tree lovers, especially my companion on so many botanical explorations, were not there to enjoy with us the rapturous exhibition.

The bark of this tree is thin and reddish, the timber white, tough, and elastic. Transported to other favorable situations, this might prove a valuable timber tree, and the experiment should be tried.

The cones are two and one half to three and one half inches long, narrowly cylindrical, attenuate at base, with several undeveloped scales; the minute bract on the back of the mature scales is linear oblong, about two lines long, denticulate, and one fourth the length of the scales, which are obovate, with thickish, entire upper edge; seeds one and one half lines long, brown, with an oblique, convex wing four lines long by half as wide. The leaves are dark green, six to fifteen lines long by one half line wide, sessile upon the persistent, one line high, base; obtuse, smooth and rounded on both sides, or carinate on one or both sides, slightly lined with stomata beneath on each side of the mid-nerve; the two longitudinal resin ducts close under the epidermis on the back.

PROBABLE EARLY DISCOVERY.

Many years ago a member of an engineering party that had been surveying for a railroad over the Siskiyou Mountains informed the writer that a curious looking tree had been seen on the eastern Siskiyou Mountains, near the Klamath River. He stated that the tree was low-headed as if cut off a few feet from the ground, and that the limbs were outstretched and bending downward with long, pendent branches, like a Weeping Willow.

Attempt was made repeatedly to visit the reported locality, but circumstances or illness prevented from year to year.

In June, 1884, Thomas Howell, of Sauvie's Island, Oregon, happened upon a Weeping Spruce in the western end of the Siskiyou Mountains, specimens of which he sent to Dr. Sereno Watson, at Cambridge, Mass.

Upon examination it proved a very distinct, undescribed species of *Picea*, and the doctor named it *Picea Breweriana*, in compliment to Prof. W. H. Brewer, now of Yale College, New Haven, a gentleman who, in connection with the early geological survey of California, had much to do with the botany of the State, especially being interested in our trees; hence it is eminently proper that the name of Professor Brewer should be thus associated with the forest trees of California.

This tree having decidedly weeping branchlets and found on the Siskiyou Mountains, although far to the westward of the first reported locality, may be the long lost Klamath weeping tree; but the low-headed character of that tree is entirely absent from this, and the original species may be waiting still for its discoverer.

TSUGA, Carrière.

HEMLOCK SPRUCE.

The trees called Hemlock Spruce, or simply Hemlock, have until lately been classed originally with the Firs; then they were separated with the True Spruces.

As late as 1875, Gordon placed them in a section of the "Spruce-Fir" family called "*Tsuga*, or those kinds with flat leaves, mostly glaucous below, and more or less two-rowed."

Previously, botanists had separated these trees from the True Spruces, Carrière, in 1855, giving the genus the name of *Tsuga*—precisely the Japanese name of their tree, meaning yew-leaved, or evergreen. Later, in his second edition of "Traite Coniferæ," Carrière found that the trees

so set off were separable into two genera, or rather that one species possessed so many divergent characters that it deserved generic rank, and, because he thought it resembled *Tsuga*, he gave it the almost unpronounceable name of *Pseudo-tsuga*, the False Hemlock. This peculiar genus is a product of West American development, and will come in for an extended description later.

The True Hemlock Spruces comprised in the botanical genus *Tsuga* are six in number, and their distribution is very peculiar. They are found in the northern part of both the grand divisions of the earth: two in Eurasia and four in America.

The Eurasian species are separated by nearly half a continent, the American species by a whole continent—a pair being distributed on each side of it.

The genus *Tsuga* (a Japanese word pronounced by them as if spelled "Soongá," with the accent on the last syllable), resembles the genus *Picea*, or True Spruces, in many respects, differing principally in having flattened sprays of foliage, the leaves mostly in two ranks instead of scattered, and petioled instead of sessile, with a single dorsal resin duct instead of two. The cones are smaller, and the seeds have one or two resin glands on their upper surface—in this last respect resembling the genus *Abies*, or Fir.

The resemblance of *Tsuga* to the *Pseudotsuga* is very slight indeed, and the naming of the latter genus, as if closely related to it, was a palpable error, besides introducing a formidable, almost forbidding term into our botanical nomenclature—as discussed later.

ORIENTAL HEMLOCK SPRUCES.

As stated, there are two species of Hemlock in Eurasia. Both are in Asia; one, the original *Tsuga*, clothing several mountains of Japan, including the sacred *Fusi-Yama*, at elevations of eight thousand to nine thousand feet, where it becomes large forests exclusively of this species, attaining a height of eighty to one hundred feet. Its timber is fine grained, of a yellowish color, and prized by the Japanese and Chinese in the manufacture of their curious wares; also, the Japanese plant it extensively about their temples. In many respects this Japanese species resembles our eastern American species.

The other Oriental Hemlock is found on several mountain ranges of India, notably on the southern slopes of the Himalayas, where it is enormously developed, becoming a tree six to eight feet in diameter.

According to Sir Joseph Hooker: "On the Himalaya this tree forms a narrow belt at an elevation of nine thousand to ten thousand feet on the south flanks of Kunchinginga, probably the highest mountain on the globe."

While it is one of the handsomest forest trees in India, its timber is of poor quality, soon perishing under exposure. On account of its fragrant odor the Hindoos called it by a name signifying pleasant smelling tree, and they use it largely for incense.

One peculiarity of this tree reminds one of our Weeping Spruce lately discovered, and it also reminds of some forms of the Douglas Spruce; that is, the drooping character of its limbs.

It is said that "its boughs ascend a little in the young trees, but are horizontal in older ones, and from these the branchlets and smaller twigs droop in the most graceful manner."

It is worthy of note that these two Oriental Hemlocks are found at nearly the same height from sea level, though widely separated in longitude.

Both are cold weather plants and belong away northward. One is maritime and takes kindly to sea air and fogs near the tops of Japanese islands; the other is inland, stranded on the southside of the long range of the Himalaya; each confined to narrow belts of only a few miles in width, indicating extremely precarious conditions that must be adjusted to a nicety, or else, presumably, these species would become extinct.

This phase of development will be discussed further when we come to take up the American Hemlocks.

AMERICAN HEMLOCKS, OR HEMLOCK SPRUCES.

There are four species of Hemlock in America, training in two pairs: one pair on the Atlantic Slope, the other on the Pacific; one of each of these pair is maritime, the other interior and alpine. The maritime species has in each case a widely extended range, while the alpine species is extremely local.

13*a*. TSUGA CANADENSIS, Carrière. Canadian Hemlock; New England Hemlock.

This, the principal of the eastern Hemlocks, is found plentifully on the northern seaboard of New England and Canada, and has a few representatives as far inland as northern Michigan and Wisconsin. It affects the coldest parts of the country, and forms three fourths of the dense forests around Hudson's Bay; but strange as the statement may appear, the largest trees of the species are found on high mountains of the Alleghany Range.

This eastern Hemlock is the best known of all the Hemlocks, being freely planted in the East, as well as abroad in Europe and Australia. It is recognized at sight by its many long, ascending, plume-like branches, divided into small twigs, each clothed with dark green leaves in two ranks, and its small oval cones, about three fourths of an inch long, produced along the edges of the plumes like a fringe of acorn pendants.

Always beautiful when standing alone where it can expand, this tree becomes singularly unsightly when crowded in a swamp. Here, in yielding to the pressure of its environment and the attacks of its neighbors of the same species—always the most ruthless of enemies, since *all* are inherently fitted for the place which only *one* may be able to seize and hold—the tree becomes extremely dejected and with crippled members.

This aspect of decrepitude does not appear when the tree is allowed to develop at will, as on the edge of a forest or when planted in a lawn, where it becomes a mass of conical foliage of great beauty. The branches, nearly horizontal, spring out irregularly from the trunk, never in whorls; the branchlets bend gracefully outward and downward, the longest in the middle of the branches, dividing and sub-dividing into tiny segments, reminding one of the compound leaves of the Poison Hemlock of the Parsnip family, and this resemblance suggested the popular name "Hemlock" for these trees.

The timber is of little value, owing to the many limbs that extend from heart to bark, making holes when the trunks are sawed; this not occurring in trees that drop their limbs early and close to the trunk, like the Sugar Pine.

14. TSUGA CAROLINIANA, Engelmann. Carolina Hemlock; Southern Hemlock.

The other eastern Hemlock is at once interior, alpine, and local, as noticed in the Himalayan species. It is a smaller tree, sparsely inhabiting dry, rocky ridges of the southern Alleghany Mountains, notably in the highest peaks of North Carolina and Tennessee. It resembles the northern species somewhat, and, until very recently, was not separated from it by the botanists.

In 1881 Dr. Engelmann published it under the above name, described from specimens (collected by Professor Gibbs, of Charleston), as distinguished by its larger, glossier, blunter leaves, and its larger cones with wide-spreading scales. These points, combined with its alpine habit, seem quite sufficient to indicate that the variation from a common type has been long continued and is sufficient for specific recognition.

This species has a homologue in the alpine species of the Pacific Slope, as the other eastern one—*Tsuga Canadensis*—has with the Pacific Coast species of wide distribution next to be described.

15. TSUGA MERTENSIANA, Carrière. Western Hemlock.

[See Illustrations Nos. 7 and 8.]

This is the widest distributed of the two Pacific American Hemlocks peculiar to the extraordinary forest development of the northwest coast, under the fostering power of the warm *Kuro-Siwa*, or Japan "Black River," bathing its islands and promontories, and the consequent saturated state of the trade winds crossing the ocean current and fanning the coast mountains.

The greatest development of this species is along the western slope of the Cascade Range, at low altitudes, where it attains the great size of one hundred to one hundred and fifty feet in height, with a diameter of five to twelve feet. From this headquarters of best growth, it extends northward, through the ranges of British Columbia, to Alaska, and eastward, along the cross ranges, to the Bitter-root Mountains of northern Idaho. Southward, it narrows to the Siskiyou and Coast Range Mountains, appearing sparsely along the latter as far southward as Marin County, California.

This large and important tree of the Northwest is so extensively distributed as to reach from its headquarters to points far within the limits of California; hence, it must be described in detail.

Even in California the *Tsuga Mertensiana* attains the height of one hundred to one hundred and twenty feet, with a diameter of four to six feet. The bark is unusually thin, sometimes thick, reddish brown; the sap-wood nearly white, the heart-wood light brown or yellowish, hard, close-grained, but not strong, making coarse, inferior lumber; but the bark is rich in tannin, and is the principal material used in the Northwest for preparing leather.

The primary branches are few, not in regular whorls, but arising alternately, the upper shortened so as to make the trees flat topped if in the forest.

In open situations the general outline is fusiform, with the long main branches ascending, feathered on both sides by numerous branchlets in two ranks, the middle ones the longest; and all again dividing into short, slender, hairy ultimate branchlets in two ranks, the latter drooping gracefully and decorated with pendent cones, that when growing are bright purple, at maturity light brown and oval, about three fourths of an inch long, the scales ultimately expanding so that the cone is globular at the time of releasing the seeds.

The cone scales are oblong, convex, with thin entire edges, the bracts, closely attached to the back of each at their base, are very small, pubescent, three-lobed; the lobes obtuse; the scales and bracts firmly attached to the cone axis by strong, ligneous fibers; seeds one to one and one half lines long, angular, with one or two resin glands on the surface; wings relatively very large, one quarter to three eighths of an inch long, widest below, thin and convex, comformable with the scale; cotyledons three or four.

The male flowers are in clusters of six to eight, terminating the short (one to two inches), hairy branchlets of the season, the large tomentose bud scales, in time releasing the spike-like head, two to three lines in diameter, of crested stamens; the whole high raised out of the bud scales on a slender stipe three eighths of an inch long at maturity.

The leaves in two ranks are linear, four to ten lines long, flat, about three fourths of a line wide, slightly keeled below, entire or minutely spinulose; cerulate near the tip, shining above; when young, white beneath with longitudinal stripes of stomata on each side of the keel; a cross-section reveals a single resin duct. As soon as withering commences, the leaves promptly separate from the prominent leaf base, which is brown, shining, convex, and abruptly truncated, half hidden by the long white hairs of the young branchlets.

This Western Hemlock, as seen, is the analogue of the eastern *Tsuga Canadensis* and resembles it in its widespread distribution and in the fineness of its foliage; but ours becomes a much larger tree, with finer grained timber, redder bark with richer tanning qualities, etc.

Carpologically it is distinguished by more elongated cone scales and consequently much longer seed wings.

The species is also closely allied to *Hesperopeuce*—next to be described —in having a single resin duct of the leaves, in the form of their stipitate male flowers and the glands of the seed; but differs in having two-rowed, flat, obtuse leaves, stomatose beneath; the pollen grains discoidal; the cones much smaller; the scales never strongly reflexed at maturity, etc.

16. Hesperopeuce Pattoniana, Lemmon.

(*Tsuga Pattoniana*, Engelmann.)

PATTON'S, OR ALPINE WESTERN SPRUCE.

[See Illustration No. 12.]

This, the last of the Spruces to be described here, is a fine representative of strictly alpine arboreal vegetation, and hence limited to the

upper points of forests that creep up along glacier beds and volcanic ravines, close to the perpetual ice.

As but few of our mountains rise into this alpine region, so there are but few localities where these trees may be found fringing the upper edge of the coniferous forests, notably: around the snow cap of Mounts Rainier, Hood, Pitt, Scott, Shasta, Lassen, Sierra Buttes, Haskell's Peak, Webber Peak, Mounts Lola, Tallac, Silver Peak, Mounts Lyall and Whitney—in short, almost every peak that rises to the region of perpetual snow in that long range called the Cascade in Washington and Oregon, and Sierra Nevada in California.

Its northern limit in British Columbia is at an elevation of only eight thousand feet; on Mount Tacoma (Rainier), nine thousand feet; and on the slopes of Mount Hood, nine thousand; at Shasta, nine thousand two hundred; at Mount Lyall, nine thousand five hundred; and ten thousand feet near Mount Whitney, where it disappears.

In many of these regions the lower part of the belt mingles with other trees, such as Red Silver Fir, Mountain Pine, or Aspen Poplar, and here the trees often attain a large size, six to twelve feet in diameter at base, tapering to a slender shaft, eighty to one hundred and fifty feet high; but in strictly alpine situations the trees are reduced to low conical masses of foliage or prostrate creeping shrubs.

In favorable situations the lower limbs are retained and become long, out-reaching, and spreading over the mountain slope for many feet; the upper limbs are irregularly disposed, not whorled; they strike downward from the start (so that it is almost impossible to climb one of the trees for the want of foothold), then curving outward to the outline of the tree; they are terminated by short, hairy branchlets that decline gracefully, and are decorated with pendent cones which are glaucous purple until maturity, then leather brown, with reflexed scales.

The main stem sends out strong ascending shoots, the leading one terminating so slenderly as to bend from side to side with its many purple pendants before the wind, and shimmering in the sunlight with rare beauty.

This Alpine Spruce, not strictly a Hemlock, was first discovered in 1852, by that sharp-eyed Scotch gardener, John Jeffrey, who was sent to this country by Edinburgh florists to collect seeds of forest trees in the wonderful region of the Northwest, but a few years before explored by David Douglas with rich results.

This tree, with three other new species, rewarded the search of this explorer, and was described by Professor Balfour and published anonymously in what was called the "Report of the Oregon Committee," under the name of "*Abies Pattoniana*," a name given to it by Jeffrey, in compliment to Mr. Patton, a botanist of the "Cairnies," in Scotland.

Subsequently, Andrew Murray collected it, and named it *Abies Hookeriana*, in honor of Sir William J. Hooker, the renowned botanist of England.

In 1855 Dr. J. S. Newberry, in elaborating the botanical parts of the results of explorations for a railroad route from the Sacramento Valley to the Columbia, described and figured this tree under the name of *Abies Williamsoni*, so named in honor of Lieutenant R. S. Williamson, commanding the expedition.

The species bore one or the other of these three names until 1880, when Dr. Engelmann revised the whole tribe of Abietineæ, or pitch trees, for the botany of California, in which he referred these Spruces to the genus *Tsuga*, restoring to this species the specific name of *Pattoniana*. I now separate it as the type of another genus for reasons shown later.

BOTANICAL CHARACTERS.

The fruit or cone of the Alpine Western Spruce (*Hesperopeuce Pattoniana*) is oblong cylindrical, two to three inches long, purple until maturity, then light brown; scales becoming strongly reflexed at maturity (see illustration), numerous, nearly all of the same size, broader than long, one half inch wide, striate, with a wavy or entire, thin, rounded edge; the bract on their backs closely clasped, small, three or four lines long, spatulate with an attenuate tip; seeds two lines long, angular, with resin vesicles on the upper side; wings large, elliptical, one fourth to one half inch long, one half as wide, thin, and convex; leaves scattered, quadrangular (not in two ranks and flat as in the Hemlocks), linear, five to fifteen lines long, a half line wide, acute, strongly keeled above and below, narrowed to a slender petiole, which is promptly deciduous when withering, from the persistent leaf base; the latter less prominent, convex, and shining than the other species; male flowers very small, in clusters at the ends of the branchlets of the season, globular, three to four lines high, slightly raised out of the bud scales.

A peculiarity of the Alpine Western Spruce is observed also in the Sub-Alpine or Mountain Pine (*Pinus monticola*), *i. e.*, the cone scales at maturity open out and turn firmly back, displaying their striated inner surface (see illustration). The leaves, never in two ranks, are often so clustered as to recall the foliage of *Larix* (Larch), as do also the cones resemble those of that genus.

Dr. Engelmann in "Botany of California," page 121 (1880), separates this species from *Tsuga Mertensiana*, as a section characterized thus: "Leaves mostly convex or keeled above, acutish, stomatose both sides; pollen grains bilobed; cones larger—*Hesperopeuce*."

The other species he places under *Eutsuga*, characterized by: "Leaves flat, obtuse, stomatose only beneath; pollen grains discoidal, cones small, an inch long or less."

The characters indicated are fully substantiated by specimens recently collected at various stations in California and Oregon, and, taken with the other features noted, they indicate clearly a wide separation of this Sub-Alpine Spruce from *Tsuga*.

Hesperopeuce is the fourth genus covered by the somewhat vague term of Spruce. The propriety if not the scientific necessity of separating it from *Tsuga* may be justified upon the ground that the Conifer family is so large and the necessity for dividing it into groups for convenience of comparison is so apparent, that comparatively slight differences—so they are fundamental—must be taken for generic distinctions, as in the case of *Tsuga* taken from *Picea*, *Libocedrus* from *Thuya*, *Chamæcyparis* from *Cupressus*, and the like. In this case, however, several fundamental characters are not wanting for the establishment of *Hesperopeuce*, a term coined by Dr. Engelmann and meaning "Western Spruce."

It is not strictly a Hemlock in appearance or characters. It resembles the True Spruces, and also the Larches, but is abundantly distinct from all. It is in fact as here classified—*sui generis*.

Cones of a Spruce collected by Rev. E. C. Smith, of Seattle, Washington, on the slopes of Mount Rainier, August, 1889, are very narrow, and not above one half inch thick; two to two and one half inches long, attenuate towards the apex, the numerous, puberulent scales more rigid and firmer on the outer border than the typical form, and not so strongly reflexed. Leaves short, scattered or almost fascicled at the ends of the slender, short, tomentose branchlets, and not convex above, but flat and channeled; dorsal resin duct small.

This Spruce, while differing from true *Picea* greatly, and less so from the present species, may serve to carry this new *Hesperopeuce* back into *Tsuga* when more of its characters are disclosed; in that case requiring a great enlargement of generic characters in order to admit these aberrant forms, which in the dim past may have been as long separated as they, and as well entitled to generic rank.

This step is not taken thoughtlessly, but only after a careful study in the homes of this alpine inhabitant of the western peaks, as well as of its allies, and I think that no botanist acquainted with the Hemlocks of both the Old and the New World will, with this alpine tree before him, doubt that it has more than a remote connection with that well known and very definite group of trees, the Hemlocks.

PSEUDOTSUGA, Carrière.

FALSE SPRUCE.

This is a small but very important genus of two species peculiar to the forest development of the American Northwest.

The botanical name of this genus—*Pseudotsuga*—was coined by the French botanist, Carrière, and is most troublesome to us who are trying to popularize a correct knowledge of our trees. Examination of the distinguishing characters of the genus reveals the fact that the objectionable name was improperly bestowed anyway, for the plants but very slightly resemble the genus *Tsuga*, being much nearer to *Picea*. Some of the differences between *Pseudotsuga* (for so we must call it, there is no recourse) and *Tsuga* may be briefly noted.

The timber of the former is strong and durable, of the latter, weak and brittle; the bark of the former is mostly thick and deeply furrowed, of the latter, thin and flaky; the cones of the former are sub-terminal, of the latter, terminal; the cone bracts of the former are long, exserted, and three-parted, of the latter, short, concealed, and obtuse; the branchlets of the former are smooth, with flat leaf scars, of the latter, roughened by hard, persistent leaf bases; the seeds of the former are devoid of resin vesicles, which are present upon the seeds of the latter; the leaves of the former have two dorsal resin ducts, extending from end to end; those of the latter have but one.

There are two species of False Spruce—*Pseudotsuga taxifolia*, the "Yew-leaved," or "Douglas Spruce" (properly called by the latter name), and *Pseudotsuga macrocarpa*, the "Big-cone False Spruce," the latter usually treated as a variety of the former, but evidently distinct, as shown hereafter.

17. PSEUDOTSUGA TAXIFOLIA, Britton.

(*Pinus taxifolia* and P. *Douglasii*, Lambert. *Pseudotsuga Douglasii*, Carrière.)

DOUGLAS SPRUCE.

[See Illustrations Nos. 9 and 10.]

The Douglas Spruce is the special product of the favoring forest conditions of the Northwest, being a component part of, and precisely coextensive with this great forest development, in all its vast extent, from the Pacific Coast to the Rocky Mountains, and from British Columbia to Central Mexico. No other tree is more manufactured in the West, and none other is found to possess more value for many purposes than the Douglas Spruce. The Sugar Pine, being comparatively scarce and very fine finishing lumber, commands a much higher price, and the Yellow Pine of the West yields a better lumber for many purposes, while the famous Redwood excels all other trees, nearly, in the beauty and general serviceableness of its lumber; but for cheap, strong, durable timber, the Douglas Spruce recommends itself to builders and manufacturers in many ways.

Its headquarters of greatest development is an elongated coast region stretching from the north end of Puget Sound to Cape Mendocino, and from the seacoast to the Cascade and Sierra Nevada Range.

In favored localities of this belt the Douglas Spruce forms almost exclusive bodies of dense forest composed of tall, straight, thick-set trees, making jungles of excessive gloom and grandeur.

Its accessibility from the ocean through the many branches of Puget Sound, the Columbia River, and half a dozen other navigable streams crossing the narrow belt, cause the Douglas Spruce to be almost the first lumber tree to be reached, and no timber is more familiar to dealers than this under various names: "Oregon Pine," "Yellow and Red Fir," "Douglas Spruce," etc., the last being the most appropriate name.

The tree in favorable circumstances, as upon a high, cool plateau of the Sierra, becomes two to three hundred feet high, and four to seven feet, often eight to twelve feet in diameter. When standing alone on the edge of a forest it assumes a perfect pyramidal form—as do all the Spruces, and like them also in a dense forest it trims itself and becomes tall, straight, and slender.

The bark of the Douglas Spruce is quite variable though generally dark, but varying from dull black to reddish and even gray.

The wood is by no means uniform in appearance or quality. Two kinds are generally distinguishable, designated by the prevailing color: one being close-grained and yellowish, giving the timber the lumberman's name of "Yellow Fir;" the other coarse-grained and reddish, and called "Red Fir." As the tree is decidedly not a Fir, but a Spruce, it is desirable to always use the proper term of Spruce, and so get it substituted, in time, for the lumberman's erroneous name of Fir.

Experienced woodmen claim that they can distinguish the Yellow from the Red Douglas Spruce by the general appearance of the tree, and the characters of the limbs, bark, etc.; but others declare that only the ax and saw will certainly reveal the characters—and this seems the

more probable, if what they assert is true, *i. e.*, that both red and yellow wood may often be found in the same tree.

It may be stated just here, that the manufactured lumber certainly presents two well marked and differently colored kinds, whatever trouble the botanists may find in trying to account for it.

The external characters are these: "Yellow" Douglas Spruce is generally found nearest to the coast, and is a heavier bodied, longer limbed tree than the other, and it has spreading, or sweeping foliage; the bark is brownish or grayish, coarse, and deeply furrowed. "Red" Douglas Spruce is generally found farther inland, and is apt to be tall and slender, but little tapered upward, its bark brown, or even black, and nearly smooth, slightly furrowed; the lower limbs are descending, often with pendulous branchlets several feet long; the hue of the foliage, also, is a darker green.

The characters of the wood as usually observed are: "Yellow" Spruce has sap-wood of a faint, creamy tint, the heart-wood darker, generally a decided yellow, often a saffron tint; the grain may be coarse or fine, but the two tissues (summer and winter) are very different in texture, but easily worked when handled with care; also, the yellow sort may often be found in long lengths clear of knots. "Red" Spruce is usually decidedly reddish, a light cherry red; the annual layers, generally coarse and wide, are so evenly grained that in working it presents a hard, flinty surface; also, the Red Spruce is apt to be accompanied by knots, usually, however, firmly interwoven with the other layers, and so not seriously affecting the serviceability of the timber.

For many kinds of construction the Douglas Spruce is used in vast quantities. For spars and ship building it has scarcely a superior.

Squared timbers eighty to one hundred feet long may be seen daily sawed and carried out of the many factories on the Puget Sound directly aboard vessels bound to foreign and domestic ports. Piles, mining timbers, railway ties, flooring, stair lumber, weather-boarding—almost every sort of use is made of the Douglas Spruce, its exceeding variableness affording a wide choice in its application.

It is impossible to arrive at any reliable figures enumerating the amount of this lumber produced in the Northwest, for the reason that the Douglas Spruce and the Tide-land Spruce, as also a species of Fir, often growing together, are usually cut, manufactured, and marketed together.

The consumption or shipment from the San Francisco market alone is not far from two hundred million feet, board measure, annually; and of this the output for California lumber factories must be from twenty-five million to thirty million feet.

In the rich Redwood sections of Santa Cruz, Mendocino, Humboldt, and Del Norte Counties, the Redwood is principally sought, and the other trees are only worked, for the most part, because they happen to be in the way, and are utilized as so much profit from what would be otherwise wasted; but in the Oregon, Washington, and British Columbia regions the Douglas Spruce is primarily desired.

POTENCY OF THE DOUGLAS SPRUCE.

No tree of the Northwest is wider or more densely distributed than the Douglas Spruce. Found abundantly in British Columbia, it is indigenous on all the cross ranges reaching to the western slopes of the Rocky Mountains, and is found on nearly all the ranges paralleling the coast, far into Mexico—the only considerable ranges omitted being those of the dry interior basin between the Sierra Nevada and the Wasatch Mountains. This great extension of habitat is very remarkable; also, it is found in apparent equal vigor and enormous dimensions alike near the sea level or near the alpine limits of forest vegetation, as at the altitude of ten thousand feet in the mountains of Colorado. In California some of the largest trees, eight to twelve feet in diameter, are found in the high, cool, western slopes of the Sierra Nevada at elevations of four thousand to eight thousand feet.*

Wherever any other trees are found flourishing best, no matter of what species, *there* the Douglas Spruce will be at its best also, as witness its enormous development in the noted groves of Big Trees in the Sierra, where it vies with them and the Sugar Pine in size. No other tree seems to have such pliability of constitution; any soil, any condition, any exposure almost, is welcome to this cosmopolitan tree, and this quality of adaptability to varied conditions has been wisely availed of by cultivators, for of late years the Douglas Spruce has been largely planted at home and abroad; especially is it used in reforesting denuded regions of Europe. Large quantities of seed are collected annually, and sent abroad, and nurseries of seedlings are found in nearly every province, while large areas of forest preserves have already been planted with Douglas Spruce.

Principal of the Old World countries intent upon benefiting themselves by the use of our trees is Germany, and especially the kingdom of Prussia. Last season Herr William Kessler, Chief Forester of Prussia, came to the United States via Mexico, and he especially examined our western forests, expressing himself as delighted with observations upon the qualities and habits of the Douglas Spruce—this arboreal product of the Northwest affording him the most material for the report to his Government, which followed his return.

Quite recently (April, 1890), a German writer, Dr. Heinrich Mayer, has published several articles in the "Garden and Forest" upon our Cone-bearers, notably one upon this tree, which in Germany is called "Douglasia." He writes at length about its desirable qualities and its cultivability. He declares that the Douglasia will become the Larch of the level and low lands of Germany. This is saying much in its praise where the Larch is as highly valued as in Germany.

The tree in cultivation maintains its disposition to vary greatly, and the doctor writes: "Where it is heaviest, it comes nearest to Larch, but when lightest it is the equal of any Fir, Spruce, or Pine."

Second only to the Germans are the French, Belgians, Austrians, Swiss, Italians, and English, in their appreciation and utilization of the Douglas Spruce, while large quantities of the seeds are exported yearly to Australia and New Zealand.

* A specimen tree section of Douglas Spruce was sent by the writer to the Centennial Exposition at Philadelphia, from a tree cut near Webber Lake, Sierra County, California, at an elevation of seven thousand six hundred and twenty feet, that was two hundred and forty-five feet high, nine and one half feet in diameter, and five hundred and sixty-five years old.

THE MANY NAMES FOR THE DOUGLAS SPRUCE.

No other western tree has been so much tossed about by the botanists and given so many names. While all the pitch trees, now treated as the tribe ABIETINEÆ, were included in the genus *Pinus*, meager specimens of this tree had come into the possession of the English botanist, A. B. Lambert, Vice-President of the Linnæan Society, collected by the pioneer Mr. Menzies, while voyaging on the northwest coast with Captain Vancouver, in 1797. Professor Lambert briefly described the species in his great work, "The Genus Pinus," published 1803, under the name of "PINUS TAXIFOLIA, the Yew-leaved Fir." In a subsequent edition, 1837, he published a full description under the name "PINUS DOUGLASII, the Trident-bracted Fir" (adopting Mr. Sabine's manuscript name of *Douglasii*), and following the description with this interesting paragraph:

"The materials whence my former account of this species was derived were so imperfect, and the name I had applied being by no means a happy one, and the more especially as the Silver Fir has been called *Abies taxifolia*, I gladly adopt the name of *Pinus Douglasii* in honor of the indefatigable botanist to whom I am indebted for full specimens, from which I have been able to complete my descriptions and plates of the species."

In 1855 the French botanist Carrière, in "TRAITÉ CONIFERÆ," described anew the known species, and he took occasion to separate the Hemlock Spruces from *Abies* under the name of *Tsuga;* and also the form we call Douglas Spruce, in a recent edition, 1887, he put into a new genus, calling it *Pseudotsuga* (meaning "False Yew-tree"), unfortunately a difficult name to popularize, as it is also inappropriate, botanically considered.

Under the name of *Pseudotsuga Douglasii*, the species has been treated in most subsequent publications until very recently.

Lately, Prof. E. L. Greene, of the University of California, followed by several eminent botanists at the East, manifests a disposition to restore the observance of the early "orthodox" law in accordance with the "immense majority vote" of the International Botanical Congress assembled at Paris in 1867, to wit:

ART. 48. For the indication of the name or names of any group, it is necessary to quote the author who first published the name or combination of names in question.

Bearing directly upon the question of the proper name of this Spruce is:

ART. 59. Nobody is authorized to change a name [not even the author of it] because it is badly chosen, or disagreeable, or another is preferable, or for any other motive of little import.

"Publication," adds the venerable De Candolle, "is a fact which even the author cannot annul."

So despite the "unhappy" name of *taxifolia*, which Professor Lambert promptly changed to *Douglasii*, and the good reasons he gave therefor, it is held that an author cannot even change his own work after it is published, and so the earliest (1803) name of *taxifolia* (meaning "Yew-leaved," a term that does not distinguish our species because all the other Hemlock Spruces have yew-like leaves also) must be restored to this species.

This is doubly to be regretted, because to change the specific name thus is to dissever the name of Douglas from immediate association with this species, and it will necessitate some difficulty in establishing his as the popular name. However, as the renowned explorer, David Douglas, had so much to do with obtaining full specimens and disseminating information concerning this as well as numbers of other trees of the Northwest, it is but proper and most fitting that the name of "Douglas Spruce," which has so long obtained precedence, should still be used as the popular name of this noble tree. The Germans, happily, though unscientifically, are helping us in this instance, by calling this Spruce "Douglasia," notwithstanding there is a genus of *Primulaceous* plants dedicated to Douglas under that name.

18. Pseudotsuga macrocarpa, Lemmon.

(*Pseudotsuga Douglasii* Var. *macrocarpa*, Engelmann.)

BIG-CONE FALSE SPRUCE.

[See Illustration No. 11.]

The Big-Cone False Spruce is found on portions of the San Bernardino and other limited ranges of Southern California. It is never so large a tree as the other species, and when mature, is less symmetrical. The limbs are apt to be few, long, and horizontal; the bark dark, thick, and deeply furrowed; the leaves are narrower, more inclined to be acute, and they are keeled by a mid-nerve on the under side; the cones, produced abundantly, are very large, cylindrical—five to eight inches long, and one and one half to two inches thick; the bracts one and one half inches long, and exserted one half to three fourths of an inch, are widest above, three eighths of an inch wide, erose on the margins, and divided above into two acute teeth, the oval-shaped mid-rib extending a half inch farther between them.

The scales are orbicular and convex, the exposed portion with a narrow, thin, crenulate, or wavy edge; seeds large, three to four lines long; wing elliptical, eight to ten lines long. (See illustration, Big-Cone Spruce, No. 11.)

This tree was first discovered by Lieutenant Ives, in his exploration of Southern California, in 1858, and it was named by Dr. Torrey, in his report of the botany of the expedition, as variety *macrocarpa* of *Abies Douglasii*. Later, Dr. George Vasey, Botanist of the Agricultural Department at Washington, in an article contributed to the "Gardener's Monthly," catalogued the tree as *Abies macrocarpa*, thus giving it specific rank; but all the writers who have since had occasion to treat of it, have regarded it merely as a variety of the Douglas False Spruce.

I have in these papers given this False Spruce the rank of a species, as *Pseudotsuga macrocarpa*, without hesitation, because I recognize in it elements that certainly point to such separation.

It must be borne in mind that the evidence of distinctness does not depend so much upon the number of characters, as upon their permanence.

Now, the characters of this Spruce are always uniform—no transition trees connect to the other species.

Again, the other species is both north and south of it, particularly north. If this big-cone development is a recent variation, what has produced it? If a southern climate, why are not the Arizona and Mexican trees still larger coned? If a dwarfed variety, why so prolific in fruit?*

Like the three species of True Cedar described, they resemble one another closely, yet they were evidently separated so long ago that they are now modified by environment, and become distinct lines of development. To unite them arbitrarily is, to say the least, unscientific.

ABIES, Link.

THE TRUE FIR.

The True Firs comprise a single but very large and interesting genus of Pitch Trees, distinguished from the rest by having lateral erect cones, with deciduous, equal-sized scales; and the leaves, falling, leave circular scars upon the branchlets.

The Firs are prominently distinguished from the Spruces, by having, in youth, their branches set in verticils, or whorls of three to nine, with the branchlets in two ranks and forming horizontal strata of foliage, in size diminishing regularly from bottom to summit of the tree, continuing most symmetrical objects in age, even, unless crowded in forests, when they become self-mutilated by dissevering the lower limbs.

The fruit (cone or bur) of the Fir differs from the Spruce, in that it is produced mostly upon the upper branches—rarely when the trees are heavily fruited on the middle ones, also—and the cones are erect upon the upper side of the short, thick branchlets; also, they are mostly cylindrical, and with woolly, close, equal sized scales. At maturity the scales fall away, leaving the axis or receptacle attached to the branchlet. The cone bracts, always conspicuous when the cone is young, in some species stop developing at an early age, while the cone scales grow larger, and soon completely conceal the bracts.† In other species the bracts continue to grow, and, at maturity, are seen protruding far out between the scales.

The leaves of the two genera—Fir and Spruce—agree in being solitary and produced in spirals around the branchlets, but the Fir leaves are more distinctly whitened on the under side (often on both sides) by many rows of white-mouthed stomata, or breathing pores, giving to these trees, anciently, the name of Silver Firs.

The male flowers of both genera are much alike, being spike-like, compound flowers, composed of numerous stamens borne on a short stipe or stalk arising from the numerous bud scales.

The wood of these two great families of trees differs greatly. The Spruce is mostly slow growing, strong, elastic, and durable, while that of the Fir grows rapidly, and is often brittle, soft—soon decaying. There are notable exceptions to these latter characters in our western Fir species, some of which are highly esteemed for their excellent manufacturing qualities.

The cones of all Firs are cylindrical, or nearly so, hence their fertile scales are uniform in size from end to end of the cone. They are

* When I first visited the headquarters of this Big-Cone False Spruce, in the San Bernardino Mountains, May, 1876, the cones of the preceding year's crop lay on the ground so abundantly that they were two or three deep under most of the trees—a degree of fecundity never observed in the *taxifolia* species.

† See short bract on single scale in illustration of California Red Fir.

always compactly and symmetrically arranged in nearly flat spirals directed to the right. The upper exposed portion of the scale is always wide in proportion to its length, and while growing is swelled outward by a smooth boss (umbo), when dried (as in herbarium specimens), so convexed as to appear swollen.

When removed from the cone axis, or receptacle, and freed from its two seeds, a scale reminds of a saddler's cutting knife or an Indian tomahawk without the handle.

The seeds are elongated, angular, and like the Hemlock Spruces, they bear resin vesicles on their surfaces; the kernel is oily, with a terebinthine taste. The seed wings are coextensive with the expansion of the scale, each wing covering one half of the scale, also covering the upper side of the seed, and lapping over a part of the lower side. In shape, they resemble a common nail hatchet, and they are firmly persistent to the seed.*

Like the Spruce and Pine families, the Firs are widely distributed over northern portions of both continents, and from the sea level to mountain summit. The most southern species on the eastern continent is on the Atlas Mountains of northern Africa, along with the Atlas Cedar described; the most southern Fir in America is found sparsely on the highest Cordilleras of Mexico.

19. Abies taxifolia, Desfontaine.

THE COMMON EUROPEAN FIR.

One of the Old World species must be described for the benefit of comparisons. The Common Fir of Europe, largely planted in parks and forest preserves, is indigenous on the higher Alps at elevations of two thousand to four thousand five hundred feet, and it forms dark green belts of color between the mountain fringes of lighter colored Norway Spruce above, and the parti-colored, deciduous-leaved Oaks and Ashes below; also, it extends farther south along the mountain ranges than does the Spruce, being found the entire length of the Apennines, and on the Carpathian Mountains south as far as the historic elevations of Greece.

This Common Fir is a lofty tree (for Europe), being eighty to one hundred feet high, and occasionally reaching four to five feet in diameter, with a straight, erect trunk, regularly furnished with whorls of branches in the usual manner. What is supposed to be a variety of the Common Fir was formerly plentiful on the Grecian mountains, including the sacred Mount Apollo, and upon the mighty and celebrated Mounts Parnassus and Olympus, where, in olden times, the people climbed up in vast numbers to consult the oracles, and where giants piled up rocks in hopes to scale heaven. On Mount Mænalaus a grove of Firs so protected the snow from melting that the ancients characterized the locality as the "Abode of Winter."

In poetical and historical references of early times, where the word "Pine" is used (in Greek *Pitys*), it is probable that some form of this Fir is meant, on account of its accessibility. Until about the year 1700,

* See winged seeds in illustrations of California White Fir, California Red Fir, and Yellow-fruited Fir.

the term *Pinus* was applied to all the pitch-bearing trees—a practice still allowed to poets, travelers, and unscientific writers.

As in the western continent, so in the eastern, often isolated ranges of mountains will possess their special species of Fir. From the Sierras of the Spanish Peninsula to the lofty masses of the Himalayas of India, thence to the sacred Fusi-Yama of Japan, the Firs are found clinging to their sides, all bearing a general resemblance, but each more or less specialized by the long separation of time and distance.

From the discussion given in early paragraphs of this report to the phenomena of the Glacial Epoch and Plant Dispersion, this specialization of the Fir family in Eurasia is just what is to be expected. As the sheet of ice receded northward at the close of the cold period the cold-loving plants endeavored to follow, but when obstacles of hills and mountains were encountered, the plants ascended them, keeping the while in congenial climate, *where their successors flourish to-day!* But if the mountains were not high enough, and winter's favoring conditions fled from them on the one hand, and the summer heat arose on the other and caught them on the last heights, withering their branchlets and sapping their vital powers year by year, from age to age, they slowly succumbed to fate, and thus many of the lines of development, which now we call species, became extinct.

20. Abies balsamea, Miller.

BALM OF GILEAD FIR.

This is the larger and more abundant of the two Firs indigenous to the eastern United States, and is found on the hills of Labrador and Canada and New England, west to the Great Bear Lake and the eastern base of the Rocky Mountains, south along the Alleghany Mountains to the peaks of Virginia.

It is a small tree, never exceeding seventy or eighty feet in height, by two feet in diameter. In alpine situations it is reduced to a prostrate shrub; in lower places it is at its best in damp woods and mountain swamps.

This tree, like most other species of Fir, is richly supplied with "balsam," an aromatic, liquid resin that is secreted in blisters or vesicles under the young bark of the stem and branches. By puncturing these blisters the "Balm of Gilead," so called, or balsam, is procured, becoming the celebrated Canada balsam, much used in the arts and in medicine.

There are several varieties of this eastern Fir in cultivation, with cones varying from three to four inches in length, and one to one and one half inches in thickness—in all respects not half as large as the Common Fir of Europe, and quite insignificant when compared with the mighty trees of the Northwest.

It is well worthy of cultivation, however, for parks and ornamental gardens.

21. Abies religiosa, Schlect.

MEXICAN SACRED FIR.

This is a most beautiful species of Fir, inhabiting the highest peaks of Mexico and Guatemala.

In the cañons on the largest mountains it becomes a very symmetrical tree, one hundred and fifty to two hundred feet high and large in proportion. On the upper limit of vegetation, as on Popocatapetl, it is dwarfed to a flat-topped bush. The cones are small, three to five inches long, with the bracts long and exserted like its congeners, *Abies Fraseri* of the Eastern States and *Abies nobilis* of Oregon.

The Mexican Fir is much used in the ornamentation of parks and in the decoration of churches and cemeteries, by the native devotees of the warm south land, who regard this tree, holding out its waving branches from the lofty Cordilleras, much as did the ancient worshipers of the Cedar of Lebanon, in the valley of Palestine, as a benison of good; blessing by the fragrance of its foliage and the healing qualities of its balsam.

FIRS OF THE NORTHWEST.

CONSPECTUS OF THE GENUS.

§ 1. Megacarpæ.—Species with cones large; bark, red within; leaves short, scattered.

A. Leaves flat, grooved above, keeled below.

1. *Abies amabilis.*—Amabilis, or Lovely Fir.
2. *Abies nobilis.*—Noble, or Bracted Red Fir.

B. Leaves quadrangular, keeled above and below.

3. *Abies magnifica.*—Magnificent Red Fir.
   Var. (*a*) *Shastensis.*—Shasta Red Fir.
   Var. (*b*) *Xanthocarpa.*—Yellow-fruited Fir.

§ 2. Microcarpæ.—Species with smaller cones; bark, grayish within; leaves longer, mostly two ranked, flat, grooved above, keeled below.

A. Leaves twisted at base.

4. *Abies grandis.*—Great, or Oregon White Fir.
5. *Abies Lowiana.*—Low's, or California White Fir.
6. *Abies venusta.*—Beautiful, or Bristle-cone Fir.

B. Leaves not twisted.

7. *Abies concolor.*—New Mexican White Fir.
8. *Abies lasiocarpa.*—Downy Scaled, or Alpine Fir.

DISTRIBUTION OF THE GENUS ABIES, OR FIR, IN THE NORTHWEST.

1. Amabilis.—Mountains of British Columbia, near Fraser River, southward to Mount Hood, Oregon.
2. Nobilis.—Cascade Mountains, near Mount Hood, and a few trees on the opposite Coast Range peaks.
3. Magnifica.—Siskiyou Mountains and Shasta, southward along the Sierra Nevada to Kern County, California.
   Variety Shastensis—Near Mounts Shasta and Eddy.
   Variety Xanthocarpa.—Near Lakes Tahoe and Webber.
4. Grandis.—Mountains of British Columbia, southward on both Coast and Cascade Ranges to Central California.
5. Lowiana.—Siskiyou Mountains and Shasta, southward along Sierra and Coast Ranges to Southern California.
6. Concolor.—Mountains of Utah, New Mexico, Arizona, and San Bernardino Mountains, California.
7. Venusta.—Local, Santa Lucia Mountains, California, in only a few short ravines.
8. Lasiocarpa.—Alpine on a few high peaks of Alaska, British Columbia, Washington, Oregon, Idaho, Montana, Wyoming, Utah, and Colorado; perhaps in California.

LARGE-CONED, RED-BARKED FIRS.

22. Abies amabilis, Forbes.

THE AMABILIS, OR LOVELY FIR.

This species of Fir, though discovered sixty-five years ago, was not certainly known to exist until recently, the reports of early explorers having lost their credence with botanists, who came to the conclusion that the traditional "Amabilis" was a form of some other species, or else a mythical Fir formed by mixing specimens of two or more species.

David Douglas, the veteran botanical explorer of the Northwest, on his first trip up the Columbia River in 1825, discovered this very local species September seventh "on the top of a high mountain, south of the Grand Rapids of the Columbia River, after a laborious climb of fifteen hours."

With it he had the good fortune to find another new Fir. The first he named *Pinus* (the generic name then of all the pitch trees) *amabilis*, on account of its lovely appearance; the other he called *Pinus nobilis*, for apparent reason, being a most noble tree in aspect.

The two species, he declared in his report, "are the grandest trees of the tribe."

Returning to Fort Vancouver, he there met Dr. Scouler, another successful explorer of the Great West, and the two spent the night in relating experiences, "until the sun, rising over the noble stream, apprised them that another day had begun."

Douglas lost the greater part of his specimens in various mishaps of long explorations during the winter season in a rough country, but succeeded in preserving a few, which he carried home to England and deposited with his English friends. Soon after, he published these two species of Firs, with a third species collected earlier at the mouth of the Columbia (*Abies grandis*, "the Grand Fir"), in the "Companion to the Botanical Magazine," 1836, as *Pinus amabilis* and *P. nobilis*.

In the year 1838 Dr. Lindley published the *A. nobilis* and *A. grandis*, under the present generic name *Abies*, in the "Penny Cyclopedia," and by this early publication of the species under the present generic reference, Dr. Lindley becomes the namer of these two species.

Subsequently (1839), Forbes, in the "Pinetum Woburnense," published all three species, with illustrations, under the generic name of *Abies*, and because he was the first to so publish the Amabilis Fir, he becomes the namer of that lovely species, while the enterprising, toiling, learned Douglas, unfortunately, loses this added honor.*

Time passed, and many botanists visited the Northwest; Jeffrey, in 1856, again reporting the Amabilis Fir from the Fraser River region,

* It is unfortunate, and it seems unjust that the discoverer of an object in natural history, one who, like Douglas, has the energy and daring to explore, the intelligence to comprehend when he has an object in sight that is new to science, and moreover, the ability to describe and name it correctly, referring it to the proper genus in vogue at the time of publishing—I say it seems unjust that such a namer should subsequently lose the honors of discovery and of authorship, because, forsooth, another view of the relative importance of groups places the object in another category, and, therefore, another person, to wit: the one who so places it, becomes the author of the species. Such is the latest usage, however, based upon lately revived ancient laws of nomenclature; and, in the long run, it works less mischief than would a reverse rule, whereby pseudo-scientists could air their vanity by foisting upon us a host of unfounded terms at will.

but others did not see it. For several years authors catalogued the species, relying upon the statements of Douglas and Jeffrey; but, at length, faith in their statements died out, and botanists began ignoring the species.

In 1879, Dr. Engelmann, who was elaborating the ABIETINEÆ for the "Botany of California," boldly declared that there must have been some mixing of Douglas' and Jeffrey's specimens, and the Lovely Fir was therefore a myth—a fictitious species.

The next year, however, in 1880, the doctor, accompanied by Professor Sargent and Dr. Parry, made an extended exploration of the forests of the great Northwest, intent upon settling, once for all, several doubtful subjects that had all along marred our descriptive work; and they were very successful—after toiling as Douglas had done—finding that in every case the original explorers had told but the truth.

On Silver Mountain, near Fort Hope, Fraser River, at the elevation of four thousand to five thousand feet, they came in sight of a beautiful, unfamiliar Fir, which they at once recognized as the long lost "Amabilis"—the *same* that Douglas had first made known fifty-five years previously.

A few weeks afterward Professor Sargent ascended the very mountain where Douglas made his fifteen-hour climb, just south of the Cascades of the Columbia River, and there also was found the Amabilis Fir in all its pristine beauty, and not far distant the Noble Fir, as Douglas had portrayed it.

In 1885, and again in 1889, the writer and Mrs. Lemmon explored the same forest region between the Columbia River and the base of Mount Shasta, where grow these two wonderful firs—*amabilis* and *nobilis*; also near and below them is *Abies grandis*, and above, high on the timber line of Mount Hood, is a fourth species—the *Abies lasiocarpa*—this restricted region of a few miles in extent, containing more species of Fir than any other known area.

The Amabilis Fir is a magnificent tree one hundred and fifty to two hundred feet high, *with a straight trunk two to four feet* in thickness in favorable situations, retaining its limbs and forming a perfect cone of dark green foliage.

The bark of young trees less than one hundred years old, is thin and very light colored for a Fir, sometimes almost white on the outside (but reddish within); that of older trees is thicker—two to three inches—and reddish gray. The leaves are fragrant in a marked degree, even in herbarium specimens. On the sterile branches they are densely crowded—all about three fourths to one inch long; those on upright shoots appressed and notched at the apex; those on bearing shoots are acute, and upward turned. All the leaves are flat, or nearly so, furrowed above and keeled below, with a white band of about six rows of stomata each side of the prominent midrib. A cross-section of a leaf reveals two small resin canals close to the epidermis below, and near the sides.

The cones are dark purple until maturity, four to six inches long, half as thick, tapering slightly towards the apex. The bracts are short, and concealed by the close packed scales in regular sets of spirals, inclined right and left, after the manner of the entire genus.

The timber appears to possess the same light, hard, close-grained character of the other Red Firs, but it is so local, and found at such a high elevation as to be practically unknown to lumbermen.

Quite extensive growths of Amabilis Fir are now known to exist on certain mountains of British Columbia; also, there are scattering trees on a few peaks of the coast mountains, and, as shown, on the Cascade Mountains, near Mount Hood. The southern limit being unknown, perhaps exploration might reveal it within the borders of California.

23. ABIES NOBILIS, Lindley.

NOBLE, OR BRACTED RED FIR.

Much of the history of the Noble Fir has been given in discussing the Amabilis Fir. It was one of the first True Firs discovered by that indefatigable explorer, David Douglas. After a fifteen-hour climb up the Cascade Mountains, south of the Grand Rapids of the Columbia River, and in the vicinity of Mount Hood, he first detected this magnificent tree, and noting its noble bearing and great size, was prompted to name it *Pinus nobilis* (all the pitch trees in his times, sixty-five years ago, being considered as in the genus of Pines, the section embracing the "Silver Firs" being called *Abies*). It happened that several botanists soon after (about 1837) raised the section *Abies* to the rank of a genus, and Lindley, in 1838, published this Noble Fir with others in the "Penny Cyclopedia" as a species of *Abies*, and so he became the author.

The Noble Fir is less frequently met with than the Amabilis, being found only on the Cascade Mountains, as stated, in a very limited area, extending southward along the Cascade Range to the Umpqua and Rogue River spurs; also, it is sparsely found on a few of the Oregon coast mountains, and doubtless it extends to high plateaus within the limits of California. Only extended and careful exploration will determine this point.

The Noble or Bracted Fir is a red-barked tree one hundred and fifty to two hundred and fifty feet in height, and becomes three to five feet in diameter. The bark is brownish outside, reddish within; the limbs in favorable situations are regularly verticillate and nearly horizontal; the leaves densely crowded on the upper side of the branchlets; those on the lower surface twisted at the base so as to bring them into the horizontal position; those on the upper more or less curved and erect, so that the branchlets resemble long, narrow, flat brushes, the leaves representing the bristles.

The leaves of this Fir are mostly flat, though often partly quadrangular, the flat ones furrowed above and with a rounded keel below.

The cones are somewhat variable, usually long, and perfectly cylindrical, six to nine inches long and three to four inches thick. The most peculiar and beautiful character of this wonderful tree is connected with the decorations of the cone, consequent upon the great length and abrupt, depending, deeply dentated, dark brown portion of the bracts that are exserted even at maturity for a distance of one half to three fourths of an inch beyond the cone scales, and clothing the entire cone, as with many spirals of exquisite, narrow fringes of scales. These bracts remind one of the scales of the sturgeon. They are purple until maturity, turning a bright, glossy brown, the long, attenuate midrib darker.

Until the rediscovery of the Noble Fir recently on the Cascade Mountains by Professor Sargent, and its perfect identification as the original of Douglas, a form of Fir with extended bracts upon its cones, found abundantly in the vicinity of Mount Shasta (my *A. magnifica*, var. *Shastensis*), was taken for the decorated, Bracted Fir of Douglas' discovery, and so it was treated as late as 1880 in the "Botany of California" and other publications. Now, the Noble Fir is found to be quite different. Its dark green, usually flat and furrowed leaves crowded upon the branchlets, and its mostly long, purple cones with long, exserted, and deeply toothed bracts, well distinguish it from all forms of the next species, with which it has been confounded.

Dr. Maxwell T. Masters, editor of the "Gardener's Chronicle," London, England, has published an able article (1886) in which he argues that all the Red Firs are but forms of one extensive, polymorphous species, the Nobilis form being the first discovered, becoming the type; the southern trees of California, he suggests, are merely varieties.

Cogent as may be these views, there are quite a number of salient points of difference, and it will be found, for the purposes of classification and forestal considerations, that it is best to treat them as separate species—doubtless derived at no distant date, geologically considered, from one stock, but separating so long ago as to be now practically distinct.

Nuttall, who visited the northwest coast in 1834, gathered materials for describing and illustrating this species in his "North American Sylva" under the name of "Decorated Silver Fir."

"To me," he writes, "this species appears very evidently allied to *Abies Douglasii*" [now *Pseudotsuga taxifolia*], a conclusion to which it seems impossible that so profound an observer as Nuttall could have arrived with the knowledge he had of both trees. Almost the only point of resemblance is the long, exserted bracts decorating the cones; but the Douglas Spruce cones are pendent, with persistent scales.

The wood of the Noble, or Bracted Fir is light, hard, strong; rather close-grained, and compact, qualities that commend it to lumbermen; but it is found only at such high elevations and in such limited range, that it is practically unknown.

It should be largely cultivated, if only for its symmetrical branching habit, its dark green foliage, and its beautifully decorated cones.

24. Abies magnifica, Murray.

MAGNIFICENT, OR CALIFORNIA RED FIR.

[See Illustration No. 13.]

This great Red Fir is not only the largest tree of the family, but is one of the largest trees in California, world famous for large forest trees. It is found on the high plateaus and sheltered slopes of the Sierra Nevada Mountains, on both sides, nearly from end to end of this lofty chain.

Around the base of Shasta, forming a dense, dark forest miles in extent, and scattered less thickly over the neighboring mountains of Trinity, Scott, and Eddy, is found a form of this Fir, with long exserted cone bracts, at elevations of four thousand to eight thousand feet; the southern typical form, with short, inclosed bracts, is found higher, reaching ten thousand feet near Mount Whitney.

This beautiful "Queen of the Sierra" is most regular in youth, with its verticils of branches maintained in perfection until age, if favorably

situated, and becoming a noble tower of stratified foliage one hundred and fifty to three hundred feet high. The leaves are so short and close wrapped, the branchlets so numerous and regularly placed as pinna along the broad, almost contiguous sprays, that the light of day is but partially admitted; and the visitor to a Fir forest, in looking upward, gazes through veil after veil of airy, gauzy, reticulated sprays that give an impression of beauty and grace that transcends anything elsewhere seen in the vegetable world.

Travelers who have visited all the noted forests of the globe constantly aver that our California Fir forests combine more of symmetrical arrangement, lofty and majestic port, columnar architecture, and gauzy, tapestried canopy, than meets the eye in any other region, save, perhaps, certain tropical groves of tree ferns; but these are not on such a scale of magnificence as characterize a California Fir forest.

The trunks of this magnificent tree, if in the forest depths, are straight, free of limbs to a great height, and perfectly columnar.

The bark is grayish or brown on the outside, very deeply cracked or seamed into large, mostly longitudinal sections. When broken or cut with a sharp instrument the bark is found to be hard and of a deep, madder red color.*

Of course, the layers of bark correspond in number to those of the wood, but the outer layers are finely broken by the expansion of the tree and are weathered off, leaving only the interior, later ones still abundant enough on old trees to be very thick—four to six inches.

The wood is light, soft, quite strong, close-grained, with a satiny sheen, and for these qualities it is much used in various manufactures. Strangely for a Fir tree, it is quite durable in contact with the soil, hence it is desirable for bridge timber, sills, railway ties, sidewalks, etc.

The color of the wood is light red; the sap-wood, usually very thick, is somewhat darker colored.

This Fir has long been known to lumbermen for its excellence, but as its habitat is usually quite elevated, not much Red Fir lumber has been manufactured, though as the Redwood, Pine, Spruce, and Douglas Spruce give out in the most approachable parts of our forests, and the sawmills are moved inland, the Firs will be more and more utilized, but, of course, each species in a different degree, according to quality.

It is quite impossible to obtain reliable figures of the annual production of any given species of Fir, for the reason that so many kinds of timber in lumber yards are called by one name; or, *vice versa*, a half dozen names are given to one species of tree.

There is need of a careful examination of our forest growths, and a systematic naming of each, accompanied by plain descriptions, that all concerned may converse about them intelligently and be understood.

* I sent to the Centennial Exhibition, at Philadelphia, a section from the trunk of one of these Magnifica Firs, growing near Webber Lake, Sierra County, California, that was eleven feet four inches in diameter, four hundred and thirty-five years old, and one hundred and seventy-eight feet high. It required the labor of two men an entire day to saw the tree down, using an eleven-foot saw, cutting away the bark on opposite sides for the play of the saw; and when it fell it brought down twenty-three other trees, with a succession of crashes that continued for fully five minutes. A cut was taken from the butt of the log two feet four inches long, turned down on end, split into halves, one of the parts split and redivided, until a wedge-shaped section, eighteen inches wide on the back, and extending to the heart, was secured. This was split across half way between heart and bark, the heart turned about and lapped against the bark, making a quadrangular block, which, when dressed down and planed on one side, made a specimen two feet long, five and one half feet wide, and fifteen inches thick, attracting much interest at the Exhibition.

As in the other Red Firs, the object of greatest beauty about them is the large and prominent cone standing upright on the uppermost limbs. They are so large—six to eight inches long by half as wide—and they sit up on the almost bare branches so prim and conspicuous that they are often taken for a flock of pigeons, or a solitary owl or hawk. Especially is the description complete in the case of the decorated cones of the northern trees, with their many spirals of feather-like bracts draping them from end to end. The cone scales of nearly all Firs are woolly pubescent externally, and are very regularly and closely arranged in many spirals around the axis, each scale with a slightly raised horizontal boss or swelling on the upper or exposed end while growing. When removed from the axis and freed from its two seeds, a scale reminds, in outline, of a saddler's cutting knife, or an Indian tomahawk without the handle. The scales of the Red Firs are over an inch broad at the widest part of the blade.

The bracts are broad, modified, leaf-like expansions on the back of each scale; are various, mostly narrow and shorter than the scales—so are inclosed; often they are long and exserted, also notched and terminated by the awl-like midrib.

The seeds of the Fir family are angular, elongated, covered above by the base of the wing, which also laps over and partially covers the lower side. The seeds of Firs, like those of the Hemlock Spruces, bear on their surfaces one or more resin vesicles, and the kernel is very oily, with a terebinthine flavor.

The wings are persistent, and always nearly coextensive with the expansion of the cone-scale, each wing covering one half of the under side of a scale therefore, large or small, wide or narrow, according to the size and shape of the scale. Red Fir seed-wings are usually bright purple, the White Fir often pale.

The leaves of the Fir are, considering the *magnifica*, peculiar, and distinguish the species from others with which it has been confounded. They are not flat and grooved above, as in most other species, but quad*rangular, and keeled by a longitudinal line* above and below. They are never *twisted* at base, but those on the lower side of branchlets curve outward, so as to bring the points of the leaves upward.

The leaves of the Fir family are usually whitened beneath by the *presénce*, in abundance, of lines of stomata, or breathing pores. All the Old World Firs have such whitened leaves, giving the popular name of "Silver Fir" to the whole family, but the name is not always appropriate on this continent.

The columns of stamens forming the male flowers of this Red Fir are usually abundant on the terminal branchlets fringing the lower limbs of adult trees, and, at maturity, when ready to discharge the pollen in yellow clouds, are about half an inch long, and of a bright, madder red color—so that when the limbs of a Magnificent Fir are swayed by a mountain zephyr at this period, it appears as if the tree was enveloped in lurid flames.

The Magnifica Fir is quite variable in the one respect—that of the length of the cone bracts—and one of its forms was, for many years, confounded with the "Noble" or "Bracted Fir" of Douglas, on account of the conspicuousness of its bracts; but, as was shown in the discussion of that species, it is plainly distinguished from that Fir by its

lighter green and less crowded leaves, quadrangular and doubly keeled; and by its cylindrical cones, with scales normally inclosed.

Differences in the characters of the timber are observable, also; not enough to classify whole forests of timber separately, but variable enough to give a large choice of material to the manufacturer.

25. Variety Shastensis, Lemmon.

THE SHASTA RED FIR.

This variety forms a large, almost exclusive forest on the high plateau of lava thrown out by Shasta in former times. A few trees are scattered, also, over the high southern slopes of Mount Eddy, Scott and the Trinity peaks, at elevations of six thousand to eight thousand feet. The illustration of two standing Firs, which accompanies this report, was taken from a photograph of trees at Horse Camp, near the timber line of Shasta, before sunrise.

The peculiarity of this variety of Fir, aside from its locality, is connected entirely with the fact of its cone-bracts becoming long and protruded, a half to a full inch between the scales, rendering the large purple cones, thus decked out with tasseled fringes, a most beautiful object. This feature of the cone caused this tree to be considered as identical with Douglas' "Bracted Fir," described, and it was so classified as late as 1880, in "California Botany," but is now known to be clearly distinct.

The trees are very large and lofty, though not so immense and high headed as in the typical southern form, but they become, on the southern slopes of Shasta, a dark, gloomy assemblage of massive black trunks, colored on the north side from base to the limbs with bright yellow lichen, or tree moss, the lower limbs draped here and there with long, sweeping festoons of black, filmy lichen, giving a funereal aspect to the whole scene, scarce relieved by the twitter of a red squirrel, the long, wailing note of a woodpecker, or the occasional cry of a bald eagle.

Too elevated to be yet reached by the avarice of man, but little is known of the qualities of this Red Fir, but it is probably not unlike its southern relatives.

26. Variety xanthocarpa, Lemmon.

THE YELLOW-FRUITED RED FIR.

[See Illustration No. 14.]

In the high Sierras around Meadow Lake, Sierra County, California, is a variety of this California Red Fir that is strikingly different from the typical trees forming the greater part of the noble forest around and below it.

It is a smaller, less symmetrical tree than the typical, and it bears smaller cones, averaging four to five inches long, half as thick near the base, tapering slightly to the apex, of a yellowish color until maturity (suggesting the name from the Greek *xanthos*, yellow), the scales, seeds, and seed wings proportionately smaller.

The leaves are very short, not over a half inch on the most vigorous branches, and they are close wrapped on the outer-bearing limbs, making the branchlets seem almost naked, giving a still more airy and gauzy effect to the foliage that was mentioned as so pleasing a feature in the canopies formed by the lofty heads of the typical form.

It is perhaps this form that has been called *lasiocarpa* by seedsmen abroad, but that must be a misnomer, as the above name was applied by Hooker in 1840, to a truly woolly scaled Fir collected by Douglas on the alpine heights of Mount Hood in 1825 (to be described in the proper place).

This variety is another of the practically unknown trees of the great Sierra forests, and suggests the possible riches that clothe the slopes and high plateaus of the great California cloud condenser—the Sierra Nevada Mountain Range.

SMALL-CONED, WHITE-BARKED FIRS.

27. Abies grandis, Lindley.

GRAND, OR OREGON WHITE FIR.

This, the first of the White Firs to be discussed, is indigenous over a large area of the Northwest from Vancouver Island down along the low, rich valleys of Washington and Oregon and the higher valleys and slopes of the Sierra to Yosemite.

It was the first new tree to confront the great explorer, Douglas, on Cape Disappointment (the heavily wooded point south of the mouth of the Columbia River), where his vessel touched the coast (April, 1825), after having been kept, by the severe winter weather, outside the bar for six weeks. Of the weather, he declares: "The hurricanes of North America are a thousand times worse than those of the noted Cape Horn."

At last, on the seventh of April, at four P. M., the ship came to anchor in Baker's Bay, just north of the mouth of the river, and "thus terminated my long and tedious voyage of eight months and fourteen days." But at once his circumstances change. "The night following, I reckon as among the happiest moments of my life." "The greater part of the country," he states, "as far as the eye could reach was covered with pines of various species."*

On stepping out of the boat he picked up *Rubus spectabilis* and *Gaultheria Shallon*, and the first tree he reached was a new one which, on account of its great size, he named *Pinus grandis*, though he did not report his discovery until five years later (1830).

In 1836 he published it under that name in the "Companion to the Botanical Magazine." Subsequently (1837) Dr. Lindley published it in the "Penny Cyclopedia" as *Abies grandis*, and this being the present reference, he thus becomes the author of the species.

* The Conifers (all called Pines in his day), which gladdened the soul of Douglas a few days after on that promontory of Cape Disappointment, were anything but disappointing to the storm-tossed botanist. There were at least eight species, representing as many genera, as we now know them, all within the radius of his vision: *Pinus contorta*, growing on the drifting sand of the outer shore; *Tsuga Mertensiana* and *Picea Sitchensis* next in the moist, swampy slopes of the promontory; the great *Thuya gigantea*, forming the greater part of the brow of the promontory, with the monster Fir, *Abies grandis*, and the great False Spruce, which was thereafter to bear his name *Pseudotsuga taxifolia*, crowning the elevation, while in deepest shade by spring or stream shone the bright-leaved Alaska Cedar, *Chamæcyparis Nutkensis*, and the Western Yew, *Taxus brevifolia*.

The Grand Fir is the most abundant and has the widest dispersion of any of the White Firs, with headquarters in the rich, moist valleys of western Washington and Oregon, where it attains often a height of two hundred to two hundred and fifty feet, with a diameter of three to four feet. It is a very beautiful tree when young or in open situations, with its regular whorls of horizontal branches. In age in the dense forest it trims itself to a great height and presents a tall, slim, naked boll, straight as a line for two thirds or three fourths of its height.

The species is distinguished for its comparatively long, flat leaves, glossy green, and channeled above, whitened below, with two longitudinal stripes of stomata, or breathing pores, in several close rows each side of the prominent midrib. The leaves are an inch or two long, narrow, and notched at the apex; those on lower limbs mostly two-ranked, on the upper branches shorter and curved around the branchlets so as to point upward. The leaves that are two-ranked become so by a twist, half round at the base, which brings the blade horizontal and on a plane with the branchlet; the leaves on the lower side of the branchlet are always twice longer than the upper ones.

The cones are olive green until maturity, small, usually perfectly cylindrical, and truncate at both ends, two to four inches long, composed of slightly pubescent, thin, uniform, closely packed scales, about twice broader than high, about an inch wide; the small bract on the back of each obcordate or two-lobed, with a short pointed midrib. The seeds are small—about one quarter of an inch long—the wing three times longer, widest above, light purple; the two wings nearly covering the upper surface of the scale.

HISTORY OF THE GRANDIS FIR.

Much confusion has existed with reference to this interesting species of White Fir, some authors putting several forms, including *Abies concolor*, and even the long lost *amabilis* with it. Dr. Masters, editor of the "Gardener's Chronicle," London, in a recent article (May, 1889), clearly shows that it is a most distinct species, limited and described as above, but he places it as variety *Lowiana*, the form of White Fir found exclusively in California in great abundance, and which I consider truly distinct, as discussed in proper place.

The *grandis*, which, being particularly abundant in Oregon, may be called, for distinction, the Oregon White Fir, makes very light, soft, coarse-grained timber, not strong nor durable, but it is largely manufactured in Oregon for interior finish, for packing cases, and cooperage. In California the trees are generally neglected as nearly worthless, except for fuel, the soft quality of the lumber giving for it the sobriquet of "Pumpkin Pine."

The bark of this tree may be brown, or even quite black, but within it is of a grayish hue like the other species with which it is associated in descriptions.

28. Abies Lowiana, McNab.

(*Abies grandis* var. *Lowiana*, Masters.)

LOW'S, OR CALIFORNIA WHITE FIR.

[See Illustrations Nos. 15 and 16.]

This Fir is distributed somewhat plentifully over the State at middle elevations, from the southern slopes of the Siskiyou Mountains and the Shasta region, down along the Coast and Sierra Ranges to nearly the southern end of the State. Its headquarters are in the high Sierra, where it often attains a height of one hundred and fifty to two hundred feet, with a diameter of four to six feet.

The bark is thick and deeply checked on old trees, and whether brown or darker, according to situation, is always whitish within, suggesting the common name of White Fir. As it is found abundantly and almost exclusively in California, I suggest that it be called California White Fir.

In the Sierra this tree is usually associated with those species of Pines that affect an elevated locality, as the Sugar Pine, Mountain Pine, and the Tamarack Pine, and with the Magnificent Fir and the Sub-alpine Spruce described—the California Fir forming broad belts of dark green forest just below and apparently supporting the other species of Cone-bearers, uplifted on the sheltered slopes of the Sierra.

The California White Fir, or *Abies Lowiana*, is distinguished by having a rather rigid habit, the branches relatively shorter and stouter than those of *Abies grandis*. The young shoots are olive green, the buds ovoid, the leaves dark green above, whitened with stomata below (also with a few rows above), the leaves relatively very long—one and one half to two inches—nearly all of the same length, obtuse (not indented) at the apex, not usually two-ranked, except on lower branches, yet all are twisted half around at the base, which allows the light to reach through to the branchlets past the distorted leaves.

The cones are nearly cylindrical, or narrowly elliptical, two to three inches long, light green until maturity; the scales not so closely packed nor so uniform as in *grandis*. They are rounded above, slightly pubescent, twice wider than high, upheld by a peduncle one fourth of an inch long, which is abruptly curved outward, thus supporting, erect, the convex blade or expansion of the scale.

The small bract, or modified leaf on the back of each scale, is lanceolate and acuminate, one fourth of an inch long.

The seeds are triangular, elongated, covered above by the shining base of the wing, which, as in all Fir species, laps over half of the lower side. The wings are light purple, widest above, half covering the surface of the scale, and are firmly persistent. (See illustration No. 16.)

The *Lowiana*, or California White Fir, though really quite distinct as shown, has, until lately, been considered a component part of one polymorphic and widely dispersed species, *Abies concolor*. Dr. Masters, before cited, calls it variety *Lowiana* of *Abies grandis;* but the true, original *grandis*, however, is indigenous to more moist, northern regions nearer the coast, and it displays several distinctive structural characters. The *Lowiana* is, in fact, midway, both in locality and in characters, between the green-leaved and green, cylindrical-coned

grandis of the moist, northern forests, and the white-leaved and light green, elliptical-coned *concolor* of the southern, arid, interior regions.

This Fir forms a large part of our California forests in certain localities, notably at middle elevations in sheltered valleys of the Sierra. Where accessible, it is largely manufactured into lumber, and used for light interior finish, as for linings, sheathings, and lathing. It is especially prized for fruit boxes, cooperage, and for all dairy products, dealers averring that this White Fir imparts no flavor to the contents of box or firkin.

For ornamental purposes this tree is planted extensively, and it thrives readily in varied soils. With its ashy green foliage, in regular, horizontal whorls, surmounted, in the season, by light green, top-shaped cones, it is a most pleasing object in cultivation. No tree could be more safely recommended for use in reforestation, as it is very hardy.

The origin of the name of this species of Fir is with Gordon, who, in a supplement to his "Pinetum" (1862), described this species under the name *Picea Lowiana*, the specific name given in compliment to the Messrs. Low, of the Clapton Nursery, England, gentlemen who were instrumental in having this tree introduced to cultivation.

Of course, when the name of the genus was changed to *Abies*, the first botanist thereafter to refer this species to that genus (which McNab did in 1876) has the credit of naming it.

29. Abies lasiocarpa, Nuttall.

(*Abies sub-alpina*, Engelmann.)

DOWNY-CONE, OR SUB-ALPINE FIR.

There is a tall, slender Fir tree bearing brown, narrow, not distinctively hairy cones, found on the timber line of certain high peaks of the Northwest, about which there has been much confusion.

It was first seen by Douglas, during his second exploration of the Columbia River country in 1830, perhaps on the flanks of Mount Hood, where it is now known to be abundant. Jeffrey collected specimens of it in 1852 on the peaks near Fraser River, in British Columbia. It (or similar ones) have been discovered since by several persons on the alpine peaks of the northern Rocky Mountains, the Cascades, and perhaps the Sierra Nevada.

It was described under the name of *Abies sub-alpina*, in 1880, by Dr. Engelmann, who, though he discussed the description of it given by Murray, and before him by Hooker, yet he very singularly ignored their names for the species. Murray, in 1864, having named it *Abies bifolia*, and Hooker twenty-four years earlier, to wit: in 1840, having named it *Pinus* (*Abies*) *lasiocarpa*.

Ever since the profound study given our western *Coniferæ* and their systematic characterization by Dr. Engelmann, in 1880 to 1884, this species has been called by his name, *A. sub-alpina*. As late as 1886, Dr. Masters, who since the death of Dr. Engelmann in 1884, has taken up our western conifers, published it under that name, though he gave some new matter concerning its history.

His reason for leaving the species under Engelmann's name is given as follows: "But for the doubt attaching to Hooker's name, *lasiocarpa*, Nuttall's name, *Abies lasiocarpa*, should have precedence, on the ground of priority, but under the circumstances it seems preferable to adopt Engelmann's designation." But now, only three years later, 1889, Dr. Masters publishes an able article, with illustrations, in the "Journal of Botany" for May, in which he clears up much of the confusion, and shows, at least, that the name is not *sub-alpina*. "The earliest history of the tree," writes Dr. Masters, "dates from 1840, when it was described by Sir William Hooker under the name of *Pinus* (*Abies*) *lasiocarpa*. At that period Sir William considered *Abies* to be but a sub-genus of *Pinus*, an opinion in which he followed the example of Linnæus, Lambert, and others, and which, after Hooker, was adopted by Parlatore and others. The maintenance of *Abies*, however, as a distinct genus from either *Pinus* or *Picea*," adds Dr. Masters, "seems imperative on the ground of convenience, and hardly less so for scientific reasons. In the great work, 'Genera Plantarum,' by Bentham and Hooker, the three groups are treated as separate genera."

Sir William Hooker stated that he received his specimens from Douglas, collected on his last journey to Northwestern America in 1830. Nuttall, in his "Sylva" in 1855, and again in 1857, described, or rather repeated, the description of Hooker, but happily for him, referred the species to *Abies* as a genus, thus: "*Abies lasiocarpa*," and the vernacular name he gave as "Downy-coned Fir," for "the cones were clothed with a dense, almost ferruginous down."

Andrew Murray, in 1864, studied the species, and coming to the conclusion that Douglas' specimen, preserved in the Kew Herbarium, was a mixture of at least two species, he erected another species upon specimens "forwarded by Dr. Lyall from the Galton Range of the Rocky Mountains," and called it *Abies bifolia*, on account of its having two forms of leaves.

Dr. Engelmann, in 1876, in the "American Naturalist," described the species from specimens collected on the peaks of Colorado under the name *Abies sub-alpina*, as stated, a name continued by Sargent in "Forest Trees of North America" in 1884, and also by all subsequent writers, until the appearance of Dr. Masters' last article cited. But Dr. Masters, while showing that Dr. Engelmann had no right to ignore the names of Murray and Hooker, leaves it to be understood that Hooker is the author of the name "*lasiocarpa*," which is true enough, but Hooker did not *fully* refer the species to the genus *Abies*, which Nuttall *did*, and was the first to do so; hence, under the rules, he becomes the namer of the species thus: *Abies lasiocarpa*, Nuttall.

Professor Sargent, in "Garden and Forest," October 16, 1889, alludes to the article by Dr. Masters and properly credits this species to Nuttall.

The writer of these pages has met with this curious, tall, slender Fir, with its brown, narrow cones, in several of its localities, and fine specimens were collected in 1889 on the timber line of Mount Rainier (or Tacoma) by John Muir, Rev. E. C. Smith, and C. V. Piper at an elevation of seven thousand six hundred feet. What appears to be this species may be seen from the California and Oregon Railway train, standing like lances on the steep spire of Black Butte, near Mount Shasta.

Doubtless the species in one of its forms is indigenous to some of the alpine peaks of California, as it is distributed widely and on peaks of similar latitude and altitude.

Specimens in the Lemmon Herbarium, from various sources, show green, obtuse leaves an inch long on sterile branches; paler, shorter, and acute on bearing ones, all with two very large resin ducts within the parenchyma or fundamental tissue of the leaf—not near the epidermis as in most Fir leaves.

The cones are small, narrowly elliptical, two to three inches long, the scales three fourths to one inch wide, and the same in height, the exposed portion covered densely with brown, short, resinous hairs—the hairs suggesting to Hooker the name *lasiocarpa*.

The scales have the abrupt outward curvature of the peduncle observed in *Abies Lowiana*, causing the scale to become nearly erect.

The bracts are very small, three to four lines long, obovate on a narrow peduncle, and with a stout terminating point.

The seeds are relatively small, with large, fan-shaped wings, each covering nearly half the scale.

It may be these three forms of an Alpine Fir, which agree in many particulars, are yet separated by characters which only fuller materials and closer observations will disclose; but from the descriptions here given alpine explorers cannot fail to recognize it, and by collecting full data any one may help to clear up the remaining doubts about the inhabitants of these lofty sentinel stations, and so advance the domain of science.

The specific name *lasiocarpa*, coined by Hooker from Greek *lasios* (hairy) and *karpos* (fruit), alludes to the distinctly pubescent character of the cones, the exposed portion of the scales being distinctly ferruginous-hairy, more so than in any other species.

30. Abies venusta, Sargent.

(*Abies bracteata*, Nuttall.)

BRISTLE-CONE FIR.

[See Illustration No. 17.]

This is the most beautiful of the many species of the Fir family, being extremely symmetrical in its whorls of foliage and unique in the graceful decoration of its numerous cones by means of long, bristle-like terminations to the cone bracts.

It is also the most local and limited of the family, being found only in four or five narrow cañons on the ocean side and near the highest peaks of the Santa Lucia Mountains, half way between Monterey and San Luis Obispo.

They are at maturity tall, slender, pyramidal trees, one hundred to one hundred and fifty feet high; the largest not more than two feet in diameter; leaves mostly in two ranks, by a twist at the base; large, one and one half to two inches long by one to one and one half lines wide; acute, with two broad, white stripes beneath; above they are pale, smooth, and channeled; cones oval to cylindric, three or four inches long by one half as thick; bracts cuneate; obcordate about the length of the rounded scales, terminating in linear, elongated, leaf-like midribs, one to one and one half inches long. (See illustration No. 17.)

This matchless Fir is another of those trophies that rewarded the laborious explorations and keen scrutiny of the veteran explorer of the Northwest, David Douglas, who discovered this tree in March, 1831.

A few paragraphs concerning this event and the various names the tree has borne, cannot fail to interest the general reader.

Mr. Douglas had made a journey to Northwest America in 1825–26, and had explored the Columbia River region industriously; making many important discoveries, especially of Cone-bearers. No sooner had he arrived home and disposed of what specimens he had saved out of his numerous disasters, than he longed to return. Favored by the Horticultural Society of England he made a second journey in 1830, reaching the mouth of the Columbia River in October. In December he sailed southward, intent on exploring California, which, though a hot country, he was convinced possessed hosts of new trees on its mountains. He passed by the Golden Gate—no one at that date attaching any importance to the large bay within and the little hamlet of "Yerba Buena" on the peninsula—and arrived at Monterey, the capital of the territory, December 22, 1830. So jealous were the Mexican authorities that Douglas had to spend three months in negotiating for a permit to explore in the territory. The little he could move about, unobserved, was richly rewarded, however.

"Early as was my visit to the coast," he writes, "spring had already commenced. The first plant I took in my hand was *Ribes speciosum* (a native gooseberry), in full bloom. The same day I added to my new species *Nemophila insignis*, an humble but lovely plant, the harbinger of California spring, and forming a carpet, as it were, of the tenderest azure hue."

When his permit to explore had arrived, he set out eagerly and soon had traversed the region round about, reporting his observations in letters to friends at home. Of California he writes: "Well does it merit its name. The heat is intense and the dryness of the atmosphere invariable, not infrequently 29 degrees, which, if I mistake not, is not exceeded in Africa or Persia. In this fine country how I lament the want of such majestic rivers as the Columbia!" he exclaims.

From time to time he contrived to make excursions to the interior and into the mountains of the coast, until the end of April, when he undertook a journey to Santa Barbara, about May fifteenth.

During one of these excursions from Monterey into the mountains, Douglas had the good fortune to discover this secluded Bristle-cone Fir, which he announces thus to his learned friend Hooker: "I will now mention another new pine to you, *Pinus venusta*, which I discovered last March [1831], on the high mountains of California (you will begin to think that I manufacture Pines at pleasure). As my notes are not at hand [they were subsequently lost], I must describe from memory." Douglas proceeds to describe from memory, and he allowed his imagination to amplify his descriptions, too. Unfortunately, he had no opportunity to revise and correct his descriptions aided by his notes, as he lost his life soon after at the Sandwich Islands.

In published descriptions Douglas is reported as stating: "The *Pinus venusta* attains a great height, and is never seen at lower elevations than six thousand feet, latitude 36 degrees, where it is not uncommon. The entire bracts or appendages between the scales are exserted three to four and one half inches." He, also, is quoted as giving another locality for the species: "On the high mountains along the Columbia River."

It is readily seen that the readers of Douglas' letters have confused this species with the other Bracted Fir of the Northwest—*Abies nobilis*—both of his discovery.

In the numerous published descriptions of this lovely Fir, another pioneer explorer is always connected with its discovery, to wit: Dr. Thomas Coulter.

Dr. Coulter arrived in Monterey in November, 1831, from the south, having the season previous explored the central States of Mexico.

Douglas gave the doctor a warm welcome to California. "Since I commenced this letter," he writes to Hooker, "Dr. Coulter has arrived. He is a man eminently calculated to work, full of zeal, very amiable, and I hope may do much good to science. I do assure you from my heart it is a *terrible* pleasure to me to meet a really good man, and one with whom I can talk on plants."

They had often met before, and around the fitful campfire had passed many a night in botanical converse. Little did the two friends dream then that soon they would be forever separated, and that inadvertently many of the discoveries of Douglas in the vicinity of Monterey would be credited to Dr. Coulter. Coulter visited, also, the locality of the new Fir, procured good specimens, which, with other conifers, he carried home. David Don, describing them in the Linn. Trans., 1837, not only ignored Douglas' name of *Pinus venusta*, published a year previous, but gave the credit of discovery to Dr. Coulter, thus: "*Pinus bracteata*, discovered by Dr. Coulter on the Santa Lucia Mountains of California, at an elevation of six thousand feet," etc. Lambert, in 1842, quoted Don; and the following botanists—Antoine, Hooker, Endlicher, Walpers, Parlatore, McNab—all continue the name of *bracteata*.

Loudon in his "Arboretum" (1844) changed the genus to *Picea*, following the error of Linnæus in assigning the Silver Firs to that genus, and he was followed by Gordon (1875), and later by Lawson, Nelson, Fowler, etc., all publishing it thus: *Picea bracteata*.

Nuttall in his "Sylva," 1854 (reprinted in 1857), had come a little nearer to the right reference by publishing the species as *Abies bracteata*, followed later by Hartweg, Lindley, Carrière, Hoopes, Engelmann, and a score of other authors, down to present date.

But all these authors have not observed Article 57 of the laws of Botanical Nomenclature, previously prevailing and readopted by one hundred and fifty botanists at Paris in 1867, to wit:

"When a species * * * is moved into another genus * * * the specific name * * * is maintained," unless in violation of Article 62, which requires that it be changed if there is already in that genus a species so named. In violation of this rule, it has been the custom of certain modern authors in revising genera to give to the species names at will, which they think are more appropriate, or for other non-essential reasons, forgetting that it is not the aim of science to make names only. "Names are used by her to distinguish things," writes De Candolle. "If a name is sufficiently distinct from others, that is the essential point."

Article 45 lays down the law: "Nobody is authorized to change a name because it is badly chosen, or disagreeable, or another is preferable," etc.

It remained for Professor C. S. Sargent, editor of "Garden and Forest," in a late issue of the journal (December 16, 1889), to restore

Douglas' name (sufficiently published with his memoirs by Curtis, in "Companion to Botanical Magazine," 1836), and to make the full and proper reference thus: *Abies venusta;* and this fortunate scientist, under the rules, becomes the namer of this beautiful species, which must hereafter always be referred to as *Abies venusta*, Sargent.

And it happens, moreover, that Douglas' name of "*venusta*" is most appropriate for this Fir. It is derived from Venus, the goddess of love and beauty, and means comely, graceful, lovely, etc. Why it was ignored so long—fifty-three years—is simply unaccountable.

Sequestered in but a few high perches on the sides of steep cañons in the almost inaccessible Santa Lucia Mountains, it required strength, daring, and zeal to make the discovery of this beautiful Fir; and the same requirements have rendered its visitation since of rare occurrence.

Theodor Hartweg, a German botanist, was sent to Mexico by the London Horticultural Society in 1836. He collected in California in 1846 and 1847, making his headquarters at Monterey, where he made some very interesting discoveries, and, being a powerful man, he determined to secure seeds of the new Fir.

John Meyers, now an aged citizen of Monterey, related to the writer recently the prominent events in the prosecution of this work of Hartweg's—for Mr. Meyers accompanied the botanist.

He describes Hartweg as a tall, slim, but strong, good-looking man of dark complexion, large, observant eyes, and quiet yet attractive demeanor.

They started out with two *burros* and what other equipments they thought necessary, and after several days of terrible struggle and almost fatal hardships, they reached the trees and secured a "flour sack full of cones."

The seeds were sent to London, and when two years old, the few plants that were produced were sold for 25 guineas apiece, or about $130.

The next season, 1847, they planned a second trip with four *burros* and better additional equipments in every respect; but although they reached the grove and scanned every tree, not a cone was to be seen (the Firs were not fruiting that season), a fact which they might have previously ascertained with little trouble by examination of other species nearer at hand, but no one at that time had observed this habit of the Fir family skipping a year occasionally.

Hartweg was blamed by his employers for failing to forward seeds and accused of playing false to them, which embittered the sensitive man and he left their service.

G. R. Vasey, son of Dr. Geo. Vasey, Botanist of the Department of Agriculture at Washington, several years ago penetrated the mountains to the vicinity of these trees and succeeded in securing good botanical specimens, with which he enriched several institutions, including the Lemmon Herbarium.

In 1882 Mr. T. S. Brandigee (now of the California Academy of Sciences) and his assistants climbed up to their fastnesses and, cutting down a characteristic tree, secured for the Jessup Museum at New York a section, which, being wrapped for safety in a bullock's hide, was dragged over the steeps to the borders of civilization by two mules harnessed tandem and led by a native.

The description of this Fir concludes the discussion of the many species of trees belonging to the ABIETINEÆ, or distinctly pitch-bearing trees, forming the largest, most important, sub-order of the Cone-bearers.

CONIFERÆ—Continued.

Sub-order 2. CUPRESSACEÆ. (See Scheme VI.)

CYPRESSES AND THEIR ALLIES.

This is a large group of trees composed of three tribes, each with two sub-tribes comprising seven genera; represented in the great forest development of the Northwest by thirteen species, eleven of them in California.

This sub-order of Cone-bearers include the largest trees known, and the closely allied forms—their progenitors—were particularly abundant in past ages, coeval with the colossal animals of the period, the megalonyx, dinotherium, pterodactyl, etc.

Like these animals, they are undeveloped in some respects, large and coarse, but not compacted and refined, especially in their respiratory and reproductive organs.

In the Cypress-like trees (with one exception) the taxonomy, or arrangement of leaves, fruit, scales, and the like, is opposite or verticillate, not scattered and spiral as is the characteristic of higher organized plants.

The exception to the general character of low development in this sub-order is found in the first tribe, TAXODINEÆ, the Redwoods and their allies, in which the taxonomy or arrangement of the leaves and cone bracts is spiral, and for that reason it is placed as the first or leader of the three tribes in Scheme VI, between the True Cypresses and the Junipers, and as leading the entire sub-order.

Very abundant in past ages, there are but few species extant; the two Redwoods of California being chief, with the less prodigious Bald Cypress in the Eastern and Southern States, the beautiful *Glyptostrobus* in China, and the likewise solitary *Cryptomeria* in Japan, both commonly cultivated in California.

The Redwoods being the special product of California, and withal trees of surpassing beauty, dimensions, and utility, will come up for extended description later on.

31. TAXODIUM DISTICHUM, Richard.

BALD CYPRESS—SOUTHERN CYPRESS.

The Bald, or Southern Cypress of the Eastern States is one of the largest trees in America. Though not particularly tall—seldom exceeding one hundred and fifty feet—it often reaches ten to fourteen feet in diameter.

This grand tree is especially abundant in the deep, frequently overflowed swamps of the Southern States, from the everglades of Florida to the bayous of Texas. "We read more of the Bald, or Southern Cypress," wrote Wilson Flagg, "perhaps, than any other American tree; but what we read relates to some of its peculiarities, such as the protuberances, called knees, that grow up from the roots of perfect trees, and of which, in the economy of Nature, it is difficult to discover the use."

Michaux, in his "Sylva," discusses the so called knees at some length: "Commonly two to five feet in thickness, of a conical shape; they are always smooth on the surface, and covered with a reddish bark, like the roots, which they resemble, also, in the softness of the wood."

"They exhibit no signs of vegetation," he writes (by which we infer that they are not subject to adventitious budding), "and are always hollow within. No cause can be assigned for their existence, and they begin to appear when the trees are but twenty to twenty-five feet high." In the South, the extension of the habitat of this tree is said to exactly coincide with that of the noted Pine barrens, two thousand five hundred miles, from Delaware to the mouth of the Neuces, in Texas.

Humboldt mentions finding it in the ancient gardens of the Emperors of Mexico, which were planted long before the arrival of the Spaniards.

In swamps that are annually covered with overflows of water and mud from swollen rivers the tree attains its utmost development, the trees being twenty-five to forty feet in circuit above the conical base, which at the surface of the earth is always three or four times as large as the continued trunk, and is always hollow.

The foliage is open, light, and of a light green tint; each "leaf," as *Michaux* calls it, is four or five inches long and consists of two parallel rows of small leaflets upon a common stem. This tender condition of the young branchlets—very much resembling the compound leaf of certain plants—reminds, also, of the frond of certain ferns; and this character of the branchlets of many species of Gymnosperms indicates the connection otherwise observable between this great class and the lower, flowerless sub-kingdom of *Cryptogamia*.

In the autumn the leaves change from light green to a dull red (a feature of our Coast Redwood, also), and are shed soon after—the only species in the tribe that has deciduous leaves.

The cones are small, globular, about an inch thick, composed of about four pairs of opposite scales, which are cuneate-pyramidal, attached by the apex to the ligneous axis of the cone, and displaying a rhomboidal, exposed surface which is slightly raised in the center and marked horizontally by a line; seeds, two, at the base of each scale, compressed, wingless. Pyramidal and quite regular when young, the trees of the Southern Cypress in age become flat-topped and somewhat decrepit. The timber is largely used for a number of purposes, being very easily worked and durable.

It is highly prized for buildings in southern cities, and shingles made of it last forty or fifty years even in that alternately moist and dry climate.

It is the favorite canoe cedar of the south, boats being fashioned from a single trunk twenty or thirty feet long.

Seedlings were planted largely about Paris many years ago, particularly upon the ancient estates of Duhamel, sixty miles from Paris, in 1750, but they have not thrived as other worthless trees do. Michaux thought (but wherefore he does not state) that in less than two centuries the *Taxodium distichum* would disappear from the Southern States.

REDWOODS.

SEQUOIA.

[See Frontispiece and Illustrations Nos. 18 and 19.]

The great size and extreme beauty of the California Redwoods has been the theme of countless descriptions ever since Douglas wrote of them in 1831 from Monterey, to Hooker: "The great beauty of California vegetation is a species of *Taxodium*, which gives the mountains a most peculiar, I was going to say awful, appearance—something which tells us plainly that we are not in Europe. I have measured specimens," he continues, "which are two hundred and seventy feet long and thirty-two feet around at three feet from the ground. Some few I saw upwards of three hundred feet high, but none in which the thickness was greater than I have stated."

The discussion of the Redwoods is only intelligible in connection with paleobotany, or the study of fossil plants. It appears through the researches of geologists that this family of monsters was once very abundant, both in individuals and species, and that, fostered by warm temperature then prevailing (known to scientists as Miocene times), these monster trees extended, coeval with the monstrous animals of the period, to high northern regions, even as far north as the 75th degree of latitude—that is, 8½ degrees within the Arctic circle.

Over a score of distinct species are known to have existed—fourteen of them in the Tertiary period.

When the Pliocene age was ushered in, characterized by the cooling of the earth, ice caps formed at the poles and extended equatorwards on both continents, driving the animals and plants before them.

The mountain tops being soonest affected by the lowering of the temperature, the flora and fauna gradually left them and began descending towards their bases, where they arrived coincident with the arrival of similarly organized beings from the north, and all together journeyed, or rather fled, before the sheet of ice to the equatorial regions, where at that period almost Arctic rigor must have prevailed.

Such plants and animals as had died previous to the time of this great migration, left their imperishable parts in the alluvium to be compacted into the rock strata and preserved as historical records.

When the Glacial age began to relax its rigor and the earth gradually became warmed again, the sheets of ice melting at their lower edges, began the retreat towards polar regions; those north of the equator retreating from the middle of Europe, and those of the United States northward, followed by the plants and animals as before they had fled before the ice.

But the retreat was vastly different from the advance. It was accompanied by dispersions, segregations, isolations, and enormous destruction, more or less, of entire groups of organisms, owing to reversed conditions. The plants and animals on the retreat arrived at the bases of the mountains, range after range, along their course, and, as being equivalent to going northward, some of them ascended the mountains, leaving others to journey along the plains, and there, as summit after summit was reached in the long retreat of ages, the plants were overtaken by the rising heat or by other inimical conditions, and were seized and exterminated. Others met with seas or deserts which they could not cross, and there, huddled on the borders, each fiercely fighting with the other for vantage ground, or crouching in lowly submission, all were blotted out of existence.

Of the once great family of Redwoods, all perished thus in Eurasia, and but two forms survive in America. One is lodged in a few cool, moist cañons of the California Coast Ranges, over a limited area; the other is stranded at a few high stations on the southern slope of the Sierra, still more limited, not exceeding in area a few thousand acres all told.

These two forms, generally regarded as belonging to one genus, that of *Sequoia*, are quite diverse in vegetative characters, especially in the foliage; the coast form, *Sequoia sempervirens*, having its principal linear, Yew-like leaves in two ranks; the Sierra form, *Sequoia gigantea*, having small, scaly, Cypress-like leaves in regular spirals.

These discrepancies led Dr. Lindley to regard them as types of separate genera, and the last discovered one (our "Big Tree"), he published (1853) in the London "Gardener's Chronicle," under the improper name of *Wellingtonia*, derived from England's greatest military chieftain, the Duke of Wellington.

As might be expected, this act was offensive to Americans, and a great tumult ensued. Attempts were made (as if it were possible) to substitute the name of Washington for Wellington. However, the French botanist, Decaisne, in 1854, and again in 1865, followed by Torrey, Gray, Newberry, Seeman, Veitch, and others, declared the characters were not sufficient for generic rank, and the *Wellingtonia gigantea* was quickly relegated to *Sequoia*, and here it has generally been classed to the present time. But some considerations resulting from the geological researches referred to, open the question, in the mind of the writer, for thoughtful consideration.

WELLINGTONIA OR SEQUOIA, WHICH?

It is important to note, in connection with the ancient records filed away ages ago in the archives of Nature's great storehouse, that the species of Redwood now found in California, though not identical with those of the Miocene period, whose remains are so abundant in the strata of Greenland and Alaska, yet the differences are only what should be expected from such extensive double migrations as have been described, and from the vicissitudes of the long and severe struggle they have waged to maintain existence.

Further (and here is the strong point), "The Miocene species," as Professor Le Conte has well said, "fall into two distinct groups—the Yew-leaved and the Cypress-leaved." "The present species," he adds, "are evidently direct descendants of the Miocene species, though, of course, somewhat modified."

Now, query: If the Miocene Redwoods, and there are about twenty-five species of them, readily *fall into two groups*, separated by important vegetative characters, as stated, is it not evident that distinct generic separation of these species was long ago accomplished; and are not genera—yes, and all higher distinctions as well—established in precisely that way?

It is admitted that besides the male flowers the carpological characters (those concerning the fruits) of the Redwoods are much alike; so they are in all the great orders of *Umbelliferæ*, *Compositæ*, *Labiatæ*, and

Gramminеæ, and it was necessary to sever these immense, cumbrous orders into genera upon slight characters. And certain groups of Conifers are so much alike that it is a matter of botanic history that the fathers of our science long hesitated to separate *Pinus* into half a dozen genera, and again to redivide *Picea*, *Abies*, *Thuya*, and *Cypress* into several genera each.

Andrew Murray, in 1859, supporting the validity of *Wellingtonia*, wrote: "There is nothing which I have learned with more certainty from my zoölogical studies than that, in determining what elements are to be considered of generic value, no one set of characters can be wholly relied upon. It is a just appreciation and balancing of the whole that leads the naturalist to a right conclusion."

Structurally considered, we know that man cannot be separated from the Simian apes; but mentally, how wide is the gap!

If I were to recognize *Wellingtonia* as a valid genus, I would be influenced principally by the underlying fact that two lines of development are plainly revealed in fossil vestiges covering a great many species. Surely it would be inconsistent to crowd all these species into one genus in order *not to admit* a genus, which it is assumed is as distinct from the other as *Tsuga* from *Picea*, *Libocedrus* from *Thuya*, or *Chamæcyparis* from *Cupressus*.

But the establishment of "Wellingtonia" outside of paleontological evidence, rests almost wholly upon the character of the leaves, which, it is claimed, are widely different. Let us compare them: The leaves of both species (whitened beneath with stomata when young), are spirally arranged, decurrent, narrow, rigid, acute, or acuminate, each with a single dorsal resin duct; those of the Sierra species (*gigantea*) are pale, mostly small, scaly, Cypress-like; on branchlets of mature trees they are appressed, the free portion deltoid acuminate, while on young trees and on vigorous branches of older ones they are linear, narrow, and spreading.

The principal leaves of the coast species (*sempervirens*) are bright green above, mostly spreading by a twist at the base into two ranks, mostly linear and about one half inch long by a line wide (Yew-like), but those on the main stems and the one inch long peduncles (and often the lower portion of each branchlet) are short, appressed, and scale-like, *i. e.*, Cypress-like.

Now *since some of the leaves of both species are precisely like the principal ones of the other*, the distinction, based upon the leaf characters, falls to the ground, and with it, "*Wellingtonia.*"

If other species existed beside the two curious remnants, the consensus of characters might show more divergence in fruit as well as foliage, and then it would be easy to recognize two generic lines of development—which I do not doubt existed—but, weighing the evidences in the two present species, the Scotch verdict must be rendered, "Not proven."

So, to the great relief of American botanists, *Sequoia* stands to-day without a rival on the face of the earth, whatever may have been the sovereignty of Giants in the Dead Past.

NOTE.—For the selection of the objectionable name of *Wellingtonia*, in violation of the laws of botanical nomenclature and of good taste, Dr. Lindley was alone responsible. But the deed was done, and duly published with descriptions. The *name* is irrevocably fixed *if the genus exists in Nature*. The naming of American genera for Washington, Monroe, or Clinton, though in a sense unwise, cannot offend the national pride of any foreign country. *Jeffersonia* and *Fremontia* do not fall under the slightest condemnation, because President Jefferson and General Fremont were distinguished naturalists. The dedication of California genera to our prominent citizens, Stanford, Crocker, Redding, Hastings, Hollister, and the like, is justifiable on the ground that these gentlemen are distinguished patrons of science—especially promoting original botanical research on the Pacific Slope.

The bark of *Sequoia*, like that of *Thuya* and *Libocedrus*, is thick, strong, slightly shredding off in age; deeply furrowed longitudinally, almost uninterrupted from bottom to top; making a tree resemble a fluted column or pilasters around a turret.

The wood is very light, soft, often brittle, coarse-grained, but taking a fine polish, very beautiful for interior finish, often remarkably gnarled and wavy, hence highly prized for ornamentation. It is not easily set on fire, hence is prized for general building purposes; fire kindled against Redwood partitions have been known to die out without igniting the partitions.

Fire does not readily kill a tree of the coast species, adventitious sprouts often coming out of a burned trunk and continuing the life of the tree.

The wood is remarkably durable, exposed to weather or in contact with the earth. Fragments of ancient trees are now lying in the forests half buried by the gradual accumulations of centuries of falling leaves and other debris, and yet they are as sound as ever.

The color of the Redwood is a bright, clear red, resembling mahogany, darker in the Sierra species, and not quite so susceptible to polishing. The quantity manufactured on the coast annually is estimated at over four thousand millions of feet. It is derived from hundreds of factories by improved methods of lumbering that secure the greatest amount of logs in the shortest space of time, and their manufacture into lumber has called upon invention and capital to provide the most elaborate machinery, while the kinds and grades of lumber produced are legion, and the uses to which they are put are innumerable.

Always among the highest priced lumber, yet the demand is, as a rule, in excess of supply, and the generous forests would be doomed to speedy destruction were it not for the inaccessibility of certain portions of every region in which it is found, coupled with the rapidity of its growth and the hardihood of its constitution, enabling it to resist alike the ravages of the ax and of fire.

The fruit of the *Sequoia*, maturing the second season, is surprisingly small. We look for large cones from colossal trees, and are disappointed to find the cones of the coast species but little larger than a lady's thimble, and that of the Great Sequoia about the size of a hen's egg. They are firmly woody, oval, of about thirty-six nearly equal sized scales, which are spirally arranged in three coils, and divergent at right angles from the axis, thick and pyramidal, with a rhomboidal, rugose, umbilical apex, traversed by a raised line and with a short spur or bristle in the depression. The scales shrink a little, but do not change position after maturing the seed. The spirals are three in number, inclining left and right, about twelve scales in each spiral. (See illustration No. 19.)

The cone (and the wood in a minor degree) secretes a dark garnet or crimson substance, which, as the cone hardens while approaching maturity, is exuded, and it crumbles away, falling with the seeds. In the

gigantea species the quantity of this garnet tannin is fully one third as great as the numerous seeds.

John Muir, while wintering in the Yosemite, experimented with this secretion, and found several uses for it, including its serviceableness in in the manufacture of ink.

The seeds are brownish, small, and very numerous, resembling parsnip seeds, five to eight to a scale, and one hundred and fifty to two hundred and twenty to a cone; elongated about two lines, but appearing orbicular on account of the broad, thick wing extending each side of it.

The leaves have been sufficiently described in discussing the generic characters. The male flowers are small, oblong, two to three lines long, the coast species much the larger, but not otherwise distinguishable.

A tree much in cultivation in California, and nearly related to the Redwoods, is *Cryptomeria Japonica*, or Japan Cedar; so close is the resemblance to a young Sequoia, that it is often mistaken for our "Big Tree," having the same general appearance, the swell of the trunk near the base, and finely divided branches; but the trees come to fruit bearing when young with large quantities of small, globose cones clothed with free, subulate scales, and the leaves are awl-shaped and succulent, like those of the Norfolk Island Pine described. This Japan Cedar and another monotypic Chinese genus, *Glyptostrobus*, cultivated in the Eastern States, are closely related to our Redwoods, and, like them, are remnants of large and, with the exception noted, extinct species.

ORIGIN OF THE NAME SEQUOIA.

"Botanists who have genera to publish," reads Article 48 of Laws of Nomenclature, "show judgment and taste by attending to certain rules," one of which is to give the etymology of each name.

In the case of *Sequoia*, the Austrian botanist, Stephan Ladislaus Endlicher, who published the genus in 1847, did not make any statement whatever of the origin of the name, leaving its meaning to be inferred. In an early number of Meehan's "Gardener's Monthly," a learned and careful writer—J. H. Lippincott—who, Meehan says, was acquainted with De Candolle, and perhaps with associates of Endlicher, stated that *Sequoia* was derived from "Sequoyah," the Indian name of George Guess, a half-breed Cherokee, who has the distinction of having invented a syllabic alphabet for his tribe.

Professor Whitney, in "Yosemite Guide Book," and others have quoted this explanation of the origin down to date.

Gordon, in his first edition of "Pinetum," 1858, writes of *Sequoia:* "Name not explained;" but subsequently, in the edition of 1875, he states: "Name probably from 'sequence,' separated, or following in order of succession, after *Taxodium*, from which Professor Endlicher separated it."

In 1877 Hooker and Gray made a journey to the Pacific Coast, and in conversation with them, I asked which was the true origin of *Sequoia?* Dr. Gray quickly replied that the report of its being derived from Sequoyah, the Cherokee, was doubtless an afterthought; that undoubtedly Endlicher derived his name from *sequi* or *sequor*, alluding to the well known fact that our Redwoods are the followers or remnants of several colossal extinct species. I received the explanation with joy, as in my estimation it added greatly to the importance and poetical significance of the name, and soon after I published Dr. Gray's explanation in the "Pacific Rural Press."

Proposing to elaborate anew, in a popular way, the Cone-bearers of the Northwest, I recently directed letters of inquiry to several eminent authorities in the East and abroad, especially for the paleontological history of our trees, the origin of their names, etc. In response came some very interesting letters. First, one from Prof. Thomas Meehan, of Philadelphia, under date of June 8, 1890, asks: "Are you sure that Dr. Gray told you *that* about Sequoia? If you did not misunderstand him, it shows that fifteen years after Lippincott's article appeared in my journal Dr. Gray had changed his mind." "For myself," continues Meehan, "I would regard the 'sequence' origin as still more unlikely, for in what way could Endlicher construct, orthographically, *sequoia* out of either the Greek or Latin root of sequence?"

Sir Joseph D. Hooker writes me, under date of July 28, 1890: "My impression is very strong that Dr. Gray accepted the view of Sequoia being named in honor of the American who invented the alphabet for his tribe language, but I have searched in vain for any printed information; however, I have not yet looked through all his writings about the Big Trees."

A letter from Alfonse De Candolle, bearing the date Geneva, 22d June, 1890, states (being translated): "The supposed origin of *Sequoia*, from *Sequoyah*, or *Sequenal*, is entirely fanciful—'fantastique.'" Endlicher seems never to have said why he had taken this name. Koch, in his "Dendrologie," 1872, says: "The name *Sequoia* has its origin in California;" but he gave no proof of the assertion. "By the appearance of the name," concludes De Candolle, "it seems probable that the name originated from or was taken up from some native word, and written more or less correctly." So the name is still a myth—"fantastique"—and may be derived from some Californian Indian word, in the opinion of the veteran botanist and author of "Prodromus," De Candolle, who is eighty-four years of age, and was contemporary with Endlicher, so is enabled to know as much about the origin of the word as any one. Dr. Engelmann evidently believed in the origin of the name as derived from the Cherokee, Sequoyah, for in 1873 he published the following in a St. Louis, Missouri, journal:

SEQUOIA.

His resting place may be unknown, but his name and his memory live in the most magnificent vegetables of the continent. The mammoth trees of California have been named by English, as well as Americans, for their greatest men—Wellington and Washington—while the celebrated Viennese, Professor Endlicher, as eminent a botanist as he was linguist, had already in 1847 established a genus, which comprises the mammoth trees as well as the scarcely less magnificent Redwood of the California coast; and he named it *Sequoia*, in commemoration of the aboriginal linguist; and so, as long as botanical science exists, both these wonders of the Western World will perpetuate the name of the Cherokee Cadmus, George Guess.

Giving Meehan and Engelmann the benefit of the doubt, it becomes interesting to us Californians to know something of the "Cherokee Cadmus" and his work:

George Guess, or *Sequoyah*, was a Cherokee half breed, born about 1770 in the Cherokee part of Georgia, where he lived on a small farm and was known as an ingenious silversmith. In 1826 he invented a syllabic alphabet of the language of his nation, consisting of eighty-five characters, each representing a single word. He used the characters that he found in an English spelling book as far as they went, though he knew no language but his own. In 1828 a newspaper called the "Phœnix" was established, part of which was printed in Guess' alphabet, and it was used in printing a part of the New Testament. Guess was not a Christian, and is said to have regretted his invention when he heard that it had been used for the latter purpose. He accompanied his tribe in their emigration beyond the Mississippi, and in 1842 went with other Indians to San Fernando, in northern Mexico, where he died August, 1843.—*Am. Cyclopedia.*

Personally we wish there were no clouds obscuring *Sequoia*, the beautiful, unique name of our pair of monster, picturesque rear guards of that long past procession of Giants of the Vegetable Kingdom; but whether derived from Sequoyah, Sequor, or a Californian Indian word, as Karl Koch and De Candolle in turn suggest, we will be consoled by the last closing words of De Candolle, philosophical, terse, and clearly restating the scientific requisites of a good name. "After all," he writes, "it matters little; a name is a name. The essential things are: first, that it be the expression of a natural genus; second, that it has not been employed before; and third, that the genus had not previously received another name."

32. SEQUOIA SEMPERVIRENS, Endlicher.

COAST REDWOOD.

[See Illustration No. 18.]

The wonderful Redwood of the California coast is too well known to need description. It is almost impossible to enumerate the uses to which it is devoted now that the Redwood has become so popular at the East. No modern house is well finished without more or less of natural dressed, unpainted curly or bird's-eye Redwood wainscotings, ceilings, panels, mantels, or other kinds of decorations.

The discussion of the quantity of the Redwood products, its value and uses, together with the ingenious means employed in procuring it, are outside of the province of the botanist, and it will be only necessary for me to give a few figures leading to other considerations we may be profited in discussing.

The lumber resources aggregrated in the Redwood forests are unquestionably more important on account of their value and accessibility than that of all the rest of the rich California forests combined.

From a consumption of Redwood lumber in the market of San Francisco alone, of ten millions of feet in 1860, an increase was noted to eighty-seven millions in 1870, and one hundred and twelve millions in 1875, falling off to eighty millions again in 1880, but vastly increasing to one hundred and fifteen millions in 1885, and perhaps one hundred and forty millions of feet for the present year, 1890.

The price ranges from $16 per thousand for pickets, and for rough dunnage at $20, up to dressed and surfaced lumber at $25 to $55 per thousand feet. Especial preparations of bird's-eye, or curled, or wavy Redwood, with their bright colors, worked into panels, veneering, furniture, etc., sell at fancy prices equivalent to $100 per thousand.

So great is its value, and accessible its locality, that it is apprehended that the supply will be exhausted, practically, at an early day, estimated at about fifty years.

The Redwood belt, so called, is rather a chain or congeries of groves of various sizes, stretched along the seacoast, coextensive with the metamorphic sandstone, from the southern border of Monterey County to near the Oregon line; no trees at a great distance from the ocean, or at high, cold altitudes.

The "Golden Gate," severing the Coast Range of mountains, and certain configurations of the range between Mendocino and Humboldt Counties, divide the chain into three principal unequal portions, the lowest one being the smallest. The largest body, and the largest trees, are found in the northern portion, individual specimens of mammoth size being aggregated in several slightly detached valleys and low bottom lands along the Eel River and its tributaries. Tall, clear shafts, uniform in size, healthy in appearance, and really very young in age, are standing in these forests so closely that their well developed foliage excludes the sun's rays except when near the zenith. These trees occupy the ground exclusively, and with the entire absence of stumps, fallen logs, as well as of young trees, they give a suggestion of a forest primeval—not derived from progenitors nor promising posterity.

However, there is not wanting evidence that forests have flourished and passed away, and been succeeded by other growths on this coast, age after age. Logs of Redwood have been met with in excavating tunnels, or exposed by river freshets that were buried from two hundred to three hundred feet under the present alluvium, and another fact of great importance is connected with this, to wit: the specimens so exposed are found to be in an excellent state of preservation, attesting the almost unexampled durability of this wood.

In this connection it should be stated that the Redwood timber is but little subject to shrinking and warping when exposed to the weather, and, next to chestnut, it is the least liable to take fire from contact with flames—a quality not recommending it for kindling wood, but especially desirable for building purposes. Fires kindled against Redwood partitions have been known to expire without igniting the partitions.

Whatever the statement to the contrary, only a few localities reveal Redwood seedling trees growing spontaneously, the principal increase or survival of Redwood groves being by suckers or sprouts.

Where the trees have been removed, either by fire in the centuries long past, or by the ax and saw of the white man, circles of trees show where the parent stood in the midst.

This power of increasing, by adventitious budding or suckering, is almost peculiar to this species among the Cone-bearers, and not at all characteristic of *Sequoia gigantea*. This feature is often quoted by thoughtless writers as evidence that this species of Redwood is—as its specific name implies—everlasting, but such inference is unwarrantable. No forest is ever maintained by such means outside of the tropics. Seedlings which admit of previous seed dispersions over wide areas only, can naturally reforest temperate regions.

This wonderful tree, second only to its gigantic brother in the Sierra, often attains a height of two hundred and fifty to three hundred feet, and a diameter of eight to twenty-two feet. The age of some evident patriarchs among them is doubtless very great, but is usually much exaggerated. Well authenticated countings of layers have given for robust, growing giants one thousand two hundred to one thousand five hundred years; and, certain relics of a practically former generation are, perhaps, twice as old.

The cones of the *Sequoia sempervirens* are very small, oval, three fourths to an inch long, composed of eighteen to twenty-one obpyramidal scales in three spirals. Seeds small, flat winged all around like a parsnip seed; brown, three to five to each scale. Leaves of two kinds, the principal ones on the internodes of the branchlets, in two ranks, by a twis at base, linear, about one half inch long, the middle ones longest, all acute or mucronate, flat, keeled below by a prominent midrib, with a stripe of stomata on each side, white when young, the leaves in age often bronzed or browned; the other leaves found on the cone stems and main shoots small, short, scale-like or deltoid two to three lines long.

The presence of these small, cypress-like leaves, similar to those of the *Sequoia gigantea*, forbid the separation of the Redwoods into two genera, as has been proposed.

The male flowers are larger than those of the other species, ovate, two to three lines long, of few scale-like stamens with peltate connective, and four to six double-celled anthers under each scale.

33. Sequoia gigantea, Decaisne.

BIG TREE—GIANT SEQUOIA.

[See Frontispiece and No. 19.]

The Big Trees of California have been the amazement of every observer and the theme of thousands of descriptions since their discovery, therefore only brief mention of their most salient features need be given here, in addition to those presented in the discussion of the genus *Sequoia*.

When the great explorer, Douglas, first reached the locality in southern Oregon of the Sugar Pine, only the seeds of which he had seen two years before, he found himself in the midst of trunks, standing and prostrate, whose enormity so affected him that he feared to describe them to his friends, lest he should be discredited. "New and rare things," he writes to Dr. Hooker, "seldom fail to make strong impressions, and are, therefore, frequently overrated." So he trusts to nothing short of careful measurements, by which he learns that one of the prostrate trees was over fifty-seven feet in circuit, and two hundred and forty-five feet in length. "These princely trees," he cannot refrain from exclaiming, "are unquestionably the most splendid specimens of American vegetation!"

Little did the awe-struck traveler imagine that there could be a larger tree in the Western World, much less that in the very range of mountains three hundred miles south of his position the Sierra Nevada held on its swelling bosom a monster sylvan product nearly twice as far in circuit and four times as large—a tree so secluded that its eyrie was not detected by hunter or naturalist until fifteen years later, 1852, long after a large population had thronged the California mountains in search of gold. And when it was discovered, as Douglas had moralized in the forests of Oregon, visitor after visitor was discredited, until almost a convention of naturalists had seen the tree and given in their unanimous testimony. But it was long before pardonable exaggeration and loose, inaccurate guesswork were eliminated from descriptions.

Andrew Murray, writing in 1859 a monograph on California trees, states (getting his information from his brother): "One of these trees is actually four hundred and fifty feet high and one hundred and sixteen feet in circumference."

Lord Richard Grosvenor, in the "Gardener's Chronicle," 1870, makes a similar statement, adding: "It is taller than St. Peter's, and little short of the highest pyramid."

When the American Horticultural Society visited the Redwood forest near Guerneville, two years ago (1888), a citizen of the place mounted upon a stump and made a flowery speech, in which he stated that the stump he stood upon was doubtless three thousand or four thousand years old, long antedating the birth of Moses!

As a matter of fact, the Big Trees, in age, unlike the coast Redwood, are not slim, tall trees, like a Poplar or Australian Gum tree, but are usually thick, and nearly columnar to a great height, where they suddenly divide into large branches, the foliage forming a rounded head.

And the present generation are mostly vigorous, fast-growing saplings, as proved by counting their rings, the oldest of them between one thousand two hundred and one thousand five hundred years old.

Fallen trees and stumps of a former generation, however, were very aged; they often show thin layers of wood, thirty to thirty-five to the inch, indicating trees probably two thousand five hundred to three thousand years old.

Forest fires occurring at a late period seem to have played havoc with these old patriarchs. There is one authentic living relic of that ancient race—Old Sequoia—in the Tuolumne Grove. A splinter of his trunk escaping the conflagration bears a green limb covered with bright foliage. This splinter is about one hundred and seventy-five feet high and forty feet wide at base, and with other remnants of the old tree, measure one hundred and twenty-one feet around a few inches above the base. A section of the splinter shows twenty-five or thirty layers to the inch and indicates an age of about two thousand five hundred years. Doubtless the height to which a tree may ascend is governed in part by the depth and steepness of the ravine it inhabits, forming a protection against the terrific storms of winter. Careful exploration at any time may reveal somewhere in the numerous cañons, trees overtopping anything reported of the Eucalyptus trees of Australia, whose slim spires, we are told, in a few instances, are slightly above four hundred feet.

The Grizzly Giant, in the Mariposa Grove, is perhaps a survivor of the old forest, as he is decrepit, and bears many evidences of extreme age.*

The Big Trees do not form a continuous belt of forest, nor are they exclusive. In the several groves they are accompanied by other trees that would be enormous elsewhere. There must be conditions in those regions that favor immense development, for Sugar Pines and Douglas Spruce are met with ten to fourteen feet in diameter, while Firs and Post Cedars are scarcely less prodigious.

*In a late able "Study of the Giant Trees," by Prof. C. B. Bradley, of the State University, he advances the theory that these great trees are self-limited in size and age by their very wealth of possessions. No sickliness or stunted appearance is ever seen in a *Sequoia* grove; no parasite or fungus attacks them.

"The *Sequoia*," he concludes, "has an astonishing exemption from disease, and this exemption, taken in connection with its sturdy build, gives it unusual immunity from accident of storm and flood; that the resources stored up in its mighty trunk enable it to repair damages which would be directly fatal to most other trees; that its thick, non-resinous bark gives it considerable defense against light forest fires, while the elevation of its top keeps that from being scorched; that the effects of fiercer fires, even in seasons of drought, are not immediately fatal, though they tend to become so eventually; that, after all, it is the tree's own weight—its overgrown wealth—which drags it down to destruction at last."

And so these young, vigorous, full habited, sound hearted giants are the only examples of suicides in the great class of exogens, or outside growers. Tempted by the favorable conditions and the bountiful food of a California forest preserve, they assimilate too much pabulum, become overweighted, and are capsized—tumbling to ruin in mid career, "with all their blushing honors thick upon them."

The groves are but few in number (about twenty-five), the principal and best known ones being Calaveras, South Grove, Tuolumne, Merced, Mariposa, Fresno, Kings River, and Kaweah. The southernmost ones are quite extensive forests of one thousand to three thousand acres, and somewhat scattered over ridges and valleys—separated only by deep cañons—for sixty miles, with a breadth of only five or six miles. The largest groves are southward, in Tulare County.

The altitude at which the Big Trees flourish, is, of course, a question of latitude also. In the Calaveras Grove they occur at about four thousand feet altitude; the Mariposa Grove is six thousand, and the Tulare Groves are over eight thousand feet altitude.

That people on horseback have rode for eighty odd feet through the body of the Father of the Forest; that a stump, with a pavilion over it, accommodates parties of thirty to forty dancers, musicians, and spectators; that trees have been pierced with tunnels for the passage of stages, with outside passengers; that hundreds of trees have been measured that are over ninety feet in circuit at the base; that the observer can verify these figures at will by pacing across their shadows; that the old ones were very aged, and that the present crop is comparatively young, are all well corroborated facts.

SATISFYING CONCLUSIONS.

Let India, with her Banyan tree—which, by the way, is a mass of trunks, not a single one—take the palm for growth of four thousand years, and the African Baobab date still further back, possibly, with its base of matchless circuit, but with a shaft only seventy to eighty feet high; let Palestine pride herself upon her Cedars, growing since the time of Moses, with layers so fine that it is necessary to use a lens to distinguish them; let Australia boast of her tall Eucalyptus trees: all these trees of the Old World, almost without exception, are slow growing, stunted, gnarled, decrepit, unsightly old relics, only interesting because of their great age.

Now all observers admit that the California Big Trees, with their vast, straight columns, limbless for two hundred to three hundred feet, and their immense, shapely crowns of finely divided evergreen foliage, are the most symmetrical in form, magnificent in appearance, and actually the largest in dimensions of any trees yet known in all the world.

And they are but young, vigorous saplings yet, only one thousand two hundred to one thousand five hundred years old! Ages hence, full grown trees may be seen here—if they escape the fire fiend—that shall attain an unparalleled age and size—

> "For still the new transcends the old,
> In deeds and objects manifold."

How came these trees there in such limited numbers and at such particular stations?

These questions are too profound for solution with our present knowledge. We only know the immediate causes that led to their lodgment on the southern slopes of the southern Sierra, and these causes are connected with the great glacial phenomena briefly alluded to in early paragraphs of this report.

The fossil remains of other species show that the family was once abundant in the extreme arctic regions of both continents. The climate of those regions must have been very warm. When the earth gradually became colder, ice formed at the poles and extended towards the equator, driving plants and animals before it. The ice caps are known to have reached middle Europe and middle United States, and the Redwoods then, from being arctic plants, *were tropical ones.* But not as we now take those terms: they were only tropical *in position*, the characters and requisites, no doubt, the same as now.

Upon the cessation of the cold period and the gradual return of warmth, the ice cap melted at the edge and retreated towards its present home in the arctic regions, followed by the organic world.

Encountering the cross ranges of mountains, some of the species separated from the rest and ascended the heights; and most of these seceders were there overtaken, seized, and exterminated by the rising heat.

Here and there a line of development suited to the present equable temperature became acclimated to its surroundings, or, reversing the terms, the environment proved suitable to certain lines of development; and so we find plants buried in dismal swamps, thronging on broad plains, clinging to mountain slopes, or stranded on lofty peaks—anywhere, everywhere, just where they can best wage the incessant battle of life.

And from all indications the climatic conditions found at particular *spots on particular slopes of* the *southern* Sierra *are* most favorable for the development of colossal vegetation, including the Big Trees.

No vestiges indicate that the line of occupation has advanced since the present epoch was ushered in; and here is an added proof of the great length of these geologic ages. Inferentially, if the earth should ever become warmer, but by a few degrees only, the line would advance towards the summit of the Sierra, or the conditions be so changed at present levels as to extinguish these wonderful remnants of what is practically a past prodigious family.

There is one fortunate and, for Americans, very encouraging circumstance connected with the name *Sequoia gigantea.* It is readily taken up by the public and made as familiar as a household word. The drivers of the Yosemite stages, the citizens living in the vicinity of the groves, even to the children, speak the name glibly, and the lumbermen have adopted it. Travelers and visitors usually at once acquire the name, and our legal documents, alluding to the *Sequoia* Parks, all employ the proper name for our Redwoods.

The Governor of California, addressing an appeal recently to the Secretary of the Department of the Interior, begs to have spared from sale and destruction the *Sequoia gigantea;* and Secretary Noble, in his reply, twice uses the same proper and beautiful name, declaring that "late decisions of the department are most positive and energetic in defense of the *Sequoia gigantea.*"

Sub-Tribe 2. CUPRESSINEÆ.

TRUE CYPRESSES AND THEIR NEAREST ALLIES.

This sub-tribe of trees include a large number of genera and species of slow-growing Cone-bearers, most of them in the Old World and Australia, with four genera in the United States, comprising ten species, six of them in California.

The characters common to them all (beside slow growing) are: leaves very small, scale-like; cones small, oblong, or globose; the scales valvate or peltate; the taxonomy, *i. e.*, the arrangement of all of the organs, leaves, scales, etc., is verticillate, in pairs, or rarely in triplets; and four-ranked, rarely three-ranked.

They comprise, in America, two pairs of closely allied genera:

First Pair—American Cedars, with cones oblong and scales flat, convex, or thickened; branchlets flat with dimorphous, decurrent leaves:

1. *Thuya*—Fertile scales, six; unequal, thin.
2. *Libocedrus*—Fertile scales, two; equal, thick.

Second Pair—True Cypresses, with cones globular, and scales pyramidal and peltate.

3. *Chamæcyparis*—Branchlets and leaves two-ranked; cones maturing in one year; seeds winged.
4. *Cupressus*—Branchlets and leaves *not* two-ranked; cones maturing in two years; seeds wingless.

SLOW GROWTH OF THE CYPRESSES.

Michaux says of the Cypress: "The concentric rings are more compressed near the center, an arrangement that is contrary to that observed in the Oak, Maple, Ash," etc.—a statement which is somewhat unscientific, since the annual layers are not "compressed" near the center, but are simply formed in thinner layers while the trees are young, an "arrangement" which is rarely seen in other trees, because most of them grow faster in youth, and consequently form thicker concentric rings. As a matter of fact, it may be stated in this connection that, in general, trees elaborate a given quantity of lignum, or wood fiber annually. While the tree maintains a uniform quantity of foliage, the output of lignum is equal; but, as the tree trunk enlarges, the material is spread over more space, and is consequently thinner. During the early, vigorous growth of the tree the layers are thick, and, while the amount of foliage increases, it increases the supply of lignum, which is spread over a larger surface, so the layers for a time are uniform; but, as age and decrepitude ensue, the foliage and lignum decrease, and the layers consequently decrease, so that in the case of Junipers and other trees—often showing but a few green twigs annually—the layers are not thicker than a sheet of paper; in fact, in certain monster trees of limited foliage, they are hardly discernible with a lens. In the case of the present trees, to say that the concentric rings are thinner near the center than in other trees, is to formulate a characteristic of the Cypress family that separates it, structurally, from other trees in a remarkable manner, and is equivalent to saying that these trees do not manufacture, at any time, as much wood fiber as others; and a moment's consideration of the difference in their foliage explains the reason. The leaves are the lungs—the elaborators of sap and building materials for the tree's needs. Of course, a little scale of a leaf cannot elaborate so great a quantity of material as a larger one, especially one with an expanded blade, like most deciduous leaves; hence, all these scaly, Cypress-leaved trees (except those with abundant foliage) are slow growing, fine-grained, often long-lived trees.

AMERICAN CEDARS.

THUYA.

The name of this genus is of ancient origin and sometimes written *Thuja* and *Thuia*, but as the letters *j* and *i* in such cases are given the sound of *y*, it is quite as well to write it so. Linnæus published it as *Thuja* in the body of his great work GENERA PLANTARUM, though he wrote it *Thuya* in the index, which was an afterthought and perhaps a better one. But the trees that first received the name of *Thuia*, meaning, in Greek, a tree yielding odoriferous gum, and *Arbor vitæ* among Latin writers, from their resemblance to the arborescent appearance observed in cutting the human cerebellum in a longitudinal direction. This distinction early separated them from the rest of the Cedars, and later these were again separated into genera, until a pair of species only were left, under the name of *Thuya*, and these being found only in America are often called American Cedars. One is indigenous to each of the forest developments of North America: the eastern one, *Thuya occidentalis*, stretching from New Brunswick and the valley of the St. Lawrence, westward to Michigan, and southward through the Middle States, along the Alleghany Mountains to North Carolina; the western species, *Thuya gigantea*, favored by a warmer climate, stretches from Alaska and British Columbia, eastward along the cross ranges to Washington, Idaho, and Montana to the western slopes of the Rocky Mountains, and southward through Oregon along the coast mountains to Cape Mendocino, in California. These regions nowhere approach each other nearer than one or two thousand miles, and the differences between them are so slight that Robert Brown conjectures that the separation has been perhaps recent. "There lies something deeper behind this dispersion," he remarks, "than we yet understand, and it really sometimes seems that a species may stretch to the utmost bounds of its range, cross over and take new characters to suit the new climate and physical circumstances it is subjected to, and here form a new race, in course of time to become representative species of the original stock of whose family it was once an individual." "The want of stragglers all the way over," he continues, "seems to militate against this theory; but the great central regions of America, like the center of all continents, now too dry to be favorable for the prosperity or even growth of arborescent species, might not have always been so." And he cites the remarkable resemblances which may be more than coincidences that subsist between half a dozen trees in each of these regions, scarce a prominent Atlantic species of conifer (or deciduous tree either, for that matter) but has its Pacific "analogue"—the Pacific region has by far the most lines of development present and unmatched, as in most of the Pines and Firs, and most notable, the Redwoods, nothing resembling them being found elsewhere on the earth.

34. THUYA OCCIDENTALIS, Linnæus.

ATLANTIC RED CEDAR.

This species of American Cedar is peculiar to the forest development of the Northeast, and forms most of the celebrated Cedar swamps of all that region. It is never seen in uplands, always in sphagnum swamps, the development exactly in ratio to the humidity.

The tree tapers rapidly from a large swollen base to a slender apex, the principal limbs wide apart and springing out at right angles with the body, from which droop many sweeping branchlets, whose foliage resembles that of the White Cypress growing in similar situations, and described later on.

The wood of the eastern Cedar, like that of all the family, is of a reddish hue, and is odorous, quite soft and fine grained, very durable, and therefore in much demand for fencing and for building purposes connected with the ground. Posts made of it have been known to be in serviceable condition after thirty-five to forty years' use, and fence rails last sixty years.

Doubtless it would be more extensively used if the tree attained a larger size, as it is seldom over forty to sixty feet high.

On the borders of lakes, where it has room, and it enjoys the benefit of light and air, it rises vertically, and attains a greater size than when crowded into swamps, where the trunk is apt to become curved. Near the base of old trees two or three prominent ridges usually form, connected with the principal roots. The bark upon the body is slightly furrowed, smooth, and very white when the tree stands exposed, and this circumstance has given the tree, often, the name of "White Cedar;" but as the wood is reddish, and there are so many white-barked trees, it is best to call this a Red Cedar, from the color of its wood. It is also often called Arbor Vitæ; but that name were better to be reserved for the compact, bushy Chinese trees, with vertical branchlets, and belonging to the genus *Biota*.

A noted locality for this Cedar is Goat Island, which divides the cataract of Niagara.

This American Cedar was introduced into Europe with the first productions from the New World, and the superior beauty of its foliage at once made it a prime favorite in the ornamentation of pleasure grounds and for planting in marshes. Being so long cultivated, a great many varieties have sprung into existence—some of them so different from the original that they would readily be called distinct species if found in nature.

35. THUYA GIGANTEA, Nuttall.

GIGANTIC, OR PACIFIC RED CEDAR.

[See Illustrations Nos. 20 and 21.]

This is the Pacific Coast analogue of the eastern Red Cedar, and for a long time was confounded with that species, but it is found to be specifically separated, differing remarkably in its enormous size, well developed trees attaining a height of one hundred to one hundred and fifty feet, with a swollen base ten to twenty feet in diameter.

Its headquarters are in the low, rich woods and swamps of the Northwest, from Alaska southward along the Coast Ranges to Cape Mendocino. In British Columbia, opposite Vancouver Island, it forms a great part of the swamp forest, dividing the privileges of the situation with the big Tide-land Spruce described. It follows along in the wet spots of the northern cross ranges through Idaho and Montana to the western slopes of the Rocky Mountains, where at high elevations it becomes dwarfed, and where it was mistaken for the eastern species. In its headquarters may be found trees of magnificent proportions, straight, tapering, tall, and the upper third clothed with bright green foliage.

A noted tree, a few miles south of Seattle, was utilized by the Hudson Bay Company in the early days of western occupation for a telegraph pole, and until the discovery of the big Sequoias later, it was doubtless the largest telegraph pole in the world, being over fifteen feet thick at base.

The limbs of the *Thuya*, with two-ranked branchlets forming horizontal sprays of fan-like foliage, and other characters of the species, cause it to be often mistaken for the next tree to be described—*Libocedrus*—and, in descriptions of early explorers, the two trees were often confounded. But the characters of the small, thin valved fruit-scales, six of them seed bearing, distinguish it in addition to the distinctly different range of the two trees—the Gigantic Cedar, widely distributed through the wet portions of the Northwest; the Post Cedar confined to drier localities of southern Oregon and throughout California.

The Gigantic Red Cedar is sufficiently represented by large timber trees along the north coast of California to be of much interest to us. It mingles with the Coast Redwood, Douglas Spruce, and the Grand Fir, while it is itself one of the largest and most valuable trees of the region.

"As a useful tree," writes the distinguished botanist, Robert Brown, "it stands preëminent in the Northwest in the estimation of the Indians and backwoodsmen. The Indians readily fashion its light, soft timber into canoes, walls for their lodges, and in the manufacture of troughs, bowls, etc., while from its strong bark they make clothing, blankets, mats, and thatches for their lodges." "Nothing so thoroughly expresses the enormous size of the tree," continues Mr. Brown, "than to see the large war canoes which the Indians fashion out of a single trunk, often forty to sixty feet long."

In preparing to cut down one of these trees, our modern lumberman, who does not desire the hollow, lower portion of the tree, cuts notches in its sides, into the highest of which he inserts a stout plank three feet long with an iron shoe, that, when the plank is depressed, grips into the tree and makes a firm footing for the workman (as represented in the accompanying illustration).

The timber of the Gigantic Cedar is well nigh indestructible in contact with the soil, or under water, as remarkably exhibited along the north coast, notably at Shoalwater Bay, where submerged trees of this species are standing in groves whose age must compass many centuries, though their exact age can only be conjectured. These trees certainly belong to the existing species, the nearest living trees being the same.

They evidently grew in long, past centuries when the surface was above water.

A slow sinking of the coast seems to be still proceeding, the tide annually rising higher and higher, killing the trees, which remain perfectly sound, and the uncovered portion becoming so well seasoned as to be of great value. Continued and careful examination of these shores may afford important information concerning changes of level; several of which have certainly taken place, as proven by alternate layers of marine shells and of logs and stumps, the latter in natural position, which form the cliffs along the shore, and which are two hundred feet or more in elevation.

So far as late geodetic surveys of the northwest coast have proceeded, no evidence is found to support the favorite theory of certain alarmists that these changes have been sudden or violent, as from cataclysms or earthquakes. On the contrary, the indications are that the submergence has been gradual, and in late Pleistocene times measurable by thousands not millions of years.

The Gigantic Cedar has been favorably introduced abroad, and is prized for its beauty and usefulness. The wood is very light, soft, not strong but compact, easily worked and, as shown, exceedingly durable. It is in demand wherever its merits are known for fencing, log house or other buildings, shingles, interior finish, cabinet work, casks, etc. In the vicinity of its growth it is the one tree of all others chosen for making boats, water troughs, conduits, etc.

The cones of this tree are cinnamon colored, small, until opened narrowly oblong, four to six lines long; when opened, the three pairs of thin concave fertile scales are widely expanded, making nearly a globular bur. They are borne erect, or nearly so, along the drooping branches, and terminating the strongest branchlets. They are composed of five pairs of unequal, very thin, oval, convex scales, the lowest and highest pairs very small and barren, all in two ranks, imbricated or overlapping slightly at their edges until expanded; seeds, two to each scale, small, elongated, but seemingly sub-orbicular by the presence of broad, lateral wings; leaves, small, scale-like, and decurrent in two unequal opposite pairs of rows, the upper and lower row on the branchlets minute, the lateral rows larger and keeled, all with a resin gland on the back. The male flowers are numerous and very small, not over one line long, composed of four pairs of opposite scales, with four minute anthers under each.

36. Libocedrus decurrens, Torrey.

CALIFORNIA POST CEDAR.

[See Illustrations Nos. 22 and 23.]

This common and beautiful tree of the California mountains, in general appearance, bark, foliage, and wood, resembles the Gigantic Cedar, but is really quite distinct in important characters. It becomes a tall, pyramidal tree in open situations, limbed to the ground, but in forests it becomes limbless, and attains a height of one hundred to one hundred and fifty feet, with a clean whitish shaft, but slightly tapering four to six feet in diameter at base.

The branches, quite numerous in youth, bear their branchlets in two ranks, making flat, mostly horizontal, sprays of dark green foliage. The cones are pendent from the side pinnæ of principal branchlets and are oblong oval, one half to one inch long, composed of three pairs of very unequal, opposite scales, the lower short (often absent) and sterile, the mucro at the apex, divaricate and resembling a spur, the middle pair expanded to the full length of the cone, thickened, semiterete and gibbous at base, bearing on their inner faces the four seeds—a pair on each scale—the upper (or inner) pair of scales sterile, much modified, compressed laterally and connate, forming a septum, or partition, between the pairs of seeds and their long wings. Surmounting all at the apex of the cone, there is a pointed vestige of a fourth pair of scales. All of the scales bear a small, deltoid protuberance near the apex on the back, the termination of the outer or bast tissue of the scale.

Examination of the fertile scales of *Libocedrus* reveals the two layers of quite different tissue closely agglutinated; the outer one, the epidermis, not so extensive as the inner, appears as if shrunken away from it, leaving a narrow space uncovered all around.

The seeds are oblong lanceolate, four to six lines long, unequally two-winged; the outer wing but little longer than the seed, the inner broad and long, nearly equaling the scale.

The branchlets are at first flattened horizontally and clothed with scale-like leaves, their bases prolonged downwards (suggesting the specific name of *decurrens*), dimorphous, the lateral rows without glands, carinate, and nearly covering the narrowed, flattened, and obscurely pitted inner ones.

The male flowers numerous and terminating, the branchlets are ovate three to four lines long, yellowish, and composed of twelve to sixteen scales, with four globular anthers beneath each.

The geographical center of the Post Cedar is about central California, on the Sierra Nevada. It ranges northward to a few of the cross ranges in southern Oregon, and southward to the San Bernardino and Cuyamaca Mountains, being sparsely found in the Coast Ranges, but not so far north as Mendocino—the species never quite mingling with its prototype, the Gigantic Cedar of that region.

In the Sierra it flourishes at elevations of four thousand to six thousand feet, in Oregon a thousand feet lower, and in Southern California as much higher, everywhere preferring dry, open situations for the display of its graceful spires, though often found with other trees, but not crowding them, and never closely set in a forest.

This tree, very valuable in its best estate, is often attacked by a species of peculiar fungus, called "dry rot," that perhaps enters the tree from its roots. It attacks the cell contents of the wood, and kills sections in rounded masses, reducing them to powdered, brown, cinder-like refuse, disposed in long chains often through the entire length of the tree.

Trees affected by dry rot lose the bright appearance of the bark, and become reddish and dingy, giving notification to the woodcutter. Cutting them down arrests the rot, and often the timber is not much injured for posts, fencing, and many other purposes. It splits readily, and sound trees make excellent finishing lumber; variegated boards, composed of the dark reddish heart-wood, bordered with a stripe of the very white sap-wood, being a favorite material in cabinet work and for interior finish.

Upon the slightest abrasion or application of working tools, this Cedar gives off a delightful perfume, which suggested the generic name of *Libocedrus*, meaning Incense Cedar.

Like other Cone-bearers, this tree often skips a season, bearing no fruit, much to the detriment of seed collectors. Robert Brown, the distinguished botanist, in 1865, "climbed or cut down and examined upwards

of one hundred trees, and did not get more than a dozen poor cones, though from the remains under the trees they seem to have fruited abundantly the season previous."

In Oregon this tree does not have a good reputation for durability (perhaps a mistake), intelligent farmers assuring me that fences built of it could be pushed over in four years. Certainly, I know of fences and underpinning of houses in California that have endured for twenty-four years, and are apparently as firm as ever.

The Post Cedar is a great boon to the California farmer and stockman, their first improvements being largely aided by selections of Post Cedar from the nearest forest. It is favorably cultivated both at home and abroad as an ornamental tree, for which its symmetrical, pyramidal form, and its dense, dark green foliage eminently qualify it.

It is fond of sparsely timbered plateaus of medium elevation, or open valleys like the Yosemite, where, on its broad floor amidst the scattered Yellow Pines and Kellogg Oaks, it forms one of the most charming features of that sequestered region. Near the Cathedral Rock, on the right after passing through the gateway, the visitor meets with several unmistakable specimens of this noble species, rising like verdant cones to the height of fifty to eighty feet, their broad bases nearly resting upon the flower-strewn valley.

When these characteristic California trees are fruiting, as they do generally every season, and they are ripening their numerous, yellowish, pendent cones, like golden ornaments during the month of September, their appearance adds a charm and attraction to any landscape. In the long chain of valleys beginning with Yosemite and including Tahoe, Sierra, Mohawk, American, Big Meadow, and Lassen Valley, lying near the backbone of the Sierra Nevada Mountains, the *Libocedrus*, with its peculiar, lovely characters forms a never to be forgotten feature.

There are two or three other living species of *Libocedrus*, or Incense Cedar: one in New Zealand, one in the mountains of Chili, and a third or perhaps a marked variety of the last in the mountains of Patagonia.

The researches of geologists show that several species existed in far northern regions during Miocene times, coeval with Sequoias, Taxodiums, Magnolias, Liquidambers, and others. The extinct species were seemingly all of colossal proportions.

GROUND CYPRESSES.

[See *Illustration No. 24.*]

We come now to the consideration of a rare, very ornamental, and valuable group of trees composed of two families found on opposite sides of the earth—one genus of ten species in eastern Asia, the other of three species in America. No trees of other groups excel, or scarce compare, with these in loveliness of form, pliability under cultivation, or in the excellence of the wood. The general appearance is that of a perfect broad-based cone, the trees usually retaining their branches, which are bordered with two ranks of flat, horizontal, fan-like branchlets, all diminishing gradually from bottom to top of the tree, which usually terminates in a slender point, swaying with every breeze, the light green foliage decked throughout with bead-like, minute cones, in their season.

The Ground Cypresses were taken out of the large family of *Cupressus* in 1842, on the score of their having the branchlets in two ranks, as stated; the cones maturing in a single season; the scales thin and bearing each but two or three seeds, which are more or less winged; leaving the true Cypresses a compact genus with branchlets not two-ranked, cones requiring two years to complete their growth, the scales thick and bearing numerous wingless seeds.

It was found that the trees so segregated (the Ground Cypresses) were also divisible, upon characters mainly of the seed, into two genera that were also separated geographically by a semidiameter of the earth.

37. *Retinospora*, Siebold. Oriental Cypress.

This beautiful family is represented by ten species, mostly of small trees or shrubs, the pride and pets of the tree-loving Orientals of China and Japan. Many of the trees are so small that they make lovely little house plants, conveniently carried about in pots and boxes, as is the custom of the Mandarin, who often arranges his garden or park in very different, not to say grotesque, forms to suit his fancy.

Other species become very large trees, as in the great Japan Cypress, constituting the greater part of the forest of the rich island of Niphon. On the central mountains it often attains the height of one hundred feet, and its timber is so white, aromatic, firm, and fine grained, with a brilliancy under polish equal to that of satin, that the Japanese prize it above all other woods, making their most valuable furniture, as well as constructing their temples and idols of it; and they also set apart certain of the trees exempt from destruction and dedicate them to the Sun-god, under the name of *Fusi-noki*, tree of the sun.

This is the famous aromatic satin wood of the Orient.

38. *Chamæcyparis*, Spach. American Ground Cypress.

[Name from the Gr. *chamæ* (on the ground) and *cyparis* (Cedar), *i. e.*, Ground Cedar.]

This genus is exclusively American, and, like *Thuya*, has representatives in both the eastern and western development. The east has one species, *Chamæcyparis sphæroidea*, Spach ("White, or Ground Cedar"), a beautiful tree of medium size, found in cold, dense swamps of the farther east, from Maine down along the Atlantic to Florida, and westward along the Gulf to near the mouth of the Mississippi.

This tree is especially at home in the great Dismal Swamp, near Norfolk, Virginia, sharing the dense sphagnum bottom with the Bald Cypress, while the beautiful Tupelo and the Red Maple circle about them. When confined closely the shade is so dense as to entirely preclude the light, and the trees then trim themselves to a great height; but such behavior is not natural to this genus, always loving to spread out its lower branches with plenty of room.

The bark of young trees is thin and reddish, like that of a grape vine, becoming thick, and flaking off in age. The leaves are in two ranks, very small, scale-like; the male flowers scarcely visible in the forks of the branchlets on mature trees; the cones, about the size of a small pea, are quadrangular, of a greenish tint until autumn, then becoming bluish just before discharging the fine winged seeds.

The wood of this tree is most valuable. It is always close grained—a general character of the slow-growing Cypress tribe—very white, soft, highly aromatic, durable, and easily manufactured, hence in great demand for many purposes. The wonderful fragrance of the wood is retained as long as it is kept dry, but frequent changes from wet to dry do not affect the durability; shingles and weatherboarding being found serviceable after the lapse of sixty years.

39. Chamæcyparis Nutkænsis, Spach.

NOOTKA, OR ALASKA CYPRESS.

The forest development of the Northwest contains two species of Ground Cypress, one northward and somewhat abundant in its headquarters around Puget Sound; the other southward and extremely local about Coos Bay, and with a few groves along the coast into the northern counties of California and eastward as far as Mount Shasta.

These two species are classed by Gordon, in his "Pinetum," as late as 1875, with the genus *Cupressus*, principally because the seeds are more in number than two each to the scale; this distinguished author very singularly ignoring the other important vegetative characters separating the genera as shown.

The Nootka, or, as it is often called, the Yellow Cypress, extends from its headquarters northward to the Alaska Islands, and southward along the coast mountains to a few miles within the limits of California, notably near the tributaries of Mad River in Humboldt County. Interior it ranges at higher elevations on the Cascade Mountains. In August, 1890, Messrs. Muir, Smith, and Piper detected fine specimens of this tree on the southern slope of Mount Rainier at an altitude of six thousand feet.

At its best, the Nootka Cypress becomes eighty to one hundred feet high, with a diameter of three to five feet. Its general appearance is that of a cone gradually tapering to the summit, but not so slender as the next to be described. The branches are less flattened, the leaves larger, the cones larger with four to six scales, which are greener and more convex, with a more prominent umbo or boss on the center of the thickened apex.

The wood is light, hard, close grained, easily worked, and durable, of a satiny sheen under polishing tools; in color a bright, clear yellow. Besides, the wood possesses an agreeable, aromatic odor, which it retains until dissipated by moisture. After the enumeration of the qualities mentioned, it is not strange that the Yellow Cypress wood is in good demand at the price of $70 to $100 per thousand, and dealers hail with delight the intelligence that an exploring party in the Olympia Mountains of western Washington report the discovery of a large forest of "Alaska Cedar," which, when developed, will become a source of great wealth to the Northwest.

40. Chamæcyparis Lawsoniana, Parlatore.

LAWSON'S CYPRESS, OR PORT ORFORD CEDAR.

[See Illustration No. 24.]

Preëminent among ornamental trees, the world over, is this lovely denizen of the Northwest, including California. No tree is better known or more highly esteemed, it would appear, from the diligence with which the seeds of it are still collected for Old World markets, and the frequency with which it is met in all our parks, lawns, and other ornamental grounds.

The Lawson Cypress is distinguished at sight by its perfectly conical shape, the numerous limbs divided into opposite ranks of nearly horizontal fan-shaped branchlets gracefully bending downwards, exposing the upper surface with its bright green foliage, and, in the season, its many small, globular, yellowish cones. The limbs diminishing towards the top, the tree ends in a slender shoot, nodding and swaying before the wind.

This family of trees may not be clipped with the shears, as in the true Cypresses, the half-remaining flat fans being unsightly; so they are used only for standard trees in open parks, or for windbreaks, for which they are admirably adapted. Formerly the Lawson Cypress was abundant around Coos Bay, but fire and the lumberman's ax have removed the most of them. The shipment from the vicinity in early times gave it the name among lumber dealers of Port Orford Cedar; and the revered Dr. Kellogg used to call it "Ginger Pine," from the spicy fragrance of the timber.

Scattered groves are found southward in the coast forests until it meets the northern prolongation of the coast Redwood, in Del Norte County, with a few groves overlapping as far southward as Mad River, in Humboldt County. Eastward a few trees are found scattered along mountain streams at the unexpected elevation of nearly four thousand feet, notably on the Trinity Mountains, near Mount Shasta.

All hunters of the past twenty-five or thirty years who have ranged those regions for deer and bear are familiar with Scotch Camp, about twenty miles west of Sisson, and a noted locality for this beautiful and rare tree. In the vicinity of other trees, the Lawson Cypress hardly develops any body limbs, the few short, drooping sprays practically not at all affecting the timber; the wood being straight, very close grained, with a satiny gloss. When all of these qualities are supplemented by a light creamy color and a wonderfully powerful aromatic odor, which is *at once extremely delightful*, and a certain insecticide, a better "all around tree" can scarcely be imagined.

Foreigners regard the Lawson Cypress as one of the finest trees introduced to them from the Great West. They especially prize it on account of its bright green aspect under all conditions, thriving well almost anywhere, and always making a generous display of its lovely depending plumes.

Although this is a California tree in part, and of great interest to us, so much of its history has been given in the discussion of the genus *Chamæcyparis* that further description will be omitted, and the reader is referred to the illustrations of this most beautiful and valuable of trees.

TRUE CYPRESSES.

CUPRESSUS.

[See Illustrations Nos. 25 and 26.]

After taking a number of aberrant forms away from the old, ante Linnæan genus of *Cupressus*, quite a distinct and natural group of species remain, distinguished as trees and shrubs having their branches scattered

more or less, and not in two ranks; leaves very small, scale-like, opposi in four lines, making the branchlets appear more or less quadrangula cone globose or polyhedral, of divergent, ob-pyramidal and peltate scale the cone requiring two years to mature; seeds numerous, six to twent to each scale, angular and narrowly winged.

The Cypress family, because of their slow, uniform growth, their ligh and airy appearance, with deep green foliage, have become great favorit in cultivation, added to which the fineness of their branchlets admi of their being clipped with the hedger's shears without injury in th season, and shaped into hedges, windbreaks, towers, temples, cages, almost any fanciful shape at will.

The Cypresses comprise about fifteen species, widely distributed ov the earth, and in diverse regions as regards elevation. Three species a in China and India; three in the Mediterranean region; eight or nine i America, all in the dry western or southern portion; five of them i Guatemala and Mexico; the remaining five in Arizona and California.

The great Indian Cypress of the Bhotan Mountains of upper Indi becomes a tree of a hundred feet in height and six to eight feet i diameter. The wood is yellowish, close grained, tough, exceedingly fra grant, and very durable, much prized by the Orientals in manufacture and the spicy branches are burned as incense in their temples.

The Funeral Cypress of China is a singular tree; when young it i upright, rigid, and pyramidal in outline; later it begins to send out lon slender branchlets that depend to the ground like the Weeping Willow and like this tree it is much used for cemeteries.

The *Cupressus sempervirens* of Syria is a valuable timber tree, sti quite common in Palestine, and is doubtless the "Cedar" of Bible time used in the building of Solomon's temple, and not the Cedar of Lebano as the latter is a notoriously poor timber tree.

Two or three of the Mexican species are large and valuable trees notably the one on the slopes of Orizaba Mountain, at an elevation o seven thousand to eight thousand feet.

41. CUPRESSUS ARIZONICA, Greene.

ARIZONA RED-BARKED CYPRESS.

An interesting species of Cypress was discovered on the San Francisc Mountains of northern Arizona (1880) by Rev. E. L. Greene, and b the writer the same year on the Santa Catalina Mountains, Arizona.

Subsequently it was detected by C. G. Pringle on the Santa Rit Mountains, and in 1882 it was found in abundance and of large size b the writer on the highest peaks of the Chirricahua Mountains, in south east Arizona.

Just previous to all these discoveries (1879), Dr. Palmer found o Guadaloupe Island, in the Pacific, three hundred miles off the peninsul of Lower California, a large fruited Cypress, which at first was take for *Cupressus macrocarpa* (Monterey Cypress); but soon after Professo Watson determined that it was distinct, and published it as *Cupressu Guadaloupensis*. Strange to say, certain botanists of the East refer thi Arizona Alpine Cypress to the *C. Guadaloupensis*, as though the latte species was identical with all these trees found on the peaks of Arizon from end to end of the Territory.

This new Cypress is particularly distinguished by having the gray outer bark of the limbs peeling off in thin flakes, leaving the thin inner bark with a smooth, claret-red surface, at first spotted with yellow, where the flakes have most recently fallen away. This character recalls the peculiarity of the Manzanita and Madroña limbs.

The cones are very large, also, an inch or less in diameter; the scales with very prominent umbos, or leaf-like points.

In the published description of *Cupressus Guadaloupensis*, the branches are described as "drooping, with very slender branchlets;" but in our Chirricahua (Arizona) specimens the branches are not drooping, and the branchlets are short, stout, and beautifully quadrangular, caused by the four rows of prominent pointed leaves.

The trunks of all the trees—some of them forty to sixty feet high—retain the bark, which is grayish, of medium thickness, and disposed in longitudinal ridges, dividing into sections a few inches in length by diagonal reticulations, imparting to the trees a curious latticed appearance.

The insular species is already in cultivation in the bay cities of California, and is highly esteemed; the young trees with their twigs coming out in four ranks, the foliage thus becoming a collection of quadrangular pyramids, all of a glaucous green color of great beauty. The Arizona Red-barked Cypress is yet to be collected in fruit, and its merits tried by cultivation.

42. CUPRESSUS MACROCARPA, Hartweg.

MONTEREY CYPRESS.

[See Illustrations Nos. 25 and 26.]

Thousands of visitors to the "Golden West" have taken the "Seventeen-mile *Drive*" from Monterey or Pacific Grove to Cypress Point to see the wonderful trees there, and a right royal treat it has proved to them.

For miles the well traveled road meanders along the rocky beach and among these arboreal monarchs of past and conquered centuries.

Great trees, forty to sixty feet high and four to six feet in diameter, are seen. Then again, dense groves are entered, while, crowning the exposed points and beetling cliffs, are met a phalanx of sturdy warriors, their crowns of foliage clipped and molded into fantastic shapes by the ocean storms. Yet the trees are stubbornly holding their ground century after century.

The furious winds of winter coming up out of the sea and meeting with the shattered rocks of the cliffs, are split and separated by the former into keen, cutting currents that plow through the forest inland, hewing down or bending out of the way all vegetation in line of their course, traveling through the Cypress trees, shaping their foliage into platforms or benches, placed now on one side, now on the other of the shaft, the platforms rising one above the other to the tabular top.

It is as if a rounded head of solid verdure were cut through at irregular places, and the greater portions removed, leaving the fragments in picturesque array.

Interior and in all sheltered localities the Monterey Cypress becomes one of the most symmetrical of pyramidal trees. In San Francisco, and in all the settlements up or down the coast, no tree is more fre-

quently met with and more utilized, principally for windbreaks an hedges, though often purely for ornament.

Only at two points on the coast of California does the forest com down to the sea in such profusion, and these localities are Point Pino where the unique Monterey Pine crowds down to the crested waves, an the other is but a few miles southward—Cypress Point—where th unrivaled Cypress battles with the winds, both species seeming to enjo rather than to suffer the hardships of their location.

The Monterey Cypress is a fine example of the great age and decre itude to which a tree may become before it gives up the struggle of lif Now and then a tree is met with that has but a few live sprays of foliag and such trees, for many past years, have consequently been putting o but thin layers of wood. And the new material is applied, not a around the trunk, but only on portions connected with the live limb and these portions become high raised and carry the sap, leaving th rest of the trunk unfurnished.

The limbs are treated similarly, and the life current, changing like stream from side to side, sharp, angular turns are frequent in the limb the lower ones succumbing at length and remaining dry, hard bayonet like *chevaux de frieze* protecting a sentinel tower.

No tree is better adapted to, or more preferable in, reforesting th coast hills of California than this Monterey Cypress.

The swift growing Eucalyptus is largely planted, and now covers broa acres of the Oakland hills with dense forests; but future citizens coul make better use of Cypress than they can of Eucalypti, because the tim ber of the latter is almost unworkable—being coarse, tough, cross graine subject to cracking and warping—while the Cypress is easily worked, fir grained, hard, durable, and agreeably fragrant.

Like the Monterey Pine, this peculiar Cypress is found on two or thre other limited and neighboring capes, and a variety of each is foun away down the coast, on the Channel Islands of Santa Barbara, sugges ing not so much the migration of these trees to those islands, as th comparatively recent separation of those islands from the main lan once presumably well stocked with these trees.

The cones of the Monterey Cypress are usually clustered near the end of branchlets on short foot stalks, frequently turning to a shining bronz color the second season. They are variable in size, usually ovate an about an inch long; the young cone scales with foliaceous tips; seed numerous, ten to twenty to the scale, or one hundred to one hundred an fifty to the cone, small, angular and narrowly winged.

As with most plants under cultivation, the Monterey Cypress ha already developed several marked varieties. One may be named:

Variety *angulata*, distinguished by having the scales nearly flat, givin the cone a hexagonal form if composed of three pairs of scales, or poly hedral if containing more scales. The leaves are very small and obtus This form is frequently met with and proves a fine standard tree.

OTHER CALIFORNIA CYPRESSES.

The other Cypresses indigenous to California are small trees or bushe fifteen to forty feet in height. One, *Cupressus Goveniana*, or Mr. Gowen Cypress, with spreading, pendulous branchlets, smaller cones, leave etc., found sparsely along the coast mountains from Humboldt County to San Diego, and into the peninsula of California.

A third species, *Cupressus Macnabiana*, is a small tree, ten to thirty feet high, with short, slender branchlets; leaves small, conspicuously pitted on the back; and small cones, with thin, prominent bosses. It is indigenous to the secluded region about Clear Lake; also, reported from Mount Shasta, but the latter locality lacks confirmation.

Both these trees are in cultivation, and are favorites where small growths are desired.

CUPRESSACEÆ—Concluded.

Tribe 3. JUNIPERINEÆ.

THE JUNIPERS.

[See Illustrations Nos. 27 and 28.]

This, the last tribe of the multitudinous *Cupressaceæ*, or Cypress-like trees, is peculiar in being so compact and uniform a group as to be generally classed as a single genus (*Juniperus*), though comprising a large number of species. The fruit is a much modified, almost consolidated cone, either berry-like and juicy, or dry and crustaceous.

The Junipers are evergreen, slightly resinous trees or shrubs, found in temperate and frigid regions of both hemispheres, generally in arid interior localities; its fine branchlets and small, scaly leaves being better adapted to hot, dry climates than would broad, expanded leaves—at once inviting the keen rays of the sun and killing the plant.

Some authors divide them into three subgenera: *Oxycedrus* (the true Junipers), with leaves in whorls of threes; *Sabina* (the Savin Junipers), with leaves in opposite pairs; and *Cupressides*, with leaves in four rows.

There are about thirty species, but some have been in cultivation so long that many marked varieties have arisen.

Twenty of these species are found in the Old World (two of these apparently extending across Northern America), four or five are Mexican, and as many more are within the limits of California.

The wood of all the Junipers, it is hardly necessary to say, is exceedingly fine grained and durable; it is hence well adapted and much used for fence posts, underpinning, log conduits, etc.

The bark is usually very thin and readily separated longitudinally into shreds or long rope-like strips. The heart-wood is a bright red or brown color, winning for the Junipers often the name of Red Cedar.

43. JUNIPERUS PACHYPHLŒA, Torrey.

The thick-barked Juniper of Arizona and New Mexico, southward to Mexico, is peculiar in having its bark thick, persistent, and deeply cracked into square checks, not unlike the White Oak. The fruit is large, nearly a half inch long, and having a sweetish taste; hence, much prized by the aborigines for food. It is a tree thirty to fifty feet high, branching near the base with long, spreading limbs.

44. JUNIPERUS OCCIDENTALIS, Hooker.

WESTERN JUNIPER.

The Western Juniper is distributed from the mountains of eastern Oregon southward along the Cascades and Sierra to the San Bernardino Mountains at elevations of seven thousand to ten thousand feet.

It becomes a small tree thirty to forty feet high, with spreading branches, and small, blue-black resinous berries. This Juniper is very serviceable in furnishing fence posts, rails, etc. The fruit is small, blue-black, resinous, and fleshy. (See illustration No. 28.)

45. JUNIPERUS UTAHENSIS, Lemmon. (*J. Californica*, var. *Utahensis*, Engelmann.)

DESERT JUNIPER.

This desert-loving Juniper inhabits the many longitudinal ranges of mountains traversing the great Fremont Basin, and comprising all of Nevada, the western portion of Utah, and an eastern slice of California.

Usually, this species is found as a large bush freely branching from the base, but often it becomes a considerable tree, twenty to thirty feet high, and with a trunk clear of limbs for several feet. This Juniper, with the similar conditioned Nut Pine, form the most available and almost the only lumber and fuel supply for the interior hamlets of this large region.

The bark of the tree is tough and shreddy; the berries reddish, dry at maturity, and very small, three to four lines in diameter; the leaves in threes, minute, and close appressed.

(Illustrated as var. *Utahensis* of *J. Californica*, on Plate 28.)

46. JUNIPERUS CALIFORNICA, Carrière.

CALIFORNIA JUNIPER.

[See Illustration No. 28.]

This somewhat local species is usually a large shrub much divided from the base, but sometimes becoming a standard tree twenty to thirty feet high.

It affects dry, rocky, or sandy barrens, and creeps from them into contiguous plains as in portions of southern California and northern Arizona, where it especially abounds in connection with Mesquite, forming the principal fencing material and fuel of the region. The wood of this Juniper is light, soft, close grained, compact, and very durable in contact with the soil. The heart-wood is light brown, tinged with red; the sap-wood bright, clear white. The berries are reddish, dry at maturity, oblong ovate, five to seven lines long, of four to six reduced scales, usually with one large, brown seed, with a thick, bony shell. Leaves ternate, short, and thick.

47. JUNIPERUS COMMUNIS, Linnæus. (Var. *Alpina*, Engelmann.)

ALPINE CREEPING JUNIPER.

For the sake of completing the list of Junipers, this variety of a large upright Juniper must be admitted, though it is only a prostrate, creeping shrub, found only on a few of our high peaks. The leaves are large for the genus, about half an inch long, rigid, pungent, and spreading; the berries are very small, dark blue, juicy, or fleshy.

This is one of those few vegetable forms remaining to show that all the world's products have a common origin, this Juniper being found on alpine peaks of both continents and northward to the arctic circle. It is remarkable as being the only arboreous product of California that is indigenous elsewhere. Not one of all our Pines, Spruces, Hemlocks, Firs, Cypresses, Junipers, or Yews, save only this dwarfed, prostrate variety of a Juniper, extends across the long north and south barrier of the Rocky Mountains, separating the American flora, and prohibiting any *but Mexican* species to reach the Northwest and be nourished to undue development by its favoring conditions.

Sub-order 3. TAXACEÆ.

YEWS AND THEIR ALLIES.

[See Illustrations Nos. 29 and 30.]

This order of Cone-bearers is really very numerous, but as its members are principally in the Old World and the southern hemisphere, it does not seem of much importance to us.

It comprises four tribes, with twelve genera and about ninety species. *Among them are the great* Podocarpus (foot-stalked fruit) genus of the southern hemisphere, comprising fifty species of mostly large trees; the Dacrydiums of nine species in the East Indies, and the curious Prince Albert Yew of Patagonia, besides the True Yews of five genera; two of which alone are represented in the western development by one species each, both in California.

TAXUS, Tournefort.

TRUE YEW.

The True Yews are very numerous as regards species in the Old World and southern hemisphere, with two species in the eastern United States and one in California.

The principal Old World Yew is *Taxus baccata*, Linnæus, found in most parts of Europe at elevations of one thousand to two thousand feet, from the mountains of Greece and Italy to Spain and England, and even upon the Scandinavian Mountains between Norway and Sweden. Usually a large bush, it often becomes a small tree, with a short stem and an ample head composed of many branches densely set with drooping branchlets and dark green leaves in two rows.

Several varieties have been produced by cultivation, principal of which is the Irish Yew, called by Hooker, *Taxus Hibernica*, with strict, erect branchlets, closely compressed like a Lombardy Poplar; the leaves not

two-rowed, but scattered and in tufts; the berries, also, are oblong, not rounded as in the Common Yew.

The principal Yew of the Eastern States, *Taxus Canadensis*, Willdenow, is distributed throughout the provinces of Canada and the New England States, extending southward as far as Maryland. It never becomes more than a large spreading bush of no forestal importance. The Yew of the Southern States, *Taxus Floridiana*, Nuttall, becomes a small tree, but is limited to a narrow section of western Florida, along the Appalachicola River, where it is much esteemed for the purposes in which strength and elasticity are desired.

48. TAXUS BREVIFOLIA, Nuttall.

PACIFIC YEW.

[See Illustration No. 30.]

This Yew is a special product of the western development, and becomes quite a large tree in favorable circumstances, measuring two to four feet in diameter and seventy-five to eighty feet in height. It affects the borders of streams in low, rich woods of western Washington and Oregon, extending northward to British Columbia; eastward, as a small shrub, to Idaho and Montana; and southward, as a considerable tree, along the California Coast Ranges to the Santa Cruz Mountains, and along the western slopes of the Sierra to Yosemite Valley, notably upon the headwaters of the Sacramento River, near Shasta, and all along its upper tributaries.

The Oregon Indians, singularly enough, call the Yew by names meaning "fighting wood," because its wood is preferred by them for making bows, and the botanical name of the genus Taxus is said to be deprived from the Greek word *toxon* (a bow), on account of the use the ancients made of the wood, but most probably the name is derived from the Greek word *toxicum* (poison), the common Yew of Europe being considered poisonous.

As might be inferred, the wood of the Yew is very strong and elastic; the bark is extremely thin and scaly; the branches long, often extending far out over a stream; the branchlets long, slender, and drooping, with yellowish bark, and the half-inch acute-pointed leaves in two ranks.

The fruit is composed of a small, fleshy, bright blood-red, edible cup, three to five lines in diameter, with a solitary, ovate, hard-shelled seed, two to three lines high, sitting like an acorn—except that it is free—in the bottom of the cup.

The so called berries of the Yew are sweetish to the taste and much prized by the natives for food.

This singular tree is rarely met with of large size in California, being two to three feet in diameter, and trees even four feet in diameter have been noted.

The Yew is particularly distinguished for its heavy, hard, strong, elastic, and durable timber, which is used by Indians in making bows, paddles, spear handles, and fish hooks. The white people utilize it for fence posts, bridge timbers, oars, spring poles, binding poles for loading wagons; in short, for any and all purposes where great strength and exceeding elasticity are required.

TORREYA, Arnott.

FALSE NUTMEG.

This genus comprises four species, found in Japan, China, Florida, and California, respectively. They are usually small trees of a heavy odor, and a one-seeded drupaceous fruit, that both exteriorly and interiorly resembles a nutmeg, but is nothing like it in taste, being strongly terebinthine and aromatic. The False Nutmeg affects borders of swamps or stream banks. When the trees are cut, there spring up many vigorous shoots from the roots, like the Coast Redwood.

The genus *Torreya* commemorates Dr. John Torrey, the distinguished botanist, who, with Dr. Asa Gray, issued the "North American Flora."

The False Nutmeg of Florida is found scattered in western Florida, in company with the Southern Yew described, along the eastern banks of the Appalachicola River, very local, and becomes a small tree fifty to sixty feet high and one to two feet in diameter. Its leaves are yellowish, giving the tree the local name of "Yellow Yew;" and on account of its strong, disagreeable odor the name of "Stinking Cedar" is often applied to it, but it is generally called the "False Nutmeg."

49. TORREYA CALIFORNICA, Torrey.

CALIFORNIA FALSE NUTMEG.

[See Illustration No. 29.]

This singular and interesting tree is quite local in two distinct regions, to wit: the Coast Range from Mendocino to the Santa Cruz Mountains, and the western slope of the Sierras from El Dorado to Tulare. The coast locality produces the largest trees, found along the borders of streams, seventy to eighty feet high, and one and one half to three feet in diameter. The wood is light, soft, close grained, susceptible of a fine polish, very durable, and much sought for posts, etc., also for ornamental and cabinet work.

The leaves are bright green, two to three inches long by two to three lines wide, lanceolate, with a sharp apex and a narrowed base, twisted so as to bring the leaves into two ranks. They are also peculiar, in not being keeled by the midrib, either above or below, but the midrib is obscure with a deep, pale colored furrow beneath and on each side of it; also, the leaves are very thin, hardly thicker than writing paper.

Notable trees of False Nutmeg are found near Pescadero two feet or more in diameter, and making a fine rounded head of dark green foliage. The trees bearing the male flowers, in their season, are colored brightly with the large, yellow spikes of flowers. The female trees later are decked off with numerous olive green pendants to the principal branchlets, closely simulating the nutmeg of commerce.

A few small trees of this species are found in the Sierras, notably in that locality which contains so many wonders in almost every department of natural history—Yosemite Valley.

With this species ends the extended descriptions of the matchless Coniferous Forest Development of Northwest America, and the attempt on the part of the writer, to describe all the Cone-bearers within the limits of California; each species for the benefit of comparison, preceded by necessary, but less elaborate descriptions of its relatives, wherever distributed over the earth.

J. G. LEMMON,
Botanist of California State Board of Forestry.

PART III.—GENERAL FORESTAL PAPERS.

FORESTS AND RAINFALL.

By J. G. Lemmon.

There is much conflict of opinion concerning the relations of forest growth to the precipitation of rain or snow; some persons asserting that forests *cause* the precipitation, others that the precipitation is the cause *of the forests*.

The history of forest denudation in Europe and its results upon climate are set forth in the many volumes of J. C. Browne, also further histories of the treatment of American forests as well, by Prof. Geo. P. Marsh.

In these publications the authors present their opinions, backed by facts, that forests cause precipitation.

Prof. Thomas Meehan, Botanist of the Pennsylvania Board of Agriculture, holds the contrary opinion. In a late periodical he writes: "The ideas emphasized by Marsh in his 'Man and Nature' are now, mainly through our efforts, thoroughly exploded." "It is now conceded," he *continues, "that forests are the result and* not the cause of climatic conditions, though they have a reflex influence on precipitation, which, however, is very small."

"*I have shown*," *he concludes*, "that forests have nothing to do with springs or streams except on mountain sides, where they obstruct the flow of surface water and force it to sink down into strata connected with underground rivers."

Certainly this exception contains a large concession to the opposition, and quite substantiates much that is claimed as the cause of the devastating effects of rainfall upon denuded, unsheltered, hard-baked regions, temporarily flooded by torrents. A recent writer, Mr. H. Gannet, the Geographer of the United States Geological Survey, has published a remarkable paper aiming to prove the absence of forest influence upon rainfall. This he attempted to prove by observations noted for several years in certain sections of the country. To this Mr. B. E. Fernow, Chief of the Forestry Division, Department of Agriculture, replied at length during the meetings last winter of the Washington Philosophical Society.

Mr. Fernow examined Mr. Gannet's statistics, and showed that they were faulty, not substantiating his deductions, and that his arguments were at variance with all accepted history of forests, quoting freely from authors in the fourteenth century down to the present, adding that the recorded cases adduced for the bad effect of the destruction of forests upon the plains and valleys would form a large library of themselves.

There are indications that western Asia and northern Africa once possessed extensive forests, and it is well authenticated that southern Europe but recently was densely forested, where now only a few narrow belts remain as private preserves or Government holdings.

The Roman and Spanish *peninsulas were once clothed with* trees upon their mountain ranges. The capital city of Madrid was founded on a lovely plateau, in the midst of forest trees, and with large sweet water lakes all about it. The Castilians set to work destroying the forests, and paused not while a native tree remained, and Madrid, one of the gayest capitals of Europe, with a population of two hundred and fifty thousand, is surrounded to-day by sterility of the most forbidding character, with not a garden or villa such as usually mark the environs of a great city. The Castilians, after the discovery of the western continent, transplanted their hatred of trees with their colonies to Central America, and founded another capital city on the beautiful and fertile plain of Anahuac, where the populous nations of Montezuma had long lived and spared the trees. The Spaniards soon completely destroyed the trees, "to make the country look like old Spain," and to-day Mexico, occupying the site of the ancient Tescuco, is surrounded by a sun-scorched plain, with scarcely a forest tree in sight—and with them vanished the sparkling lakes and cooling streams.

The descendants of the Pilgrims, though less wasteful, and while utilizing the trees for lumber, have nearly destroyed the most valuable forests in the United States east of the Rocky Mountains.

The great southern Pine belt near the Gulf of Mexico, and the many noble forests of the Pacific Slope remain, save where comparatively small sections have been gleaned of their timber and larger ones denuded by fire. But of late a great change is observable in the sentiments of the people, a healthful agitation of the subject of forestry in all its details, with the dissemination of important *information, has resulted* in the awakening of the public mind to the dangers arising from the destruction of forests.

Within a few years most of the Northern States, including California, have enacted laws for the preservation of existing forests from wanton destruction, and in some of the States provision is made for renewal or for planting in new situations.

Commissioners of Forestry have been appointed in many of the States charged with the duty of collecting, arranging, and disseminating information in regard to forestry, tree culture, and tree preservation, especially with reference to the necessity of trees for the maintenance of water sources and a salubrious climate, and the prevention of torrents and "cloudbursts."

Powerful advocates of forest preservation have consequently arisen here and there, and appealed to the awakening sense of the community, arguing the feasibility of so cutting out timber and bushes, burning the debris in detail, at favorable seasons of the year, as to both leave sufficient growing trees to preserve the water sources and to keep up the supply of seedlings.

The examples of European nations are cited, nations that were aroused too late to a sense of their wasteful practices, but who are now engaged in renewing and creating forests; and the important facts are pointed out that the foresters of Europe have much more to contend with, in the slowness of the growth of their trees and the cumbersome character of their methods of care and culture, as compared with the extensive machine planting and procuring of more vigorous species of trees on our western prairies. The example of the French in the reclamation of the dunes and the Landes is so important and successful as to justify a brief description:

In 1785, or about one hundred years ago, M. Nicholas Bremontier, a French engineer, undertook to plant the long stretch of sand hills that skirt the southwest coast of France (the Bay of Biscay shore) with trees of the Maritime Pine.

These dunes cover a strip of coast between the mouths of the Gironde and the Adour Rivers, one hundred and fifty miles long by three to six miles wide, composed of white sand cast up by the sea, utterly barren, shifting with every gale, and constantly creeping more and more inland.

By various ingenious devices, M. Bremontier succeeded in planting, at first a small section, then the whole strip, with Pines, and soon the forbidding dunes, amounting to one hundred and forty-eight thousand acres, were covered with a fine growth of trees, entirely changing the character of the country, and permitting the establishment of several towns therein, in one of which, *La Teste*, stands a noble monument to the memory of the faithful experimenter.

Reclamation of worthless lands did not stop here. The landlocked region back of the dunes and extending far inland was equally valueless, for opposite reasons, however; floods of water a great part of the year, fatally malarious in summer, and occupied by a poor, ignorant, superstitious class of people, herding their flocks on stilts.

About forty years ago an engineer named Chambrelent examined this forlorn region, called the Landes, and he conceived a plan for its reclamation. Having purchased a large tract, he laid out an extensive system of ditches, carrying the water off into reservoirs as soon as falling; he then sowed upon the drying plains in the spring season, when they could get a start, seeds of the same Maritime Pine, which, to the surprise of the inhabitants, "grew like weeds." This first plantation succeeding so well, Chambrelent had no difficulty in enlisting the aid of the people, and soon similar ditches were draining the entire triangular district of the Landes, in all one million five hundred thousand acres.

To-day a vast forest is found there, railways traverse it, stations and towns have been established where formerly desolation and poisonous gases prevailed; factories are erected, millions of hop poles and telegraph poles are yielded by the thinning out of the plantation, while merchantable square timber and excellent sawed lumber are largely manufactured into useful objects on the spot, or carried to interior towns—and all this from the worthless, malarial, desolate Landes, in less than forty years!

Much was learned, and many facts gathered about forestry in Europe, from the recent visit to California of Herr Kesler, the Chief Forester of Prussia. The Prussian Government plant and care for trees as we do orchards: for the profit there is in them.

They have regular schools of instruction, in which are taught all that pertains to the cultivation, the uses, the preservation of trees. Young men are trained to take care of large areas of lands in forest, selecting the trees to be felled, directing the pruning and thinning, the planting of nurseries and the transplanting to the fields, so that there shall be a constant augmentation of forest values, with proper consumption and no waste.

In such schools Herr Kesler was taught, and, for twenty-one years,

was drilled in the care of stations, being promoted from one position to another, and severely examined in each, until he reached his present high and responsible office, with the direction of the forestry affairs of the entire kingdom.

USEFULNESS OF SNOW DRIFTS.

ECONOMY OF NATURE IN THE STORAGE OF WATER.

By J. G. Lemmon.

A thoughtful article, entitled "Trees and Snow," forwarded to me by R. L. Fulton, of Reno, Nevada, in which he combats several misconceptions concerning the relation of moisture to forest development, as well as agricultural prosperity, tallies so thoroughly with my observations for twenty-three years in the midst of the Sierra Nevada forest, including two winters—or rather two half years at Webber Lake, at an altitude of about six thousand seven hundred feet, that I submit nearly the entire article for publication in this Forestry Report, that it may reach the large number of readers at home and abroad which so able a paper merits.

"TREES AND SNOW.

"It is the general belief that the presence of trees has a tendency to protect the water supply of a country, and that the destruction of forests does much to decrease the flow of streams and to dry up springs.

"There seems to be ample proof that such is the case where the moisture falls in the shape of rain or quickly melting snow; but that it is equally true where it falls in heavy snows, and especially on high mountains, there are many reasons to doubt. That water which drops on shaded ground, thickly spread with spongy leaves, and the air so near the dew point that it cannot absorb much more moisture, should be held back, while that coming down on open ground should run off quickly, seems very natural; but in mountain regions there are peculiar conditions which do much to modify the action of the law.

"The Pine and Fir are the only trees found growing high on the mountains in any abundance, and their thin needles do not make the heavy shade when on the tree, nor the thick mat when on the ground, that the broad leaves of the Maple or the Oak do. Instead of forming a spongy layer three or four inches thick, they are swept away by the wind, and it is not unusual to see the ground bare under the trees in a mountain forest, and all the needles lodged in one or two drifts. Even when they lie where they fall, the coating is comparatively worthless so far as holding moisture is concerned.

"On the other hand, the foliage on this class of trees being as heavy in winter as in summer, the branches catch an immense amount of the falling snow, and hold it up in mid-air for both sun and air to work on, and only those who have had experience of the absorbing power of the dry mountain air can form any idea of the loss from that source. The theory that the shade protects the moisture-laden soil, thus retarding evaporation, and that each tree, by giving off a constant touch of dampness to the surrounding atmosphere, tends to increase the rainfall, means less when applied to the Sierra Nevada than anywhere else.

"The law is doubtless in force with more or less strength wherever rain falls and plants grow, but the class of trees that thrive in such places require comparatively little moisture, and consequently throw off less than other varieties. They do best on a loose, sandy soil, and are often growing where there is no earth in sight at all, clinging to the sides of cliffs so bare that the roots run along on the surface entirely uncovered until they reach some crevice which they fill, and send tendrils down to drew sustenance from an unseen source. In such places the melting snow disappears quickly from the surface, and except for the influence the trees exert in the way of keeping the ground light and porous, so that the water will soak in instead of running off, it matters but little whether they are there or not. No moisture remains on top of the ground for the shade to protect. It goes either into the air or else into the ground as soon as the snow is melted; and it is a well known fact that a very large portion of the water which finds its way down the steep sides of the Sierra disappears near the sources, and is found again far below, either in springs, by means of artesian wells, or in the increased flow of the parent stream. Indeed, a number of very respectable rivers, not only in the mountains but in some of our valleys, seem to owe their existence to such distant and hidden sources.

"In timber the snowfall is comparatively evenly distributed, and by the radiation and reflection of heat from its own body each particular tree *immediately* sets *itself* to work to clear the ground around it, and long before there is a vacant foot out in the open, a space will be bare for several feet around each trunk. So long as there is no color but pure white for the sun's rays to work upon, its heat is largely thrown off; but let a straw or a hair stick through and break the surface, and it will melt the snow or ice for several times its own diameter on every side and stand alone in a few hours. Exactly the same is true on a larger scale of every tree and stump in a forest. Following the reappearance of the sun after every storm, the process begins, slowly or rapidly, according to the temperature, clearing up large patches before that beyond shows signs of a break. It was the observation of these facts more than anything else which led me to believe that Nature has a better and surer way to secure the steady and regular flow of water in the streams than we have been led by popular teaching to believe.

"Another way in which thickly growing timber acts unfavorably, is in the prevention of drifting. The wind will throw up miniature banks in places, it is true, but nothing to what it does where it is left free. Outside the timber belt, where there is nothing to prevent the entire snowfall from reaching the ground, and nothing to break the force of the wind, one of the most powerful and active agents in preserving the water supply of a country comes into play. By forming solid bodies of snow, in the shape of drifts, the most effective means of saving water is reached.

"Across the bleak summits and down the vast cañons of the Sierras the wind has a force well nigh irresistible, and it not only gathers up the snow after it has ceased to come down, but it usually keeps at work all the time it is falling, and carries it, in whirling clouds, until it strikes a cliff or a cañon set at just the right angle, and there the whole

load is deposited. As long as there is any material left outside to work upon, this is kept up, and there is no knowing how deep some of the drifts get to be in the course of a long winter. As the days get warmer the surface thaws and moistens a little, but the cold nights, found all the year around at such altitudes, soon transform it into ice, making a crust, upon which the heat of the sun and the absorbing powers of the air find it difficult to make any impression. On open ground the process is aided by the packing power of the wind, and it is not unusual to see a man on horseback traveling comfortably across snowbanks high enough to hide both the horse and his rider many times over, if they broke through.

"It is hardly necessary to point out the advantage of having snow heaped up in large bodies, or buried deep in the cañons, rather than to have it spread out, exposing large surfaces to the sun and the dry air, which in such places is almost constantly in motion. The melting is then almost all done at the bottom, and far into the summer a little rill will be found running away from the lower side. Good sized caves are sometimes formed in this manner, and often the top crust is so solid that the last seen of the big drift will be an arched shell of frozen snow from one bank to the other. The beautiful adaptation of the means to the end, seen everywhere in Nature, is illustrated here. To attempt to hold back an adequate water supply for a great region, like that lying under the Sierra Nevada Range, in any except a solid state would be utterly useless.

"From Roseville, at the western base of the mountains, the summit is reached by crossing just eleven townships of six miles each, making sixty-six miles. Roseville is one hundred and sixty-three feet above the level of the sea, and the summit at the lowest place is over 7,000, and where the straight line touches it, over 9,000. Nothing in a liquid state would tarry long on a hill-side like that. No shade nor mat of leaves would be strong enough to overcome the law of gravitation to that extent. Nothing could detain it but a short time at the furthest, and if it were not for vast drifts which hold the snow until late in the summer, all the horrors prophesied from spring floods and summer droughts would be realized; for I notice that heavy storms continue to visit the places from which the timber has been taken, but when an unfavorable season fails to bank up the snow there is no water in the streams. A strong reason for doubting the orthodox faith is the well known fact that the temperature of the air in a forest is always several degrees higher than it is on open ground under the same conditions otherwise. A series of careful observations were made by Cornell University several years ago, and although the belt of woodland was only half a mile long and sixteen rods wide, the results were very marked. The trees were oak, maple, and chestnut, with some hemlock and pines intermixed, and an abundant undergrowth. The thermometers were changed and one put in another's place frequently, in order to detect possible errors."

The reporter sums up as follows: "A study of the records will show that the temperature of the wooded belt is somewhat higher than that of the open field, amounting from 2 degrees to 4 degrees on the average; that fluctuations are less extreme and less rapid, and that gradual changes in the temperature of the field do not affect that of the belt until a day or two later.

"Five different stations were kept open for several months, one thermometer being placed against the trunk of a large oak near the center of the woods; one near the same tree, but not touching it; a third on a pole four feet from the ground, ten rods from the edge of the woods, and two others in the trunks of trees. A considerable warmer temperature was shown by the instrument suspended from the oak tree, but not touching it, although on several days the one out in the field was exposed to the sunshine, while the others were in the shade all the time. Of course, the higher temperature would have a twofold effect a snowbank. The warmer the air the greater its capacity for holding moisture, and consequently the greater the evaporation, and at the same time the greater its power to melt the snow and start it to running off as water.

"As I have laid considerable stress upon this matter of evaporation, which some may think hardly applies to snow, I will say that a very considerable body of snow has been known to disappear from our streets [Reno, Nev.], without making a particle of mud, leaving the ground dusty, showing that none of it melted, but that it all went directly into the air; and this will occur any time when the thermometer does not go above the melting point (32 degrees) within a short time after a storm. The importance of presenting as small a surface to the action of such an air as that is very apparent, and it is in storing up her snow in heaps and packing it away in deep pockets that the economy of Nature is manifested. The center of the bank will not melt at any time, and it requires a very warm day to get at the underside of a snowdrift. The grass will be growing all around it before the ground gets thawed out sufficiently to start a stream from it; but let a tree stick its head up through the crust, and it will go quickly. I have yet to see the first body of perpetual snow lying among the trees. It will hardly do to say that the only reason is that the timber line lies below such places; for there are many banks of snow which only disappear once in ten years or so, when there comes a long, dry summer, which have trees growing higher up on the same mountain side."

In as large a subject as this there are many peculiar conditions and unknown quantities to discover and consider, but it seems to me that it is worthy of more attention than it has received. My own observations, while they have extended over a period of many years, have been those of a layman and have not been such as to afford mathematical proof, even that a given quantity of snow, say a foot, will last as long on open ground as it will among trees. My belief is that it will last longer, and such is the opinion of those who have had the longest residence in the mountains of California and Nevada, but so far as I am informed no one has made accurate experiments.

In any case I do not wish to be understood as favoring the destruction of the forests of this or any other country. I have never cut a tree down in my life and have never seen one fall without feeling as if I had lost a friend. Whatever is proven, there will always be abundant reasons for preserving extensive tracts of woodland everywhere that trees will grow, and it is time that the matter became one of public concern.

FOREST FIRES.

By J. G. Lemmon.

Whatever may be said about the necessity or wastefulness of the processes of forest consumption by the ax and saw of the lumberman there is but one opinion concerning the supreme misfortune or criminality of forest destruction by fire.

Property to the amount of $100,000,000 is annually destroyed within the territory of the United States, and it is estimated over $10,000,000 worth of property has been already destroyed in the limits of California during the past season.

Besides the loss of the trees to the State or to individuals, there is usually experienced great inconvenience and misery, owing to the burning of houses, fences, and personal property, to which are often added serious bodily injuries and horrible losses of life that cannot be estimated by money values.

Great as is the damage to present inhabitants when vast forests are swept out of existence in a few hours, or a few days, by devouring flames yet it is estimated that three times as great damage is done by the fire burning out the mold and other organic elements from the soil.

Always the young seedlings are destroyed utterly, and usually the saplings are killed, if not consumed; while on a section of country from which the whole tree growths have been removed, only fire weeds and brambles will come in until many years after.

How shall the crying evil of forest fires be stopped? Where is the remedy? Who shall apply it?

Legislation is necessary, wisely prepared, judiciously enacted, and thoroughly prosecuted.

"To dispel ignorance should be the first object of legislation," writes Mr. Fernow, of the Agricultural Department at Washington.

If people knew the value of trees, the damage and danger of forest fires; if they once experienced in their own bodies or purses the consequences of carelessness or design in setting fires; if they had the proper conscientious regard for the property, comfort, or safety of others, these wasteful, often woeful, fires would be less frequent.

Then the thoughtless or criminal circumstances that contribute to the firing of the forests; the wholesale slashing of timber, the tree tops and limbs, the cut bushes and other tinder, left by the lumberman or the farmer, ready dried for the escaping campfire, the lighted gun wad the cigar stump, or the neglected pipe—these contributory conditions must be abated.

The owners of large tracts of timber land which they are denuding cannot be required to clean up all the tree tops and other tinder traps This would be absurd, and furthermore unnecessary, but they could be justly required to clean a quarter-mile band around their possessions and, in case of large holdings, the making of clean traverses through them sufficiently near each other to stop the terrible running fires now so frequent.

We do not make a senseless attack upon the legitimate lumbermaking interest. It is not requisite to do so in order to preserve the forests sufficiently for their own betterment or their moisture-holding conditions. Trees are maturing and decaying everywhere in the dense, primeval forest, and it harms the forest not; in fact, it were better for many considerations if these old ripe trees were removed.

In our northern coast regions, where the rainfall is naturally very abundant and the forests consequently very dense, the complete removal of the trees is not followed by so calamitous a state of affairs as in the sparsely forested southern regions. Once strip the latter and a perpetual desert remains, unless man, with his art, comes to the assistance of Nature, with measures now unknown.

It is a common observation that forests are usually bordered by a fringe of saplings, and these by points and patches of seedlings, all apparently flourishing finely, and promising a material enlargement of the forest area. This is especially noted in nearly level regions where there is no apparent difference in soil between the forested and non-forested areas. Scarce an instance is known where the edge of a forest is dying off, or becoming abridged by the natural course of events.

The question arises: "Is this a normal attribute of forest growth? of forest development? Did they always thus strive to expand, or has some change occurred to them, or their environment, that now enables them to increase their periphery?"

The key to the problem is contained in two words—*Indian fires*. The aborigine desired open prairies and intervales for his game, that the latter might find better forage thereon, and, also, that he might the better mark them for his arrows.

With the retirement of the Indian, and the suspension of the annual forest and prairie fires, the forests everywhere expand; and it is well known that young forests are covering large areas of the eastern United States, and it is believed that the great alluvial plains of the central West, and of the Pacific Slope, might in time be covered with trees, if the practices of modern agriculturists did not serve to prevent their growth, desirable or otherwise.

More than all the destructive practices of the lumberman, the close grazing of the flocks and herds of the stockraiser, is the ruin of the *fire fiend*; and against him the blazing forests, the menaced settlements, and the ruined inhabitants of California appeal to citizens generally, and legislators especially, for instant and adequate protection.

REVISION OF BROKEN-CONE PINES.

By J. G. Lemmon.

Recent explorations and studies have brought out more clearly the real characters of the pair of valuable timber trees which, in the previously issued Forestry Report, I described as the Broken-cone Pines.

The result is a general augmentation of characters, with some important modifications of public descriptions, and one transposition of a misplaced variety.

As these two species constitute the greater part of our western forests the further discussion of them cannot be without interest.

Most of our impressions of physical objects, their dimensions, relations qualities, etc., are gained by comparison. This is the touchstone o naturalists.

It was for this reason, and to facilitate a comprehension of our nobl trees, that, in the report referred to, the eighteen species of Californi Pines were first grouped into large classes; then subdivided upon characteristic features into groups, and lastly described in pairs or triplets that by the simple aid of comparison their characters could be easil detected and retained.

The Broken-cone Pines comprise one of these pairs of species, an they are readily distinguished from the entire-cone group by the fac that their cones at maturity (the second year) break away from th branch by an irregular, transverse fracture within the base of the cone leaving a few undeveloped basal scales.

No entire cones are ever seen beneath the trees, unless they have bee cut off by squirrels or other means before their maturity, which occur in the Sierras during the months of September and October.

While the cones of other species are occasionally met with that ar broken in a similar way, the species alluded to *habitually* behave i this manner, and the designation of "Broken-cone Pines" is therefor sufficiently discriminating.

1. PINUS PONDEROSA, Dougl. "Yellow Pine," "Hard Pine."

The tree that is always called on the Pacific Slope the Yellow Pine is when fully developed, a tree of the first class, ten to fifteen feet in diameter, and two hundred to two hundred and fifty feet in height.

It may be detected by the color of the bark in mature trees, which i whitish yellow, or sometimes darker, but never black; generally ver thick—four to six inches—deeply fissured irregularly into mostly large longitudinal plates, which, in the whitish yellow trees, is usually soft flaky, crumbling before the ax into small sinuous lozenges or buttons and releasing a quantity of yellowish powder from the sutures. Th sap-wood, even of small trees, is usually very thin, the annual layers of this tree being soon converted into the condition of dryness and yellowness called heart-wood, at an early age; trees of the largest dimensions often having but one or two inches of live sap-carrying wood, incasing like a scroll, the mass of darker, lifeless, often resin-filled heart-wood.

The leaves, usually three in a fascicle, are comparatively short—tw to four inches—dark green, never glaucous, in young trees remainin persistent for many years, in older ones but a few years, thus giving a tufted appearance to the twigs.

The branchlets of *ponderosa* pines are brownish-green, and shining as if varnished, and, when bruised, they exhale the odor of turpentine these characters readily distinguishing the trees from the glaucous branchlets with pleasantly aromatic or orange-flower fragrance of the other species—*P. Jeffreyi*—these qualities being especially observable b comparing young trees of the two species.

The infant cones or aments of *ponderosa* are greenish in color, an oval or elongated, one half to one inch long, with pointed, appresse scales. They remain light green or change to olive green until maturity when they become a rich brown color, darker within; ovate conical in shape, two to four inches long, the umbo or dorsal protuberance being quadrangular and pyramidal, but slightly elevated and terminated by a small prickle, which is erect or divaricate or but slightly recurved.

Seeds dark brown above, four lines long, wings ten to twelve lines long, widest above the middle, translucent, slightly veined with brown pigment, which the microscope reveals as chains of globules like brilliant rubies.

The male flowers are numerous; long and reddish brown, becoming swollen and flexuous at the time of pollen dispersion.

The Yellow Pine, or *ponderosa*, as thus limited, does not usually comprise the largest number of timber trees in any region and is seldom kept separate in manufacturing, hence statistics of quantities, qualities, values, etc., are impossible.

While the typical *Pinus ponderosa* usually presents the foregoing characters, yet there are forms that differ much from the description given, the principal of which may be designated as follows:

VARIETIES OF PINUS PONDEROSA.

Variety (a) *nigricans*. "Brown-bark Pine, Sappy Pine, etc."—Trees of medium size, one hundred and twenty to one hundred and fifty feet high, flourishing in moister situations than other forms, longer retaining their numerous limbs, hence more symmetrical and spire-shaped or rounded in outline.

Bark dark brown or almost black, hard, comparatively thin, rather coarsely checked, sap-wood of many layers, heart-wood consequently meager, often very resinous.

This form is generally found in company with the larger, typical, whitish-barked trees, but in moister localities. It is particularly prevalent in small valleys and along the edges of forests in the Sierras, notably at Strawberry Valley, near Shasta, and Sierra Valley, Sierra County.

In flowering time during the last days of May, it is conspicuous for its large masses of male flowers, which are reddish brown, flexuous, and long cylindrical, two to four inches in length—the longest of the family.

Female flowers greenish brown, oblong, about an inch in length, with slender, appressed points, becoming the cone, which is apple green until maturity, then leather brown, and three to six inches long, with slender, erect, or divaricate prickles. (Seeds and wings largest of the species.)

This form has been confounded with forms of *Pinus Jeffreyi*, but may always be distinguished by its lighter colored bark, not braided in appearance, its smaller and narrower cones, green until maturity, its leaves apple green, never glaucous, and by its longer, narrower reddish brown male blossoms; also, by its terebinthinous, not aromatic odors.

Variety (b) *Benthamiana* (*P. Benthamiana*, Hartweg). "Foothills Yellow Pine."—A medium sized tree in the coast mountains, and on the western slopes of the Sierra. The young trees usually symmetrical, of spire-like contour, with their apple green foliage, contrasting agreeably with the ashen hue of the Gray-leaf Pine of the same regions, and the olive hue of the Douglas Spruce and White-barked Fir.

Infant cones or aments oblong, nearly an inch in length, on peduncles half as long, drab gray or greenish, with short appressed pointed scales. Maturing cones light green before opening, long and narrow, three to

six inches long, becoming leather brown when opened. Seeds pale, with long—one inch—transparent wings, slightly veined with brown pigment, as described.

Variety (c) *brachyptera*, Engelm. "Southern Yellow Pine."—A medium sized tree, eighty to one hundred and fifty feet high, and in its best estate, on the high plateau of northern Arizona, three to six feet in diameter. Found on the mountains of Arizona and New Mexico, and extending into the northern States of old Mexico. Cones small, ovate, two to four inches long. Seeds small, pale, mottled with brown; wings, one half to an inch long, and nearly transparent.

The great plateau of northern Arizona and New Mexico is overlaid in the center by volcanic scoria—called by the natives *mal pais*—the overflow of the great volcano of Agassiz standing at its northern end, and the scoria is exactly covered throughout its extent—one hundred and fifty by seventy miles—with a noble forest of this pine. Minor forests inhabit the summits of other mountains southward, along with another Broken-cone Pine, the *Pinus Arizonica*, principally distinguished from this by its leaves being constantly in fives, and its branchlets are glaucous, not reddish.

Variety (d) *scopulorum*, Engelm. "Rocky Mountain Yellow Pine."—This is a small spire-shaped tree of the Rocky Mountains, and extending as far east as the Black Hills of Dakota.

Leaves two to three inches long, often in pairs; plume-like at the ends of the branches, owing to their persistence thereon for three or four years before falling. Bark on old trees three to four inches thick; cones ovate, three to four inches long.

This is the principal lumber tree of the Rocky Mountains, and is one of the hardiest of the conifers, occupying arid and exposed sites with southern exposure. Under the conditions stated, if this forest tree should be removed by fire, it could not be expected to recover the ground, as seen in northern, moister localities.

The same remark applies to the forest trees of the southern Sierra and San Bernardino Mountains; once strip them off, and bald mountains must ever remain with deserts about them.

2. PINUS JEFFREYI, Murr. "Black Pine." "Jeffrey's Pine."

The "Black-bark Pine," which by reason of recent examinations is conceived to be clearly distinct, comprises several forms of Broken-cone Pines, chiefly distinguished from the *ponderosa* pines by its affecting more particularly eastern slopes, its darker bark, glaucous branchlets and leaves, with aromatic not turpentine odor, the greater size of its cones with strong, spiny, firmly recurved mucro on the scales, larger seeds with more cotyledons; also, the male flowers mature later and are greenish yellow, shorter and thicker than those of *ponderosa*.

The typical *P. Jeffreyi* in the vicinity of Shasta becomes a large tree, four to six feet in diameter, but not proportionately lofty, being usually rounded in outline, with large, long, often drooping limbs.

The aments or female flowers are purplish, oblong, about an inch long, on stout, erect peduncles of about the same length, the scales of the ament with strong points nearly divaricate, the whole becoming, at maturity, a large cone—the largest of the Broken-cones—six to ten inches long, elliptical in shape, and purplish until maturity the second season, then changing to leather brown, with wide expanded scales, each armed with spiny, firmly recurved prickles, six to ten inches long, seeds about an inch long, pale with brown veins above, wings narrower than other forms, quarter inch wide, and one to one and a quarter inches long, translucent, slightly veined with brown pigment.

Trees of this description are sparsely met with in many localities of the Sierras, always at high elevations, usually on spurs or outcroppings of granite in an eastern or northern exposure, often as in Eddy Valley, twenty-five miles west of Shasta, composing the principal tree of the region. Characteristic trees of this typical form are met with on the southeastern flanks of Lassen Peak, and Downieville Buttes, southward to the similar exposures near Webber Lake and Lake Tahoe. When accompanied by other pines of the group, they are usually on the highest situations, precisely those crags or slopes which were first left bare by the withdrawal of the ice at the close of the Glacial epoch.

VARIETIES OF PINUS JEFFREYI.

Variety (a) *deflexa* (*P. deflexa*, Torr.). "Red-bark Pine."—This form constitutes the principal timber tree of the higher Sierra, notably near Truckee, and for many miles north and south on the eastward slopes. The trees are of the largest size—one hundred and fifty to three hundred feet high, and under best conditions of development, six to ten feet in diameter, and of the most favorable character for clear lumber, being free from body limbs to a great height. The bark is usually reddish brown, thick, and coarsely checked by wavy lines, especially towards the tops of the trees, giving the bark a braided appearance.

The young trees and branchlets are glaucous, as also are the leaves, and both exhale an aromatic fragrance when bruised, resembling orange or apple.

Infant cones purple, about an inch long on peduncles half as long. Mature cones long, ovate, four to eight inches long, at length broadly *ovate by the expansion of the scales.* Seeds large, with large, broad wings one to one and a half inches long and half as wide, translucent, and with few brown veins.

Variety (b) peninsularis. "Peninsula Pine."—This very marked variety is found only on the San Rafael Mountains, on the peninsula of Lower California, east of Todos Santos Bay, and at an elevation of about four thousand feet. It forms an extensive forest upon loose debris of white granite, seemingly exactly covering the region where this character of rock prevails. Trees of medium to large size—one hundred and fifty to two hundred feet high, with full retained limbs, giving a spire or fusiform appearance. Bark grayish or darker, thick, hard, deeply furrowed, not braided in appearance. Infant cones very large, one to one and a half inches long, elliptical, purple. Mature cones remarkably abundant, covering the ground beneath the trees; broadly ovate, six to eight inches long, distinctly truncate at base, mahogany colored within, scales large, with strong umbo and thick, firmly deflexed prickles.

Variety (c) *ambigua.*—A pine noted by Canby and Sargent, in Flathead Lake Valley, Montana, as being "the prevailing tree of the valley, with purple cones, and long, glaucous foliage." This tree probably belongs with the Jeffreyi group of forms, although Professor Sargent

doubtfully referred it to *P. ponderosa* in his report of "Forest Trees of America," in the tenth United States Census, page 193.

The forestal and economical importance of this pair of lumber pines was set forth in the Botanist's Department of the Forestry Report referred to, viz.: 1887 and 1888, pages 93 to 102.

PART IV.—SCHEMES OF DEVELOPMENT AND CLASSIFICATION.

By J. G. Lemmon.

SCHEME I.—General View.

Showing the relations of each group to the others, the characters upon which they are separated, and the position of the Cone-bearers in the vegetable scale.

VEGETABLE KINGDOM. Plant development is upward and onward along curving lines, dividing and subdividing—the leading lines advanced.

- **Sub-Kingdom I. SPERMOPHYTA.** Flowering, seed-bearing, and conspicuous plants.
  - **Class 1. ANGIOSPERMÆ.** Plants with seeds inclosed in seed vessels.
    - *Sub-Class A.* DICOTYLEDONS. Seeds with two lobes. Growth exogenous.
      - Gamopetalæ { Compositæ.
      - → Polypetalæ { Leguminosæ, leading all.
      - Apetalæ { Cupuliferæ { Oaks, etc.
    - *Sub-Class B.* MONOCOTYLEDONS. Seeds undivided. Growth endogenous.
      - Petaloideæ { Lilies, etc.
      - → Spadicea { Palms, leading their division.
      - Glumaceæ { Grasses, etc.
  - **Class 2. GYMNOSPERMÆ.** Plants with seeds naked and devoid of pistil or stigma. Growth exogenous.
    - Gnetaceæ { Joint-stems, etc.
    - → Coniferæ { Pines, etc., leading their class.
    - Cycadaceæ { Cycads, etc.
- **Sub-Kingdom II. SPOROPHYTA.** Flowerless, spore-bearing, visible plants.
  - BRYOPHYTA { Mosses.
  - → PTERODOPHYTA { Ferns, leading their sub-kingdom.
  - THALLOPHYTA { Algæ, etc.
- **Sub-Kingdom III. PROTOPHYTA.** Sexless, microscopic, germ-like plants.
  - *Schyzomycetes* { Bacteria, etc.
  - → *Saccharomycetes* { Yeast, leading the microgerms.
  - *Palmellaceæ* { Protoccus.
  - *Cyanophycæ* { Nostoc.

The Protophyta are placed below the Sporophyta in deference to prevailing custom, but if we understood them rightly perhaps we should find them statical conditions of higher plants, and so they might be represented as well above as below the seed-bearing plants.

SCHEME II.

Class 2.—GYMNOSPERMÆ. Trees and Shrubs having pitted wood-cells. Seeds naked, usually in scaly cones. Male and female flowers separated, either on distinct branches (Monœcious), or on separate trees (Diœcious). Pollen distributed by the wind. Leaves mostly persistent, evergreen.

- **Order 2. GNETACEÆ.** Joint-stems. Arid regions.
  - *Gnetineæ.* Ephedra and allies. Five species on Pacific Slope. Two species in California.
  - *Welwitchineæ.* A solitary African genus of a species.
- → **Order 1. CONIFERÆ.** Cone-bearers. Widely distributed.
  - *Cupressaceæ.* Cypress and allies. Three tribes.
  - → *Pinaceæ.* Pines and allies. Three tribes.
  - *Taxaceæ.* Yews and allies. Four tribes.
- **CYCADACEÆ.** Palm-like plants. Tropical regions.
  - *Zamiæ.* Zamia and allies. Rarely cultivated.
  - *Cycadeæ.* Cycads and allies. Common in cultivation.

SCHEME III.

Order 1.
CONIFERÆ.—The Cone-bearers.
Widely distributed, resinous, and mostly evergreen trees and shrubs of cool regions; fruit mostly cone-shaped and scaly; leaves mostly needle-shaped; male flowers spike-like, of many stamens.

- Sub-Order 2. CUPRESSACEÆ. Cypresses and their allies.
  - *Cupressineæ.* Cypress tribe.
  - → *Taxodineæ.* Redwood tribe.
  - *Juniperineæ.* Juniper tribe.
- → Sub-Order 1. PINACEÆ. Pines and their nearest allies.
  - *Araucarieæ.* Southern pitch trees.
  - → *Abietineæ.* True pitch trees.
  - *Cunninghamieæ.* Chinese pitch trees.
- Sub-Order 3. TAXACEÆ.
  - *Taxineæ.* True Yews.
  - → *Podocarpeæ.* Foot-stalked Yews.
  - *Dacrydeæ.* Tear-gum Yews.
  - *Saxe Gotheæ.* Prince of Wales Yew.

SCHEME IV.

Sub-Order 1.
PINACEÆ.—Pines and Their Allies.
Comprise the greater part of the resin-producing trees. Fruit, conical or globose, of woody or leathery scales spirally arranged, and imbricated on an elongated axis; ovules one to seven under each scale, inverted.

- Tribe II. ARAUCARIEÆ. Austral pitch trees. Cone-scales one-seeded.
  - *Dammara.* Wax Pines.
    - *Alternans.*
    - *Decussans.*
  - *Araucarieæ.* Araucaria.
    - *Eutacta.*
    - *Columbea.*
- → Tribe I. ABIETINEÆ. True pitch trees. Cone-scales two-seeded.
  - *Fasciculares.* Secondary leaves fascicled.
    - *Cedrus.* Cedar.
    - → *Pinus.* Pine.
    - *Larix.* Larch.
  - *Solitares.* No secondary leaves.
    - "*Penderes.*" Spruce.
    - *Abies.* Fir.
- Tribe III. CUNNINGHAMIÆ. Oriental trees. Cone-scales one seventh-seeded.
  - *Arthrotaxis.* Joint-stem Yew.
  - → *Sciadopytis.* Parasol Pine.
  - *Cunninghamia.* Chinese Pine.

SCHEME V.

Tribe I. ABIETINEÆ.—True Pitch Trees. Very resinous trees, confined to cool northern regions. Fruit, a woody or leathery cone or burr of spirally over-lapping scales on an elongated axis, each scale bearing two inverted ovules, becoming usually winged seeds.

- **Sub-Tribe 1. Fasciculares.** Secondary leaves fascicled.
  - *Cedrus.* True Cedar. Fruit erect.
    - *Decidua.* Scales deciduous; one species, "Tree of God," Himalaya Mountains.
    - *Persistans.* Scales persistent; two species, one in Algeria, one on Mount Lebanon.
  - → *Pinus.* True Pine. Fruit diverse.
    - *Pinaster.* Fruit armed; sixty-two species, fourteen in California.
    - *Strobus.* Fruit smooth; fifteen species, four in California.
  - *Larix.* Larch. Leaves deciduous.
    - *Pseudo-larix.* Fruit pendent; scales deciduous; one species in China.
    - *Eu-larix.* Fruit erect; scales persistent; eight species, two on Pacific Slope.
- **Sub-Tribe 2. Solitares.** All the leaves scattered.
  - "*Penderes.*" Spruce. Fruit dependent; scales persistent.
    - *Tsuga* and *Hesperopeuce.* Seeds resinous; branchlets rough; leaves petioled; six species, two in California.
    - → *Picea.* Branchlets rough; leaves sessile, keeled; eight species, two in California.
    - *Pseudo-tsuga.* Cone-bracts exserted; leaves petioled, flat; two species on Pacific Slope.
  - *Abies.* True Fir. Fruit erect; scales deciduous.
    - *Megacarpæ.* Cones large, bark red within; five species, four on Pacific Slope, one in California.
    - *Microcarpæ.* Cones smaller, bark grayish within; twenty species, five on Pacific Slope, four in California.

SCHEME VI.

Sub-Order 2. CUPRESSACEÆ.—Cypresses and Their Allies. Slightly resinous trees, found in cool northern regions. Fruit berry-like, or a woody cone, of ob-pyramidal or valvate scales; ovules erect, two to seven under each scale, mostly wingless.

- **Tribe II. CUPRESSINEÆ.** (American genera only.) Scales verticillate or opposite.
  - *Arbor Vitæ.* Fruit elongated. Scales valvate.
    - *Thuya.* American Cedar. Six known species, one in California.
    - *Libocedrus.* Incense Cedar. Four known species, one in California.
  - *Cupressi.* Fruit globose. Scales peltate.
    - *Chamæcyparis.* Ground Cedar. Twelve known species, two in California.
    - *Cupressus.* True Cypress. Seventeen known species, three in California.
- → **Tribe I. TAXODINEÆ.** Fruit-scales spiral and peltate.
  - Taxodieæ. Fruit axis elongated.
    - *Sequoia.* Redwood, Big Tree. Two species, and only in California.
    - *Taxodium.* Bald Cypress. Three species, one in eastern United States.
  - Glyptostrobi. Fruit axis depressed.
    - *Glyptostrobus.* Embossed Cypress. One species, China, much cultivated in California.
    - *Cryptomeria.* Fringe-cone Cypress. Two species, Japan, much cultivated in California.
- **Tribe III. JUNIPERINEÆ.** Fruit berry-like.
  - *Juniperus vera.* Leaves ternate and pungent.
    - *Oxycedrus.* Sharp-leaved Junipers. Ten species, two in California.
    - *Cupressoides.* Cypress-like Junipers. Twelve species, none in California.
  - *Sabina.* Leaves opposite and scale-like.
    - Savin Juniper. Eleven known species, two or three in California.

APPENDIX TO BOTANIST'S REPORT.

Correspondence relating to certain mooted questions concerning our *Sequoias.* [Discussed in the report, pages 157–168, inclusive.]

CIRCULAR LETTER OF INQUIRY.

The following letter was addressed to the principal dendrologists of the East and Europe:

LEMMON HERBARIUM, CALIFORNIA HALL,
105 CLAY STREET, OAKLAND, CAL., June 1, 1890.

Professor ——:

MY DEAR SIR: In the Second Biennial Report of the California State Board of Forestry for 1887 and 1888, I had the honor to classify and describe in a familiar, popular way the genus *Pinus*, of which you know we have a large number of species on the northwest coast of America.

I am now elaborating the rest of the tribe *Abietineæ* for the forthcoming report due in August next, and perhaps will also reach the *Cupressaceæ* this season. At all events I shall soon have to grapple with the troublesome genus of *Sequoia*, and I need all the light that has been recently shed upon the subject, hence I apply to you, my dear sir, for information.

First, in regard to the origin of the name *Sequoia.* It is current among us Americans that Professor Endlicher so named our Redwood in honor of Sequoyah, a half-breed Cherokee, who had invented an alphabet for his tribe; but as long ago as 1878 Dr. Gray assured me that such a reference was an after-thought; that Endlicher certainly meant by *Sequoia* that our giant tree was a sequence, a follower, as it truly is the rear guard of *a past procession of prodigious species.*

Now, what is the fact in the case? Did Endlicher leave any statement of his reason for coining the word *Sequoia?*

Another question. I contemplate adopting Dr. Lindley's view [opinion reversed since] *regarding the distinctiveness of Wellingtonia, notwithstanding the* almost identical character of the fruit. The vegetative character separating our two species are certainly most marked, in the one case resembling those of Cypress, in the other those of the Yew.

If systematists without a qualm consent to separate *Chamæcyparis* from *Cupressus*, and *Tsuga* from *Picea*, I cannot see why, reasonably, they can hesitate to give *Wellingtonia* generic rank.

All paleontological research strengthens this opinion, it appears, for the vestiges of a score or more of fossil *Taxodiæ* fall decidedly into two classes of cypress-like and taxus-like characters, indicating two marked lines of development, of which our two giants are undoubtedly descendants; so why not recognize separate generic types, as in other closely allied cases?

Please favor me with your views upon these important questions, and I shall be always

Your greatly obliged servant,

J. G. LEMMON.

REPLIES.

Reply of Prof. Thomas Meehan, Botanist of the Board of Agriculture of the Commonwealth of Pennsylvania:

GERMANTOWN, PA., July 8, 1890.

MY DEAR PROFESSOR LEMMON: I love a new thought, and enjoyed your chat on Wellingtonia in "Gardener's Chronicle," p. 798. But are you *sure* Dr. Gray said *that* about Sequoia? From the time I started the "Gardener's Monthly" till his death, Dr. Gray had a habit of sending me a friendly criticism whenever anything occurred that did not meet his full approval. In an early number of my periodical was a full account of the origin of the name as "currently" received, by a very learned and careful critic long since deceased, J. H. Lippincott, who was personally acquainted with De Candolle, and possibly with some of the immediate associates of Endlicher. I think his opportunities for judging would be equal to any one's, and you will see by the article he regarded it no myth. But, and this is what I want to say, I am sure if Dr. Gray, *at that time*, regarded the story as but an after-thought, he would have so said to me. If you have not

misunderstood him in 1878, it would only show that fifteen or sixteen years after that article appeared Dr. Gray had changed his mind. For myself I should regard the "sequence" origin as still more unlikely, for, in what way could Endlicher construct orthographically *Sequoia* out of either the Greek or Latin root of *sequence?* Endlicher did not leave any *written* statement for his name, but it is understood that he so stated verbally to his friends as "reported."

As for *Wellingtonia*, while your points are well taken, it would scarcely then be the Wellingtonia of *Lindley.* I think Veitch shows clearly that Lindley's reasons are untenable.

After all, who can set bounds to any of the genera of coniferæ? I have often been struck by the resemblance of the seeds of *Sequoia gigantea* to those of *Cryptomeria Japonica.* When mixed who could separate them? If we went by such characters alone, the big fellow might be Cryptomeria. Even the cone, if it were not quite too rough, has no great unlikeness. I am not following changes in coniferal nomenclature with much ardor.

Very sincerely,

THOMAS MEEHAN.

Reply from Prof. E. B. Southwick, Secretary of New York Forestry Association:

NEW YORK, January 23, 1890.

Professor LEMMON, *Botanist California State Forestry Association:*

DEAR SIR: I received your very valuable report some time ago, and have waited until I might read it before sending my "thanks." I now do so, with the assurance that it is one of the ablest and best reports extant; and the way you have handled the Pines is truly wonderful. I fear some of our "big guns" will be put in the shade somewhat, and I am glad of it. I have not only read your work *three* times, but have copied all your classifications, etc., so I might better become acquainted with it. In fact, the matter has been so valuable to me that I want to thank you personally for your labors. I wish you could come here some time and enthuse us. I would like to get cones and fruits of your trees. Could you exchange, or sell? I have a large collection of our own forestry specimens. May I hope to hear from you some time?

Sincerely yours,

E. B. SOUTHWICK.

Reply from Dr. Maxwell T. Masters, editor of "The Gardener's Chronicle:"

41 WELLINGTON STREET, STRAND, W. C., LONDON, May 4, 1890.

MY DEAR SIR: I have received your report on California forests, etc., with great pleasure, as its contents are specially interesting to me just now, when I have been working at the morphology and life history of the conifers. It so happens, also, that many of the species introduced to this country by Douglas, Jeffrey, and other later collectors, are now getting into the cone-bearing stage here, so that I have had an opportunity of studying them. I enjoyed the benefit and pleasure of Engelmann's correspondence on the subject, as I still do that of Sargent, and if my results are not always the same as those of those great authorities, the reason is not *wholly* on account of my lack of knowledge as compared with theirs, but is also to be attributed to the different circumstances and conditions under which the trees grow here. Your report, and its *illustrative photographs*, will be of great service to me. I sent you a few days since one of my miscellaneous papers on conifers, the illustrations in which were taken from the "Gardener's Chronicle." If, during the summer, I have occasion to figure any more of the Californian or Oregon species, I will do myself the pleasure of sending you a copy.

With many thanks, faithfully yours,

MAXWELL T. MASTERS.

To J. G. LEMMON, Esq.

Reply from the venerable French botanist, Prof. Alphonse De Candolle, principal editor of the "Prodromus." Translated from the French:

GENEVA, SWITZERLAND, June 22, 1890.

MY DEAR SIR: I thank you for your Bulletin No. 7, which you so kindly sent me. The conservation of the forests in California is very important, because the country has dry seasons, which would hinder the reproduction of trees, as was formerly the case in Greece, Syria, Italy, etc.

The supposed origin of the word Sequoia is entirely fanciful, having no basis. Endlicher seems never to have said why he had taken this name. See Synopsis Coniferæum, Geneva supplement to Gordon's Pinetum, 1858, p. 303, he says: "Name not explained." Koch in Dendrologi, 1872, Vol. 2, Part II, p. 173, says: "It has its origin in California." He gives no proof of the assertion, but by the appearance of the name it seems to be very probable that the name originated or was taken up by the natives, and perhaps written more or less correctly.

After all, it matters little, *a name is a name*. The essential thing is, first, that it be the expression of a natural genus; second, that it had not been employed before; and, third, that the genus had not previously received another name.

As to the question, to admit or not admit another species of Conifera, will you please allow me to be excused from an opinion, as I have not made a special study of that family.

Receive, please, my dear sir, the assurances of my cordial regards.

ALPHONSE DE CANDOLLE.

Reply from Sir Joseph D. Hooker, late Director Royal Gardens, Kew, England, and President of the Royal Society:

THE CAMP, SUNNINGDALE, July 28, 1890.

DEAR MR. LEMMON: I have been looking in vain for anything that would throw light upon the subject of your queries.

My impression is very strong that Gray accepted the view of Sequoia being named in honor of the American who invented the alphabet of his tribe language. But I have sought in vain for any printed confirmation of this. I have not, however, looked through all his writings about the Big Trees.

I cannot go with you at all in separating, generically, *S. gigantea* from *S. sempervirens*; even if the distinction you make (the disposition of the leaves) held good, *which it does not*, it would not suffice to found a genus upon.

Not only has *Sequoia sempervirens* some states in which the leaves are imbricate, as in *S. gigantea*, but other genera, as *Podocarpus*, and I think the *Dacrydium*, have them with bifarious and imbricate leaves on the same tree, and even on the same branch.

Very sincerely,

J. D. HOOKER.

INDEX TO BOTANIST'S REPORT.

ERRATUM.

Page 46, line 26 from top, for "Arundinaria macrosperma" read "Arundo donax."