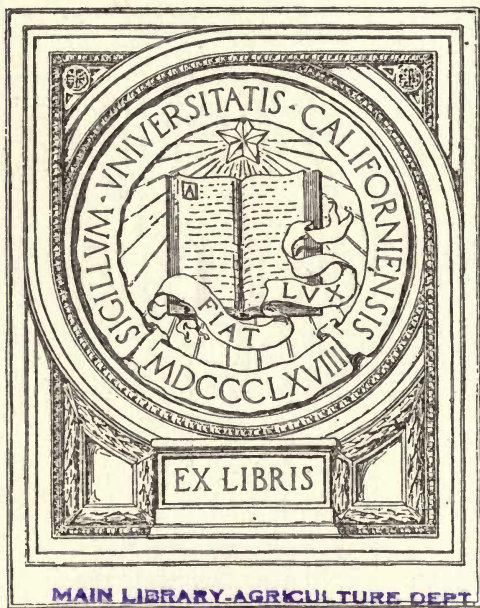


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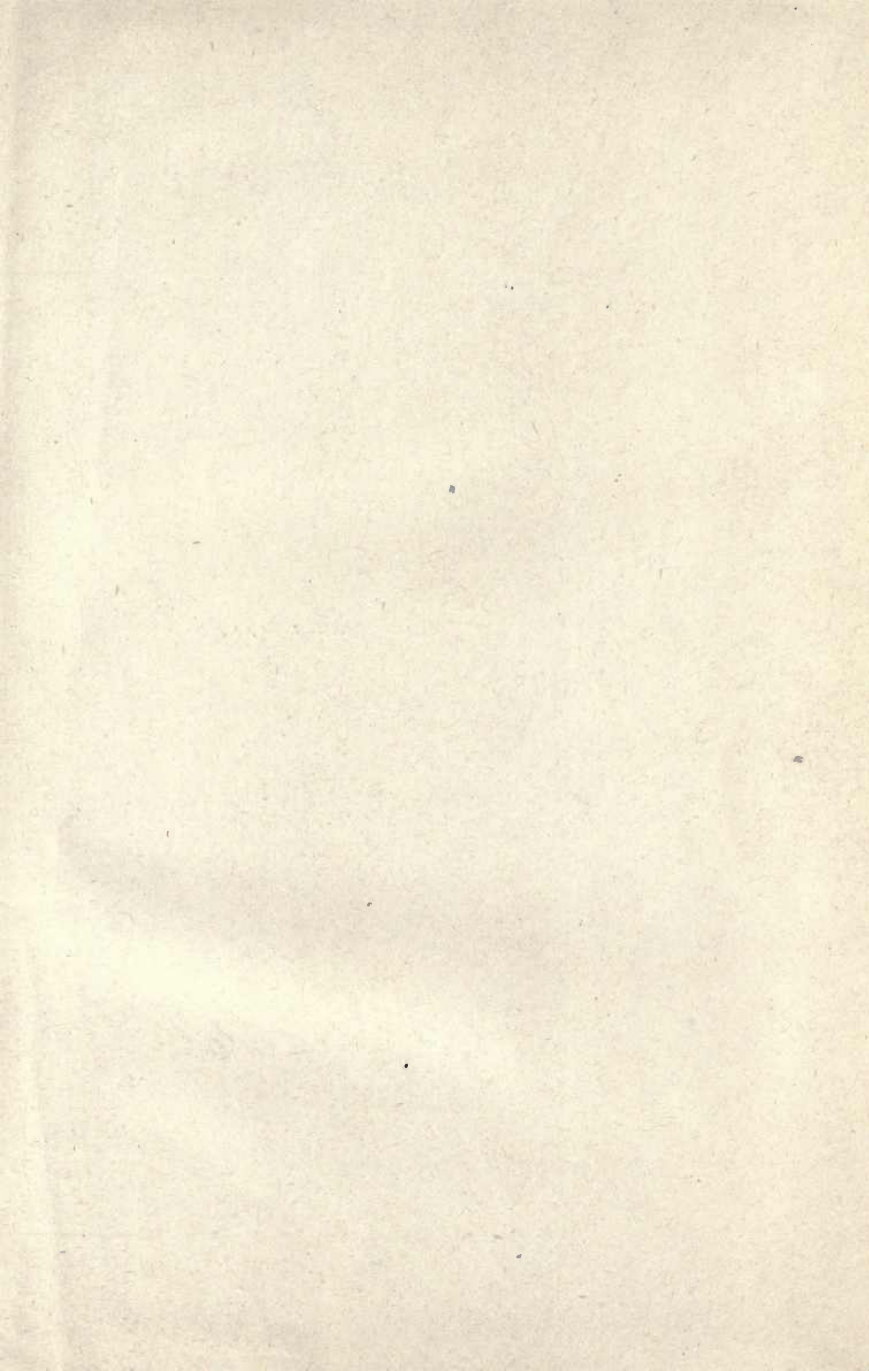


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CULTIVATION AND DISEASES OF FRUIT TREES

IN THE

MALTESE ISLANDS

BY

J. BORG, M A , M.D.

*Professor of Natural History
and Superintendent of Agriculture.*

Printed by Government Authority



MALTA
GOVERNMENT PRINTING OFFICE

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INTRODUCTION.

The cultivation of fruit trees represents a more advanced stage of civilization than the mere cultivation of field crops, and could be taken up only by a people which has settled down and occupied the land for good, and has given up definitely its original nomadic habits. Half-savage tribes with ill-defined ideas of property, and therefore with no notion of continuity, may have their herds of domestic animals, and may grow field crops or even such perennials, as the banana, which are likely to yield an early and abundant food, but have no fruit groves or orchards, and rely chiefly on the produce of the trees of their native forests. Hence the idea of property or continuity is the first condition for the cultivation of fruit trees. Land held in common, belongs to nobody, and it requires an altruism altogether beyond human nature for the individual to go to the trouble of planting trees, the fruit of which others will gather who have no connection with the planter and no natural claim on the results of his labour.

In the same manner the farmer who holds his land on short lease,—and our short lease is based on a brief period of a four years course of rotation,—can have no right of property on the fruits of his labour after the expiration of the term of lease, and if he improves the land by planting fruit trees, his rent is probably increased just when the trees are coming to fruit so that he is either ousted out of his land by some other farmer who is willing to pay more rent for improvements made by others, or he has to submit to pay the increase of rent demanded from him. In

other words, the short-lease farmer who improves his land is made to pay interest on his own capital and on the value of his own labour. Thus, our system of land tenure by short leases is a serious obstacle to the planting of fruit trees, and generally speaking to any other improvement of the land. This antiquated system originated in times when only the rights of the capitalist or landlord were duly recognized and safeguarded, and the rights of labour were not supposed to exist or to deserve consideration.

Therefore we find that the planting of fruit trees is done only when the land is owned by the planter, or when his rights are protected by a long lease or *emphytheusis*. Unfortunately landowners are unwilling to part with their land on long leases, although the payment of rent is thereby better secured than in the case of short leases. This reluctance on the part of the landowner is due in great measure to the existence of the antiquated system above mentioned, but should the tenant be allowed the full enjoyment of his rights and of the fruits of his labour, so long as a fair rent is paid and the soil properly cultivated, it will not be long before both Islands become covered with fruit trees to the advantage of agriculture and of the entire community.

The cultivation of fruit trees in these Islands must have dated from the early Phœnician days. The fig-tree is probably the oldest tree in cultivation but the olive-tree and the vine were also cultivated extensively. The olive-groves furnished the oil which was a useful article of commerce and was carried to Iberia (Spain) and there exchanged for silver. The ancient trench-like excavations in the rock all over the western part of the Island, similar to those which are occasionally constructed even at present for the planting of vines, testify to the extent and importance of our ancient vineyards. It does not appear that our fruit-culture and agriculture

generally have suffered much during the struggle for supremacy between Carthage and Rome, in fact in the last period of the Roman republic when the Maltese Islands were governed as a semi-autonomous municipality, the opulence of the Islands which then as now depended mainly on agriculture, was such as to induce Verres to commit those notorious acts of rapacity for which he was brought to task by Cicero in the Roman Senate. With the partition of the Roman Empire the Maltese Islands passed under the sovereignty of the Eastern Emperors, but even then it could not be said that our agriculture was neglected and that poverty had followed in the wake of this neglect. With the advent of the Arabs in A.D. 870 the Greek garrison was captured and the soldiers sold as slaves to the Maltese for a good round sum in gold. The Arabs were keen cultivators of fruit trees, and to them is probably due the introduction of the Bitter or Seville Orange, the Common Orange and the Lemon. The Arabs were also good administrators, but it appears that in the eleventh century an antagonism had sprung between the Arabs and the Maltese population which culminated in the eventual overthrow of the rule of the Arabs in 1090. This was effected under the auspices of the famous Count Roger who had already cleared the Arabs out of Sicily, and henceforth the Maltese Islands formed part of the Kingdom of the Two Sicilies. In the long period which followed between 1090 and 1530 when the Islands passed to the Order of St. John as a fief of the Kingdom of the Two Sicilies, the Maltese Islands were exposed to occasional invasions of Arabs from the mainland of Africa, and still more to frequent visits of pirates from the semi-independent Islamitic states of that region. These incursions brought about a great deal of harm, the cultivation of lands along the easily accessible coast line was abandoned, and the impoverished and dwindling population concentrated

in the central parts of the Islands. Commercial intercourse with Sicily, Italy and Spain was greatly interfered with by these pirates and was often stopped altogether for long periods. The extensive plantations of olive trees, vines etc. were gradually destroyed, and the rich alluvial and agricultural soils of Burmarrad, Puales, Ghain Tuffieha, Gneina and Marsa were neglected and became hotbeds of malarial fevers which further decimated the population, and were consequently avoided by the farmer, as dangerous, for a long period afterwards.

However, even then extensive plantations of olive-trees, fig-trees, vines and almonds, and also of oranges and lemons were yet in existence in many parts of the Island, such as at Sceb-ir-ras and Xaghret Neuia (the promontory now occupied by Valletta and Floriana), the Marsa (which like Xaghret Neuia belonged to the ancient Maltese family of Neua or Nava, which on the coming of the Order of St. John left the Island and became established at Catania), at Zeitun and Zabbar, at Kormi, at Lia, Balzan and Attard, at Zebbug and Siggieui, at Ghain Mula, Uardia and Selmun, and at the head of the various valleys where spring water was available, and although in reduced circumstances, the cultivation of the land was on a sufficiently extensive scale to support the population.

Moreover, it is probable that at that time there were still considerable remnants of the woods and small forests with which both Islands must have abounded in ancient days. The holly-oak or evergreen oak (*Quercus Ilex* L.) must have been common all over the Island and probably formed a considerable proportion of the holy groves at Imtarfa and Rabat. Remnants of such groves or woods of the evergreen oak (Maltese=*balluta*) still exist on a hill near Boschetto, at Uied Hazrun near "ta Baldu", at Uardia, at Ballut ta Ghain Tuffieha and at Imgiebah near Selmun, the gigantic evergreen oaks at Uardia and at Imgiebah being particularly beautiful

and are a national monument of no mean importance. Another constituent of the holy groves was undoubtedly the Sandarac tree, *Callitris quadrivalvis* Vent. (Maltese = *gharghar*), a conifer which flourished in many places and remnants of which still exist at Makluba near Krendi, at Uied Filep close to Musta, and at Ghain Rihana. The Aleppo pine (*Pinus halepensis* L.) flourished at Mellieha and in all probability the Aleppo pines now so often planted for the purposes of ornament, are the descendants of the aboriginal trees which existed at Uied Znuber down to comparatively recent times. The unwieldy but useful Carob tree (*Ceratonia Siliqua* L.) was then as now the principal tree in both Islands, the fig-tree was planted and grew self-sown everywhere; and the wild pear, the hawthorn and the pomegranate abounded in the valleys, where the white poplar, the willow and the elm also flourished these last being reduced now to a few survivals at Bahria, Gnien ta l'Iskof, Ghain il Gbira, Ghirghenti etc. and seem destined before long to disappear altogether.

In the sixteenth and seventeenth centuries the Islands had recovered so far from former devastations, that plantations of fruits, particularly of olive-trees and vines again became numerous and extensive, and olive oil was produced in quantity for local consumption and also for export. Orange-groves and plantations of almond trees increased in importance, and there was every appearance that the cultivation of fruit trees would eventually become the main branch of local agriculture. However, in the latter half of the eighteenth century there arose a large demand of cotton from Spain, and vast olive groves and vineyards were sacrificed to make room for the cotton plant. It is stated that in the last decade of the eighteenth century over 80,000 olive trees were destroyed, and the plains around Zebbug where this tree flourished became practically treeless. During

the first half of the nineteenth century important vineyards were planted especially in the neighbourhood of Rabat and Notabile, at Imriehel, at "ta Bria" near Siggieui etc., but a fresh impulse to cotton growing was created by the shortage of cotton during the American war of Secession, and the vineyards were destroyed once more, and the number of olive groves was still further reduced. The production of olive oil and of wine had ceased altogether in the beginning of the nineteenth century, the produce of the remaining olive trees being consumed pickled or salted, and only a few table grapes were henceforth planted, although the manufacture of wine in small quantities was again resumed about the middle of the nineteenth century to be discontinued soon after when the vines were removed again to make room for cotton.

In the nineteenth century the cultivation of the carob tree was extended on rocky and shallow soils all over the Island; the hill sides around Gargur, Naxaro, Birchircara, Maghtab, St. Julians, Halluka, Zabbar, Krendi, Rabat, Siggieui etc., became clad with the dark glossy foliage of this evergreen tree, but unfortunately the high cost of fuel during the Great War 1914-18 and afterwards, induced many owners to fell their carob trees, until the Government stepped in and by Government Notice No. 378 of the 22nd November, 1917, put an end to this ruinous practice, but many carob trees had been felled in the meantime, and some olive-trees, almond-trees etc., were also sacrificed.

The cultivation of Citrus trees, particularly of the orange, in enclosed or walled-in groves began to assume importance early in the eighteenth century when many groves were planted at Lia, Balzan, Attard, Siggieui, Zebbug, Curmi, and wherever it was possible to make provision for the storage of water required for irrigation. The cultivation of the orange continued in favour until

the decline of the nineteenth century ; at that time however, the cultivation of the vine began to rise rapidly in favour and large areas in both Islands were quickly transformed into vineyards, so that it is questionable whether there were ever more extensive vineyards at any other period of the history of the Islands, nor has the advent of the Phylloxera in the least affected the ardour of the vine-growers.

The cultivation of fruit trees in these Islands is greatly handicapped by the import duty on wheat. This duty at the rate of 10 shillings per quarter, amounts in normal times to an *ad valorem* tax of 25 to 33 per cent. on the value of the imported article and is therefore a powerful incentive to the cultivation of wheat and of other field crops which form part of the usual courses of rotation. The import duty on wines has of course, the same effect on the cultivation of the vine for the production of ordinary table wines, and the present popularity of vine culture is no doubt due mainly to the protection afforded by this import duty. The cultivation of other fruit trees is not in the same fortunate circumstances as regards protection, indeed it has to compete with field crops which are directly or indirectly protected by import duties and has often to stand the severe competition of the foreign produce which is imported free of duty.

Without entering into a discussion on the merits of these import duties either from the social or from the agricultural standpoint, it is enough here to repeat that the detection of Phylloxera in various localities in Gozo in July 1919, has hardly damped the enthusiasm of wine growers, who are keen to start planting American vines for grafting stock, so as to secure immunity for the newly planted vineyards ; and it is not improbable that, at no distant date, wine will eventually replace wheat as the staple produce in both Islands. The change will not be for the worse, as the cultivation of the vine will offer

more scope for employment than that of field crops, and if the wine produced could be standardized so as to have a product of good quality and uniform type, an export trade of fine wines might be created which would become a reliable and permanent source of agricultural prosperity.

Besides the fruit trees mentioned and described in the following pages, others have been introduced now and then which did not agree either with the soil or the climate and therefore have proved a failure. The cultivation of the mango (*Mangifera indica* L.) has been attempted many times. Seeds saved from choice imported fruits have been sown and germinated quickly. The plants with their long leaves of metallic green at first made satisfactory growth, but generally succumbed during winter. Seedlings of mango grown in vegetable mould in sheltered situations have survived for three or four years, but were ultimately killed by the cold. The pine-apple (*Bromelia Ananas* L.), is not a tree, but its cultivation was successfully undertaken under glass by the late Mr. Bisazza in his villa at Rabato, and was frequently fruited to perfection. In summer the pine-apple thrives very well in the open air in full sunshine or in the shade of tall trees, but when the thermometer descends to 15°C. the growth is checked and the plant must have the shelter of a glass house, otherwise it will perish. Even under glass the growth suffers a severe check unless steps are taken to apply some artificial heating in the coldest months, December-February. The mangosteen (*Garcinia Mangostena*), *Vangueria edulis*, the bread fruit tree (*Artocarpus incisa*, *A. integrifolia*), and other tropical fruits have been introduced in our gardens with negative results. *Nephelium Litchi*, the Litchi of South China, has been repeatedly introduced in the Island from Hong-Kong by the late Captain Worcester, local agent of the Peninsular

and Oriental Company. The plants did fairly well, for a few years, and some of them fruited and matured their fruits, but they have all succumbed, chiefly owing to our calcareous soil, but also to occasional spells of severe weather.

Monstera deliciosa Liebm., an Aroid from Mexico and Central America, better known to our gardeners as *Philodendron pertusum*, is commonly grown as an ornamental plant in gardens and country yards. It flowers in autumn, and the green fleshy spadix matures usually in the following autumn. It is highly perfumed and has a very sweet and delicate flavour, but leaves a burning or itching sensation on the tongue and lips, due to the minute needle-like crystals which adhere to the fruit beneath its outer coating. This fruit is usually seedless, but black seeds are sometimes produced which germinate well if sown at once before they get too dry. However, the *Monstera* is best propagated in spring or summer by cuttings of the stems, including two buds or eyes in each cutting, planted at a level with the soil.

Another evergreen bush or small tree which is grown chiefly for ornament is the Barbadoes gooseberry (*Malpighia glabra*, Order-Malpighiaceae). The plant is very ornamental on account of its opposite, small lanceolate shining green leaves. It has small inconspicuous whitish lilac flowers borne on long stalks, which are succeeded by small ribbed, tomato-like fruits of a shining cherry-red colour, hanging by a long stalk. The fruit contains one large, round, soft seed, by which the plant is propagated. The pulp or flesh is orange red, and has a sweetish flavour with a pleasant acidity. The fruit matures in autumn and keeps long on the tree, but is more valuable on account of its very pretty appearance on the tree or on the table. The Barbadoes cherry was introduced towards 1885 by the late Baron G. Depiro Gourgion who has also introduced many other ornamental or useful trees and shrubs.

The Key-Apple, *Aberia caffra* Hook & Harv., of the Order Flacourtiaceae, is a deciduous thorny shrub native of Natal. The shrub is polygamous, that is individual plants produce only male flowers, and others only female flowers, while others have both sexes in the same flower. The plant is propagated easily by cuttings in winter or early spring, or by layers in summer. The small pinkish white flowers are succeeded by small fruits, more or less pear-shaped and not exceeding 3 c.m. in diameter, of an orange yellow colour, with several hard seeds. The fruit matures throughout the summer and the pulp of the fruit is sweetish and acidulous. This shrub thrives very well in our gardens, but is disliked on account of its thorny branches and the dull whitish green colour of its foliage.

Another shrub sometimes classed with fruit trees, but grown chiefly for its highly ornamental qualities is the Strawberry-tree (*Arbutus Unedo* L., Ericaceae) This small tree or shrub is native of Europe and thrives best in temperate regions and in siliceous soils, but does well in these Islands if planted in a deep red soil and in a cool situation. It is an evergreen shrub with alternate, elliptical, acutely toothed leaves of a dark lustrous green, and the pretty bell-shaped wax-like flowers are produced in small bunches in winter and early spring, and are succeeded by round fruits like strawberries of a reddish colour. A large strawberry tree formerly existed at San Antonio which must have been more than a hundred years old and was in fruit almost every year. Young trees of fruiting size exist in several well known gardens. This shrub is of slow growth and is propagated by seed or by rooted suckers.

The Tomato-tree (*Cyphomandra betacea* Order-Solanaceae) is cultivated in gardens as an ornamental shrub for its large heart-like leaves and for its egg-shaped orange red fruits, which hang in small clusters throughout the autumn and winter. The fruits are eatable and may be used as tomatoes. This shrub is propagated by

seed, and requires a sheltered situation, as it is liable to suffer severely from cold in winter. In good situations it assumes a beautiful umbrella shaped habit, but never loses its herbaceous character.

Sizigium jambolana which produces fruits shaped like an olive, suitable for pickling, and *Achras Sapota* have been recently introduced in the Island but have not yet fruited. *Feijoa Sellowiana*, an evergreen Myrtaceous shrub from South America, nearly allied to the Guava, has been introduced in 1903 and fruits abundantly every year. The shrub is ornamental on account of its pink flowers with long red stamens. The fruit is highly perfumed and is said to be good for pickling. This shrub is easily propagated by seed or by layers. Various species of *Eugenia* have been introduced in our gardens during the last twenty years, but they all failed to agree with our calcareous soil.

Attempts to grow the coco-nut (*Cocos nucifera* L.) have failed altogether, as all the imported plants died off in the first winter. The coffee shrub (*Coffea arabica* L.) was grown and fruited several times, and at one time there were hundreds of plants at San Antonio Gardens raised from seed brought over from Brazil, but the coffee shrub can be grown here only as an object of curiosity and at considerable trouble.

It is not easy to give a proper definition of a "fruit tree". In the popular sense a fruit tree is a tree grown chiefly for the sake of its fruit, which is used as food in any way whatever or even as condiment. In this sense the bitter almond and the Seville or bitter orange are fruit trees, the uneatable seed or kernels of the one and the rind and juice of the fruit of the other being used as condiment. The carob-bean or locust is chiefly or entirely fed to animals, although it is also sometimes used as food, and it cannot be denied that it is a real fruit tree in the popular sense. On the other

hand the "small fruits" including the gooseberry, the blackberry, the raspberry, the currant and the strawberry, are low bushes or herbaceous perennials, and are certainly not fruit TREES in the accepted sense. So also the melon, the water-melon, the tomato, the pumpkin etc. are herbaceous annual plants grown for their fruits but of course are not trees. Certain fruits, such as the shaddock, and certain apples and pears are placed on the table only for ornament, but they are grown for their fruits, and being nearly allied to eatable fruits are therefore classed as fruit trees.

Another difficulty lies in the distinction made by the law which regulates the planting of trees on adjoining property. It is not possible to say exactly what is a tree of "lofty trunk". A carob tree very commonly has a very short trunk which branches close to the ground, but if the distinction made by the law is insisted upon, it is hardly possible not to include the carob with trees of lofty trunk. On the other hand, an almond tree, a loquat tree or even an orange tree may have a trunk exceeding 4 metres in height, but these cannot be classed as lofty trees in the obvious sense of the law. Again, the ivy does not answer to the description of a tree of lofty trunk, but the roots of a full grown ivy may cause much more damage to an adjoining tenement than either a carob tree or a fig tree, and it is chiefly or solely on account of the possible injury which may be caused by the roots that it was thought necessary to regulate by law the planting of trees in adjoining lands.

From the point of view of the cultivator all fruit trees, and indeed all trees and shrubs, may be grouped into two main classes, viz: EVERGREEN and DECIDUOUS, the fundamental requirements of cultivation being practically the same for all trees in each class. Thus evergreen trees such as the orange and lemon, the olive, the loquat, the carob, the avocado

etc. are best pruned or planted during the growing season, March–October, and require to be transplanted with a ball of earth and during the same period ; but deciduous trees such as the fig, the pomegranate, the vine etc., should be pruned during the period of rest, November–February, are transplanted in the same season, and need not be taken up with a ball of earth. Propagation by cuttings of ripened wood, for all deciduous trees, is best made in the period of rest, but in the case of evergreen trees, whenever practicable, it is done at the resumption of vegetation in early spring. Again, under favourable conditions the growth of evergreen trees is continuous throughout spring summer and autumn. Deciduous trees start growth in spring with great vigour, but even in the best conditions, the growth is usually brought to a standstill early in summer. In both cases the activity of the root system is in close relation to that of the vegetation.

Deciduous trees shed their foliage in autumn, but in the case of evergreen trees, apart from the effects of inclement wintry weather, the bulk of the annual shedding of foliage takes place in spring along with the resumed activity of vegetation or soon afterwards. Deciduous trees should be watered sparingly when the period of active growth is over, and only just enough to bring their fruit to maturity and to prevent them from starting fresh growth should the autumnal rains arrive too early, which would affect very seriously the crop for next year. Evergreen trees may be watered continuously, and indeed they make better growth if watered more liberally in the last period of summer and early in autumn.

What is the depth of soil required for a plantation of fruit trees ? This question may seem unimportant for other countries, but it is of paramount importance in these Islands where the soil, though generally of good quality and naturally fertile, is too often very shallow.

However, a deep soil is not always an essential condition for a successful plantation.

In connection with this question some reference must be made to the geological formations of these Islands from the cultivator's standpoint. The uppermost formation is the Upper Coralline Limestone, and consists of a hard rock, often semi-crystalline in character, but generally porous and moist, with many pockets and seams of bright red earth, rich in oxides of iron and phosphates, and made up of calcareous matter and clay in just proportions. The surface of the rock is more or less broken and permeable, and the soil is often less than half a metre in depth, except in places where a sort of alluvium has been made up in the course of time. The land on this formation is often levelled artificially, that is a layer of stones of variable depth, derived from the leveling, is spread on the surface of the rock, and is covered over by a layer of stone chippings and fine material, also derived from the same operation. The red earth is then spread over to the depth of at least 30 c. m. if more earth is not available. Such land is suitable for trees which do not disagree with a calcareous soil, and the roots penetrating into the moist subsoil and spreading on the moist surface of the rock, will secure the tree very effectively from the ill effects of the prolonged summer drought. In places where the rock contains no such pockets of red earth, it is often very soft and friable, and presents very desirable conditions for the formation of a vineyard where wine grapes of superior quality can be produced. For this purpose, trough-like ditches are excavated with a pickaxe, which are $1\frac{1}{2}$ to 2 metres long, 1 metre deep and about 50 c. m. wide, and are filled in with the same material which has been taken out, two vines planted in each trough, one at each end, with a basketful of red soil round each plant. The upper coralline limestone formation varies in thickness from 3 or 4 metres to 125 or more. It caps the summit of hills

in Gozo and covers the heights of the western part of Malta. This rock is called in Maltese *Zonkor tas-seconda*, or *Zonkor tal fraglu* or *Zonkor gulglieni*.

The next layer consists of the greensand (Maltese = *ramel hadrani*), so called from its greenish colour, and is made up of glauconite gravel and sand mixed up with lime. It varies in thickness from 5 to 30 c.m., and is often absent altogether. It is of no importance to the cultivator. Underneath this layer there is the clay or marl formation, more or less coloured yellow with iron oxides, or coloured bluish brown with manganese oxides, and is met with along the slopes of hills in the western part of Malta and Gozo, where it forms considerable tracts of cultivated land. This layer owing to the retentive nature of the clay (Maltese = *tafal*) acts as a natural reservoir of subsoil water, and to its presence are due the few natural high level springs which exist in both Islands. The soil resulting from the weathering of this layer has a greyish white or bluish brown appearance, is more or less stiff and retentive, and if it happens to be only slightly inclined, easily becomes water-logged in winter, requiring the construction of ditches to ensure a satisfactory drainage. These lands when properly tilled will retain a fair amount of subsoil moisture throughout the summer, and therefore give good results for dry farming. However, lands on the clay formation are little suitable for the cultivation of trees, unless special attention is given to deep trenching and drainage before proceeding to plant. The fruit usually is too watery and lacking in flavour, often with an increase of acidity. This formation varies in thickness from two or three metres to twenty or thirty, but extends for long distances along the slopes of hills, covering the surface of the underlying formation of Globigerina beds.

The Globigerina formation is exposed all over the eastern part of the Island of Malta, for about two thirds of the total area of the Island, and is also exposed in

many parts of Gozo. It varies in thickness from 20 to 50 metres or more and is made up of a number of distinct layers with intervening beds of shells and coprolites, which are particularly rich in phosphates. This rock is made up of minute calcareous shells of Foraminifera, cemented together by carbonate of lime, and is naturally rather soft, porous and moist, but is almost everywhere glazed over by a thin semicrystalline crust, which is practically impermeable to water, formed in the course of time by the carbonate of lime dissolved by rain water and deposited again on evaporation. The upper layers of this formation contain pockets of red soil of good quality, suitable for most fruit trees. By levelling the irregularities and breaking up the thin hard crust which encases the rock, the natural moisture contained in the rock becomes available for the trees and therefore this operation is generally performed whenever it is intended to transform a field into an orange grove or an orchard.

The lowermost formation consists of the Lower Coralline which may be called the basement or pedestal of the Maltese Islands, but is only exposed over limited areas. This rock, like the preceding, and still more like the Upper Coralline, consists chiefly or almost entirely of carbonate of lime and is rich in fossils and therefore in phosphates. It is usually very hard, with a semicrystalline or crystalline texture, and is often altogether impermeable to water. It is particularly rich in pockets of deep red soil of excellent quality, often at considerable distance from the surface. This soil is always of a deep red colour, and is the best of the three types of red soil above mentioned. Trees growing on this formation have the advantage of the superior quality of the soil, but the rock is too dry, and in a prolonged drought the trees are apt to suffer severely unless watered. Where the soil is deep enough, and permits the growth of trees which ordinarily are not watered, such as figs, grapes and stone-fruits, the fruit may remain somewhat undersized, but the loss in

size is amply compensated by the superior quality and flavour.

From the foregoing it is clear that a study of the geology of the district is of great importance to the cultivator in general and to the fruit grower in particular. In fact the amendment of the upper layer of the soil by the addition of ingredients, which may be missing, and are required either for their physical or for their chemical quality, or for both, will be generally sufficient for field crops, but such a superficial amendment will be found inadequate for trees whose roots penetrate deeply in the soil. In this case the amendment must be carried out simultaneously with deep trenching to a depth of about one metre. Again, certain fruit trees or even a particular variety of the same species may not thrive well in a calcareous soil, and therefore must be budded or grafted on stock which agrees with such soil, and on the other hand the physical quality and the loose or stiff nature of the soil and subsoil may require variations in the methods of tillage, manuring and watering, so that the grower may derive the full advantage with the least cost.

Another important matter is the water-supply available for irrigation. Hard water is injurious for most trees, and if the hardness is of permanent nature and is due to chloride of sodium or common salt, that is if the water is brackish, it is particularly injurious to vegetation. In such cases if the land is not thoroughly drained so that the excess of salt is washed off in winter and diluted by rain water, the chlorine may accumulate to a dangerous extent and the soil then becomes practically a salt pan and altogether unfit for the cultivation of fruit trees. If water of better quality is not available it is better to water sparingly, by watering liberally but at longer intervals. Even if the land is perfectly drained, it is always wise to follow this rule, and not to trust too much on the washing action of the winter rains, which in dry years may

fail, and then the accumulated salt remains in the soil to hamper vegetation in the following summer.

Water pumped from deep wells in the Globigerina formation is always more or less hard owing to the carbonate of lime held in solution by an excess of carbonic acid. Such water should be pumped into an open reservoir where it is allowed to remain for two or three days to deposit the excess of carbonate of lime, and to become properly aerated by absorbing its full share of atmospheric oxygen. Freshly pumped water is also decidedly colder than the ground water, and if allowed to remain for some time in open reservoirs in summer, its temperature is raised and the roots will be spared a shock, which is sure to prove detrimental to the organism of the tree, at least momentarily.

CITRUS FRUITS.

The Citrus trees include the orange, the mandarin-orange, the citron, the lemon, the lime, the bergamot and the shaddock, besides numerous intermediary hybrids. Their cultivation originally limited to India, China, Persia and the Mediterranean region is now extended to all tropical and sub-tropical regions of both hemispheres. They are grown chiefly as fruit trees, and their vast economic and commercial importance is well known ; but on account of their evergreen foliage, their pretty sweet-scented flowers and their beautiful fruits which come to maturity at a time when the garden is bare and most trees are leafless, they are rightly considered as very desirable trees in ornamental gardening, and at any rate in the sunny regions of the Mediterranean no garden is complete without its orange-grove or its avenue of citrus trees. To the Maltese cultivator they are known collectively by their Italian designation,—AGRUMI, so called no doubt owing to the acidity of the fruit, which is more or less marked in almost all species and varieties.

The original home of the orange-tree is supposed to be India, in the forests at the foot of the Himalayas, and it is probable that its cultivation was carried by the Arabs during the 7th or 8th Century, through Persia and Egypt, to the shores of the Mediterranean. The Bitter or Seville Orange (*Citrus Bigaradia*, Loisel), was probably the first to attract the attention of the Arabs on account of the essential oil obtainable from the flowers and from the rind of the fruit, and of the highly perfumed orange-flower water which is obtained by distilling the blossoms, and is still so much in use. The introduction of the ordinary commercial orange

(*Citrus Aurantium* Lin.) is probably due to Arabian travellers in the tenth century, while certain improved varieties of the common orange, such as the Portugal Orange, was probably introduced by enterprising Portuguese travellers returning home from India. The mandarin-orange (*Citrus deliciosa*, Ten.) is native of Southern China, and the Shaddock (*Citrus decumana*, Murr.) is native of India, and so also are the Lime (*Citrus acida*, Desf.) and the Bergamot (*Citrus Bergamia* Risso). The Lemon (*Citrus Limonum*, Risso) and the Citron (*Citrus Medica*, Lin.) are said to be natives of Persia and their introduction in the Mediterranean region has probably preceded that of the orange.

From a botanical point of view the distinctive characters of the species above mentioned are quite unimportant, and their specific value is often denied. The confusion is still further increased by the existence of numerous hybrids, natural and artificial, so that it is now generally understood that the various species or rather sub-species, have originated from a common stock, probably the wild citron of Persia and northern India (*Citrus vulgaris*, Lam.) The most interesting of these hybrids is the so-called "Bizzarria," a hybrid between the orange and the lemon, often producing on the same branch and on the same twig, perfect oranges and perfect lemons, but generally bearing lemons perfect in shape and size, with a chrome-yellow rind, and a very acid pulp of a reddish hue, like that of an orange, or lemons with an orange-coloured rind and an orange-like, or even a lemon-like pulp. This classical hybrid was raised in Florence. Many other hybrids, chiefly of botanical interest, have been raised in recent years, among which the orange-citron which is a diminutive citron in all its parts, but the small round fruit has a deep orange rind, and a pulp of the same colour ; and the lemon-shaddock raised at San Antonio Gardens, Malta, in 1900, as a chance seedling, in which the habit of the

tree is that of a shaddock and the appearance of the fruit is that of a full-sized oblong shaddock, but the foliage, the colour of the blossoms and the pulp and juice of the fruit are those of a lemon. From a commercial standpoint the most important hybrids of comparatively recent origin are the grape-fruits or pomelos raised in America, which seem to be a direct descendant of the shaddock, but with smaller fruits, round or egg-shaped according to the variety, with smaller leaves like those of an orange, and with a colourless pulp and juice like that of a lemon, with a pleasant bitterish taste.

Citrus fruits have been classified, in a popular way (E. Ferrari, *L'Agrumicoltura*), into fruits with an orange-red peel (*agrumi a pigmento rosso*), and fruits with a yellow peel (*agrumi a pigmento giallo*); but this classification is decidedly inaccurate, as there are citrons and lemons with an orange-red peel, and bergamots (*melarosa*) with a reddish-yellow peel, as well as true oranges with a decidedly yellow peel or even with a cream-coloured peel. A better classification may be based on the colour of the blossoms, all true lemons and citrons producing blossoms with the petals tinted purplish red on the outside, and the young twigs and foliage are more or less purplish red, while all limes, bergamots, mandarins, oranges and shaddocks have pure white flowers. The value of this distinction will be found of real practical assistance in the classification of hybrids or varieties of doubtful parentage.

Citrus trees can be propagated by seed, layers or cuttings, but by far the best method of propagation is by budding or grafting. In these Islands the only Citrus tree propagated directly by seed is the common Seville or Bitter Orange (*Citrus Bigaradia*) which comes true from seed or at least is not liable to considerable variation, but all special forms or varieties of the Seville orange are propagated by budding or seedlings of the common type. Seedling lemons, mandarines and oranges

are met with, here and there, but although usually very productive, they are too full of thorns, and the fruits are usually undersized, or contain too many seeds. However, propagation by seed is always a ready way to obtain new and interesting varieties, which perhaps may be of commercial importance ; but of course all citrus trees are so variable, and so rarely come true to type, that direct propagation from seed is and must remain the pursuit of the amateur gardener. In certain countries it is the practice to grow seedling lemons as grafting and budding stock for all sorts of citrus trees, no doubt on account of their rapid growth, as seedling lemons are often strong enough to be budded in the first or second year of their life. Thus, the *rough lemon* is largely used as stock in Florida etc.

The local custom of budding all Citrus trees on seedlings of the common Seville orange presents the great advantage of producing young trees which grow rapidly after budding, come soon to bearing condition, and are altogether of a stronger constitution and not so liable to suffer from gumming and other diseases, as those grown on own roots or budded on seedlings of the common orange or lemon.

Propagation of citrus trees by cuttings is never resorted to by our gardeners, but in Sicily and Italy, and also in other countries, the citron, the lemon and other citrus trees are often propagated in this way. Cuttings are made from healthy growth not more than two years old, and are planted early in spring in lines in the nursery, the soil having been properly worked and manured. The cuttings are kept constantly moist until they are rooted, and are shaded off by a covering of reeds and dry foliage. After a year or two they are transferred to their destination. The cuttings may be planted directly in site, but then they require considerable attention during the first two or three years, until they become properly established, and it is usual to plant two or three cuttings together

to make good against failures. Small cuttings made of ripened wood, with two or three leaves attached, root easily if planted early in summer in ordinary garden soil, in small pots, and placed under a hand-glass, or in a garden frame or greenhouse. In about six weeks they can be transferred to the open air in a shady corner of the garden.

Our gardeners occasionally propagate the lemon tree by layers, when seedlings of the bitter orange are not available as budding stock ; but all citrus trees can be propagated in this way. The layers are made early in spring and are watered regularly throughout the summer. Layers, of which the part under ground is not more than three years old, are preferred, but no particular system is followed in layering beyond bruising the interred stem to facilitate the formation of roots, and a heavy stone is placed on the soil above the layered branch in order to keep it down firmly and to prevent all movements by the wind. The layers as a rule are sufficiently well rooted at the end of a year, to be severed from the mother-plant, and to bear transplanting to their final destination, but they are often allowed to remain for two years or more to develop a strong root-system before shifting them. Citrus trees raised by layers are often weakly and misshapen, and present the same disadvantages as those grown from cuttings.

There is no doubt that the most satisfactory way of propagating citrus trees on a large scale is to bud them on seedlings of the bitter or Seville Orange. The pips or seeds of the bitter orange are sown in March or April, at once on removal from the fruit or soon afterwards, as their germinating power is impaired if kept in a dry condition, even for a few weeks. The seed-bed should be made in a sunny situation, and the soil properly tilled and well manured, and afterwards kept quite free from weeds. The seeds germinate in April or May,

and with proper cultivation may be strong enough to transplant when they are a year old. Seedlings left in the nursery-beds for two years are stronger, and give a smaller percentage of failures. Transplanting is performed in May or June or in September. The seedlings are taken up with as many roots as possible. Then the tap-root is shortened to induce the formation of lateral roots evenly distributed ; all lateral shoots on the stem are removed to provide a clean, straight stock for budding, and the seedlings are planted in the nursery, in regular rows, disposing the seedlings alternately, or according to the quincuncial method, 60 c. m. to 1 m. apart, and are watered carefully. They soon commence to make fresh growth, and budding may be started in May or September, when the seedlings have been in the nursery for about one year and are strong enough to bear the operation. In about two years the budded plants will have formed a nice head, and may be transplanted with a ball of earth to their final destination. Transplanting from the open ground can be performed at any time between April and September, provided that the soil is dry enough to allow the plant or young tree to be lifted with a good ball of earth, which of course must vary in size according to the size of the plant. In performing this operation the soil is removed down to the first layer of roots, and then a trench is dug all round the young tree, the roots are separated with a clean cut, until the lower roots are reached and cut in the same manner, when the young tree can be removed carefully with its ball of earth. Of course young trees are more easily transplanted, and establish themselves more readily in their new quarters ; but older trees, that is trees which have been allowed to remain for more than four years in the nursery, require to be pruned back a little when transplanted, in order to re-establish the balance between the growth above and that below the soil. The young trees should be planted deep enough so as to

have about 15 c. m. of soil above the first layer of roots, when the circular trough is made for watering.

Adult trees with a stem up to 15 c. m. in diameter can be transplanted in the same way, but in their case the operation is laborious and not always successful. Their ball of earth should be very large, and they must be severely pruned back, and carefully attended to as regards watering for one or two years afterwards. If possible, the operation should be commenced a year before, by digging a trench 15 c. m. closer to the trunk than otherwise advisable, cutting asunder as cleanly as possible all the roots met with. The trench is then refilled with a mixture of soil and manure and watered frequently, in order to induce a free formation of rootlets from the stumps of the larger roots cut during the operation. When the final operation for removal is performed the trench is dug on the outer side of the former one, so as to spare the new rootlets which are meant to assist the tree in overcoming the severe ordeal to which it has been subjected.

SOIL. Citrus trees will grow in any soil except when too stiff or too poor in quality. They seem to delight in our calcareous red soils overlying the Globigerina or the Coralline formations. When they are regularly watered, a moist subsoil is not necessary, but where it is not always possible to irrigate at regular intervals throughout the summer, a moist subsoil on a porous and humid rock is essential. Stagnant moisture is injurious, and in deep clayey soils liable to become water-logged, it is necessary to drain the land thoroughly at least to a depth of one metre. On a good porous subsoil, whether consisting of broken rock, or properly levelled material, a surfacing of good red soil 60 c. m. in thickness is generally considered sufficient, but a greater thickness of about 1 metre will afford better protection against the drought of summer, besides providing more space for the roots.

DISTANCE. Citrus trees are ordinarily planted about 4 metres apart, the Seville Orange requiring more space, and the sweet lime, the shaddock, the pomelo or grapefruit and the seedless or navel oranges perhaps less space. Where the soil is rather poor or the place is exposed to winds and the trees are not expected to attain full size, it is advisable to plant closer, viz : 3 to 3½ metres. On good soils and very favourable situations with satisfactory arrangements for irrigation the distance should not be less than 5 metres.

SHELTER. All Citrus trees require shelter from the cutting north and west winds. All our orange groves are surrounded by high stone walls, not only to protect them from marauders, but also as shelter against the cold winds. The lemon, the lime and the citron thrive better along a shady wall looking north or north-west, and are rather less liable to injury from these winds. All varieties of the edible orange, particularly the more delicate sorts, such as the egg-oranges, become stunted and unproductive in similar situations. The protection of tall evergreen trees will be found useful, provided that their root system be not allowed to interfere with the normal development of the more delicate root system of Citrus trees. The terraced hillsides looking east or south, with rich red soils, are particularly suitable for the cultivation of the orange-tribe ; but a site exposed to the north or west, must be protected by a stone wall or other wind-screens, about 4 metres high, in parallel lines from 20 to 30 metres apart.

IRRIGATION. Except in very favourable situations, with abundance of moisture in the subsoil, Citrus trees require to be regularly watered during the dry season. Circular troughs are constructed, not less than 10 c.m. below the level of the ground, and extending from the trunk to nearly as far as the boundary of the crown or head, and water is led to these troughs by means of permanent stone conduits, or along furrows made in the

soil. The first watering usually takes place about the middle of June, and is repeated at intervals of two or three weeks until the soil is well soaked by the autumnal rains. The average quantity of water allowed to each tree is about 1 cubic metre, and as the trees are watered seven or eight times from June to October, the total quantity of water available for irrigation throughout the summer should not be less than 8 cubic metres per tree. The quantity of water required for young trees is less, but these must be watered earlier and oftener, in fact it is advisable to water young trees every week from the middle of August in order to induce them to make good growth in the latter part of summer and cause them to attain bearing condition and adult size in a few years. Trees newly transplanted are usually watered every week during the first summer. If a water-service under pressure is available, spraying the trees by means of a hose will be found very beneficial, if the spraying is done lightly and frequently, but regular watering by spraying is liable to provoke an excessive formation of superficial roots, which will cause the trees to suffer severely in a prolonged drought. After each watering it is advisable to till the surface of the soil, lightly, as soon as it tends to crack and become dry, not only to keep down weeds, but chiefly to check evaporation by establishing a finely powdered layer of soil between the moist lower layers and the dry atmosphere.

TILLAGE AND MANURING. The ground should be kept well clean of weeds at all seasons, especially in spring and summer, and should be well tilled at least twice in winter, and once in spring (April). The hoeing of April should be deep, and afterwards the ground should be evenly levelled, and all sods well broken up so that the soil may retain its moisture as long as possible. The object of the deep hoeing in April is to open the soil to the action of the air, and at the same time to remove the superficial rootlets which may have developed

soon after the first rains of autumn. Deep tillage or trenching, usually associated with manuring is performed every sixth or eighth year, the best time for this operation being May or the early days of June, and is immediately followed by the first watering, but is sometimes done in autumn soon after the first rains, and before the soil becomes too wet to be worked properly.

Manuring without trenching may be done at any time, but chiefly in autumn, when the circular trough used for irrigation, is deepened, the manure evenly distributed over the whole surface and the earth again drawn in and levelled. The operation is repeated every third or fourth year. When trenched the manure is given at the rate of 48 m. tons per hectare (20-22 m. tons per acre, or 25 viaggi per tumulo, Maltese measure), but when supplied in the circular trough above mentioned, one bag per tree, weighing on an average 50 kilog., will be sufficient. Trenching is of course much more expensive, but has the great advantage of tilling deeply and manuring the whole area, and the trees are benefited in proportion. Well-rotted manure from the cow-shed is the best for red soils, and stable-manure well matured is preferred for whitish and clayey soils. Young trees recently transplanted are induced to make vigorous growth by a supply of manure from the pig-sty. Chemical fertilizers, as a complementary dressing, particularly superphosphates may be given before commencing the operation of trenching. Superphosphates may be distributed on the surface of the land at the rate of 800 to 1200 kilog. per hectare or 360 to 540 kilog. per acre, or 100 to 150 kilog. per tumulo; or they may be strewn on the surface when trenching is completed, before levelling the heaps of soil. It is not advisable to give superphosphates in the trench, in direct contact with organic manure. A dressing of superphosphates may be given every second or third year, in the circular trough, before commencing watering, at the rate of three to five kilog.

per tree. Superphosphates are useful to provoke vigorous growth, particularly after a severe attack of scale, and materially assist in obtaining a better crop.

Chloride of potassium (*kainit*) or wood ashes are useful for sandy soils, and are best supplied late in spring before watering. They may be given at the rate of one or two kilog. per tree in the case of *kainit*, and of three to five kilog. in the case of wood-ashes. Nitrogenous fertilizers, (nitrate of soda and sulphate of ammonia), may be used whenever organic manure is not available, but as a rule Citrus trees are not much benefited by nitrogenous fertilizers, except when they are young. It would be certainly cheaper, and perhaps better, to resort to green-manuring, making use of some leguminous plant, such as the vetches, or the lucernes, which may be sown broadcast when the land is first weeded and dugged in November or December, and the plants are dugged in when they are in flower, in April. This operation repeated every second year will enrich the soil in nitrogen, and also in humus or organic matter resulting from the decay of vegetation.

PRUNING. All Citrus trees are pruned every second or third year, and the operation can be done at any time of the year, the best period being from May to September. The essentials for good pruning are (a) the removal of all dead wood, and sickly growth, (b) the removal of superfluous growth within the tree and also on the outside, (c) the disposing of the main branches to the required shape when the tree is young, and keeping the tree to the required shape, when adult. Careful gardeners trim their trees every year between one pruning and another, in order to remove all dead twigs, and to put down superfluous growth which may injure the bearing capacity of the tree. In fact it is known that most Citrus trees, particularly the orange, have a tendency to produce several shoots close together at the end of the twig, and the resulting distribution of energy provokes a

general weakness, owing to which the fruit is easily dropped off when it has reached the size of a pea or of a hazelnut. The shedding of green fruit generally commences in May, but goes on more or less until the first days of August, and by that time an orange-grove which was most promising in May or June may have retained few fruits in the beginning of August, when no further danger is apprehended. Trimming is best done from the beginning of June to the middle of July. Small twigs are cut with the secateur and larger ones with the pruning knife. Thick branches are sawn off or cut with the pruning axe, or with chisel and mallet; the surface is then levelled with the pruning knife, and besmeared with tar, or with a mixture of tar, wax, and clay, to keep it cool and favour cicatrisation, the process of healing being greatly aided by cutting in a slanting direction from below upwards towards the branch retained, thus leaving no stump to perpetuate the wound. This attention is particularly insisted upon when cutting off the stump of the stem, which is reserved on budded plants in order to secure to it the tender shoot to give it a straight upward direction and to protect it from injury.

Old trees which have become partly sterile, are sometimes rejuvenated by being headed off, all the main branches being lopped off at an equal distance from the trunk. This operation is best done in February or March and the strong shoots which are soon formed are allowed to ripen until September, when the superfluous twigs are removed and those retained are trimmed to shape. In about two years the tree forms a new crown of healthy foliage and enters into a new period of productiveness. As a rule the lemon and the mandarin dislike heavy pruning, and the seedless or navel oranges are found to have their productiveness markedly impaired if they are not allowed to retain a dense crown of foliage. At any rate, large wounds should be carefully avoided, as they heal slowly or do not heal at all, and are usually the

starting point of canker which sooner or later destroys the tree. For this reason it is always advisable to have all wounds more than two centimetres in diameter painted over with tar, or with a mixture of bees' wax, tar and clay in equal proportion, to be slightly heated when about to be used.

Citrus trees begin to form the flower-shoots in January or February, and by the end of March the first flowers begin to bloom. The blooming period may be prolonged to the first week of May. Late blossoms may appear in May and June, and it is generally held that flowers produced until the second week of July will set fruit which will develop in time to ripen with the main crop. Oranges begin to turn yellow in November and are often picked in quantities for consumption in December, but no orange is really ripe before January, and the aroma is rarely fully developed before February. Oranges are at their best in February and March, after which period they are more liable to deterioration than to improvement. The best time to pick oranges for the oversea trade is in January, when they are ripe, and are still in a good condition to bear a sea voyage. The earliest orange to reach maturity is the round sweet orange or China orange, often called Malta Vanilla orange, but many dislike its absolutely sweet taste, without any acidity. The mandarin-orange is next in point of earliness. The seedless oranges are generally quite ripe towards the close of December, but their flavour improves in January, at which time also the Malta blood-orange, and the egg-orange have acquired their special qualities, but the fine flavour of the egg blood-orange is not well developed before February.

Certain Citrus trees, such as the ever-flowering lemon, the seedless lime, and the sweet lime habitually flower several times in the year, producing various crops of fruits, besides the main crop which is the produce of

the spring blossoms. In the case of the ever-flowering lemon it often happens that the tree is laden with blossoms and fruits in all their stages of development. It is the practice with lemon-growers in Sicily to remove all the main crop fruit and to withhold irrigation until midsummer, when the trees are given a good soaking twice or thrice in quick succession, and soon produce a profusion of blossoms, followed by lemons which remain green until June or July, and are then sold at a good price as "*verdelli*". But most orange trees, if they have suffered at all from want of water in summer are apt to bloom in autumn, soon after the first rains, and the fruit which sets will survive the winter and ripens in summer, and although it is usually quite tasteless and of inferior quality, often fetches a good price.

It is probable that the cultivation of the BITTER or SEVILLE ORANGE was originally started in these Islands by the Arabs, presumably not long after they had occupied the Islands in A.D. 870, in the so-called natural gardens at the head of valleys where there was spring water available. Such were originally the bitter-orange groves at Boschetto, Gnien il Gbir, Ghirghenti, Ghain il Gbira, Bahria, Imtahleb etc. in Malta, and the neighbourhood of Nadur and Xaghra, and the valley of Xlendi in Gozo, of which only a few remnants are still visible. Of course these groves must have been replanted several times, as there is at present no bitter orange tree anywhere which can be said to be more than 500 years old. The common orange was introduced somewhat later, and our egg-orange usually known as "*tuil*" or "*taunali*" or Portugal orange is probably a selection or sport of an improved common orange introduced from Portugal during the rule of the Knights of St. John. A few trees of this variety apparently of great antiquity and much decayed still existed some years ago in an orange-grove said to be planted by Grand Master Vilhena at Boschetto.

The MALTA BLOOD ORANGE is an old variety of local origin. It is described and figured in Risso's work "The Natural History of Orange-trees" published in 1747. The egg-blood orange is a sport of the egg-orange and originated in a small orange-grove at Casal Balzan towards 1850. The seedless, navel, or Bahia Orange was introduced from Bahia, Brazil, in 1900 at the request of the writer, by Lord Grenfell, then Governor of Malta, and later on in 1907, Lt. Colonel Roupell introduced from Washington U.S. America, three new forms of the Navel Orange, viz: Thompson's Improved Navel, Golden Nugget and Golden Buckeye. Other forms of the orange, viz. Washington Navel Orange, Navalencia and Valencia late were introduced by the writer in 1914.

The SWEET ORANGE OR CHINA ORANGE, often called Malta Vanilla Orange was introduced early in the eighteenth century. Most of the varieties of lemons and limes now cultivated, must have been introduced at an early date, with the exception of the large "Perù" lemon or Ponderosa lemon and the diminutive China lime which were introduced toward 1885. The Shaddock was introduced towards the close of the eighteenth century. The mandarin orange was introduced in 1811, but its propagation on a large scale dates only from 1850.

The CITRON (*Citrus medica*) and the LEMON (*Citrus Limonum*) are botanically hardly distinguishable. They both have blossoms of a more or less reddish hue on the outside, and fruits with a persistent pistil or column, which in most forms continues to grow with the fruit and forms a well marked and prominent navel. The colour of the peel is very generally of the peculiar lemon-yellow, although there is a variety of the citron and another of the lemon with an orange-coloured peel. The juice is sprightly acid and devoid of a special aroma, although again there is a true lemon (the sweet lemon)

with a perfectly sweet juice. The leaf of the citron is usually elongated and more elliptical, and is also more markedly crenated and not so pointed as that of the lemon. The blossoms of the citron usually appear in small clusters on the short spurs along the branches. The citron flowers at all season, like the ever-flowering lemon and like most limes, and the tree may have normally at the same time blossoms and fruits in all stages of development.

THE CITRON.

(*Citrus medica* L.).

The Citron (in Maltese *citrat* or *xcomb*) is cultivated primarily for the sake of the peel which when candied is much used by confectioners. In these Islands the citron is grown only here and there in single specimens, and as an object of curiosity. The fruit which is best cut when turning yellow, is sometimes sold to confectioners. The following sorts are met with in our gardens.

1. The LONG-SNOUDED CITRON (*citrat tal karnuna*). Tree middling or weak, very productive. Fruit middling, long-snouted, rather smooth, with a thick peel of fine fragrance.
2. The ROUND CITRON. Tree rather strong, fairly productive. Fruit middling, nearly spherical, navel large but not prominent, peel uneven and rather thin.
3. The SAN ANTONIO CITRON a chance seedling of the preceding, raised at San Antonio Gardens in 1906. Tree strong, with long deep green foliage, productive. Fruit large or very large, elliptical or elongated, navel large slightly protruding. Peel uneven, often thrown in longitudinal folds, very thick and tender, light yellow at maturity, strongly fragrant.

4. LARGE SMOOTH CITRON OF CALABRIA. Tree strong and very productive. Fruit large or very large, egg-shaped, sometimes nearly round. Peel very thick and tender, very smooth, clear yellow at maturity, and of good fragrance. This is one of the best sorts for candying, and is largely grown in Calabria.

5. LARGE GROOVED CITRON OF CALABRIA. Tree strong and very productive. Fruit very large, egg-shaped or elliptical, wrinkled, and usually with deep longitudinal grooves or folds. Peel very thick and tender, clear yellow at maturity, very fragrant.

6. GIANT CITRON OF CHINA. Tree middling; little productive. Fruit very large or enormous, elliptical; peel deeply wrinkled, golden yellow at maturity, very thick, and fragrant, pulp greenish and very acid.

7. SALÒ CITRON. Tree middling, productive, fruit oval, navel depressed, with a deep groove around it.

8. SMALL CHINA ORANGE-CITRON. Tree small or very small, productive, leaves small. Fruit round, very small, 3 to 5 c. m. in diameter, navel not protruding or depressed. Rind of a deep orange colour, pulp yellow, slightly acid or sweetish.

THE LEMON.

(*Citrus Limonum*, Risso.).

The tree is invariably larger and stronger than the citron and although it prefers a cool, shady situation, a hot and dry place will not affect it adversely to the same extent as the citron. The lemon is grown principally for the sake of its acid juice, which is used largely in domestic economy and in the arts, and also for the extraction of citric acid. The citric acid industry is always associated with that of the extraction of lemon essence from the peel. The rind is peeled off and the essence pressed out on a sponge, and the juice is then pressed

out of the pulp and manufactured into citric acid. In our gardens the lemon is solely grown for the use of juice in domestic economy, no citric acid or essence is extracted, but the peel is sometimes used by confectioners as a flavouring ingredient. The tree is grown chiefly in orange groves along shady walls, and is very generally met with in the yards of country houses where it is cultivated to supply the needs of the household. The following varieties of the lemon are met with in our gardens.

1. The COMMON LEMON. (M. = *Lumi ta l'istagiun*) Tree very productive, middling, peel deep yellow, pulp very juicy and acid. Produces normally only one crop in the year.

2. The PERPETUAL OR EVER-FLOWERING LEMON. (M. *Lumi ta cull kamar*, or *Lumi ta cull stagiun*). Is similar to the preceding, but usually smaller and more rounded. This is the variety now most often planted, owing to its natural habit of producing normally several minor crops of blossoms and fruits throughout the year. It is supposed to flower every new moon, but besides the normal blooming in spring, the tree flowers more or less regularly in July, August, September or October, and often also in December and January.

3. The TRIPOLI LEMON. Fruit very large, elongated, with a long navel and a protruding neck next to the stalk. The peel is thick and deep yellow. The juice is very acid but rather scarce.

4. The LONG BINJETTA LEMON. In size and appearance is like the Tripoli Lemon, but there is no protruding neck at the insertion of the stalk. The peel is not so thick and the pulp is more juicy.

5. The BALOTIN LEMON. The lemon is of large size, rounded in form with a long navel. The peel is deep yellow, the juice is abundant and sprightly acid. The tree is very productive.

6. The PONZIN LEMON is usually large, elongated, with a long navel and an uneven and thick peel, deep yellow at maturity.

7. The ORANGE-LEMON. (M.=*Lumia-laringia*). The fruit looks like a common lemon in size and shape; the peel is of a deep yellow, and the pulp is in colour like that of an orange, but is sprightly acid. This is a true lemon, the blossoms and foliage being quite distinct from those of the lemon-orange or "bizzarria". There is a form containing few seeds or none, the pulp of which becomes sweetish and tastes like an orange when fully ripe.

8. The FURROWED LEMON. (M.=*Lumi scannellat*). The tree is very vigorous and productive. The fruit is of the size of the common lemon, but has longitudinal ridges or folds from stalk to navel. The peel is very thick, and the pulp is juicy and very acid. The peel is very rich in essential oil of the strongest quality.

9. The VARIEGATED LEMON. The leaves are beautifully variegated with white, yellowish white, and light green, and the fruit which is of the size and shape of the common lemon, is when green striped with the same colours, the variegation being still quite visible at maturity.

10. The SWEET LEMON. (M.=*Lumi helu*). The fruit is in size and shape like an ordinary lemon, but the juice is sweet, without any trace of acidity.

11. The SHUTTLECOCK LEMON. (M.=*Lumi mec-cue*). The fruit is large, very elongated and pointed at both ends. The peel is deep yellow, and the juice is very abundant and of good quality, but the tree is not productive.

12. The SEEDLESS LEMON. This is probably a bud sport of the everflowing lemon, raised in a garden at Casal Balzan towards 1875. The fruit is similar to the everflowering lemon, but rather flattened towards the

stalk. The peel is thin and smooth, the pulp is quite seedless and very juicy. The tree is very productive and is everflowering. This variety is still rather rare, but being seedless, will be more planted when it is better known.

13. The PEAR-SHAPED LEMON. (M.=*piretta*). There are several forms of the pear-shaped lemon, but all are distinguishable from the lemons by the small and narrow foliage, the small blossoms with long thin petals, and the pear-shaped elongated fruits, usually with a very thick peel and sub-acid pulp. The fruit is often eaten raw at maturity, only the outer rind being peeled off. It contains no seeds or hardly any, and the soft rather dry pulp has a mild sweetish acid flavour. The pear-shaped lemons are particularly recommended for candying whole. The variety commonly met with is the "table" pear-shaped lemon (M.=*piretta tal meida*) so called on account of its frequent use as a dessert fruit, but other sorts are also grown here and there.

14. The PERU or PONDEROSA LEMON. The tree is middling in size, and fairly productive in alternate years. The fruit is the largest of all lemons, often measuring 15 c.m. across; it is nearly spherical with a broad and flattened navel, more or less smooth, but sometimes rough and wrinkled, with a thick peel which becomes clear yellow or straw-coloured at maturity; the seeds are numerous and very large. The blossoms are as large as those of a shaddock. The juice is fairly abundant, of good quality, and may be used like that of the common lemon. The peel is candied like that of the citron, and the fruit is sometimes made into marmalade.

15. The SHADDOCK LEMON. This is a chance seedling raised at San Antonio Gardens in 1904. The tree is as large as a lemon-tree, but is distinctly more vigorous. The foliage is large, but typically lemon-like. The blossoms are as large as those of the Peru lemon.

The fruit is like an oval-shaped shaddock, with an indistinct navel, only marked out by a broad groove, with the peel of the same thickness and general appearance as that of the shaddock, but with the fragrance of the lemon. The juice is abundant, of the same appearance and quality as ordinary lemon juice. The tree is productive and very ornamental when in fruit.

THE LIME.

(*Citrus acida*, Desf. and *C. Limetta*, Lin.).

The foliage of the lime resembles that of the lemon, both in shape and in fragrance, but is usually more rounded. The young shoots never have the peculiar purple tinge characteristic of the lemon and citron. The blossoms are always pure white like those of the orange, but are usually smaller. The fruits are small or middling in size, with a yellow peel, which may become deep yellow or chrome yellow at perfect maturity. The navel is always well marked and usually prominent.

The following varieties of the lime are found in our gardens.

1. The SEEDLESS PERPETUAL LIME. (M. = *limetta bla zerrigha*). The tree attains a large size, with a thick and spreading crown and a drooping habit, and thrives in moderately shaded situations as well as in full sunshine. It is very resistant to drought and to gumming and is very productive, producing several crops of blossoms and fruit, like the perpetual lemon. The fruit is often borne in clusters, is elliptical in shape, middling or rather small in size, with a short and pointed navel, and a thin peel, which becomes light yellow at maturity. The pulp is greenish or greenish yellow, absolutely seedless, with abundant juice which is sprightly acid, and somewhat bitterish. Several crops of fruit are produced throughout the year as in the case of the perpetual lemon, the crop produced by the autumn

blossoms being specially abundant. The juice supersedes very well that of the lemon, being sometimes preferred on account of its slightly bitterish flavour.

2. The SWEET LIME. (M. = *lunicella*). The tree is middling but makes rapid growth, attaining full size in a few years, and is a perpetual bearer, flowering three or four times in the year. The fruit is rounded, with a large navel, more or less obtuse, with a deep groove around it. The peel is rough, and chrome yellow at maturity, with a delightful fragrance, and on that account it is often used for flavouring. The juice is sweet without any trace of acidity, but is devoid of aroma. A sport of this variety, bearing smaller and more numerous fruits, is also cultivated.

3. The SMALL CHINA LIME. (M. = *Limetta tal China*). The tree is small or middling, making a dense growth and is very thorny. The leaves are small and elongated. The flowers are very small, and are succeeded by very small, egg-shaped fruits, with a flattened and often indistinct navel. The peel is thin lemon-coloured. The juice is abundant, and very acid. The fruit is suitable for the same uses as the lemon, but is liable to drop from the tree soon after maturity.

4. The LARGE ACID LIME (unnamed). The tree is fairly large, with lime-like, dark green, pointed foliage. The blossoms are small and white, occasionally faintly tinged pink on the outside, thus showing that there is some admixture of lemon blood. The fruit is large, perfectly oval, with a large blunt navel. The rind is thin and soft, canary-yellow. The pulp is greenish, with very abundant juice, sprightly acid, containing very few seeds, sometimes seedless. The original tree exists in the garden of Count Sant Fournier at Casal Lia.

THE BERGAMOT.

(*Citrus Bergamia*, Risso).

The foliage and the blossoms of the Bergamots are similar to those of the orange, but have a fragrance of their own. The flowers are white as in the orange and lime. The fruit has a persistent navel more or less marked. The peel is yellow, or chrome yellow, with a powerful and characteristic fragrance. The bergamots may be said to have the habit, the foliage and the flowers of the orange, and the appearance of the fruit and its peel is that of the lime, but the strong and grateful fragrance is their own. The pulp is devoid of acidity, but is intensely bitter. The peel is also much more bitter than that of the bitter orange. Bergamots are cultivated on a large scale in Calabria for the sake of the valuable essential oil which is obtained by pressure from the peel. In our gardens they are grown chiefly as a curiosity, but the peel is often candied, and is much used as a flavouring ingredient by confectioners and in household economy. The following bergamots are grown in our gardens.

1. The COMMON BERGAMOT (M.=*bergamotta*). The tree attains the size of an orange tree and is very productive. The fruit is of the size of an orange, round or slightly oval at the stalk-end. The navel consists of the persistent column or style of the pistil, without any thickening at its base. The peel is yellow at maturity. A form still more productive, but bearing smaller fruits is also cultivated. There is also another form bearing variegated fruits, the peel having longitudinal white or greenish white streaks, which become deep chrome yellow at maturity. For the extraction of essence, as well as for candying, the fruit is picked when it has reached full size, but has not yet turned yellow. A seedling variety at San Antonio Gardens has oval or pear-shaped fruits.

2. The MELAROSA BERGAMOT. (M. = *melarosa*). The tree is middling or small and is fairly productive. The foliage is small, elongated, and often crimped as that of an egg-orange. The fruit is small more or less flattened with an uneven peel, and a large and flattened navel. The peel changes from greenish yellow, to yellow and then to chrome yellow at maturity. The pulp is greenish and very bitter. The fruit, or its peel, has the strongest and most persistent fragrance of all Citrus fruits, that of the ripe fruit being more delicate and pleasant.

THE BITTER, SOUR OR SEVILLE ORANGE.

(*Citrus Bigaradia*, Loisel.)

The BITTER ORANGE often attains a large size, and lives to a great age. It is resistant to drought and to gumming, and thrives well in all situations, but is dwarfed if exposed too much to the N.W. & W. winds. The tree is productive and is usually very thorny. The blossoms are pure white, fairly large and very fragrant, and are preferred to all other Citrus blossoms for the extraction of essence of orange-blossoms or oil of Neroli, and for the distillation of orange-flower water. The leaves are more or less distinctly winged, the fruits are round or spheroidal, with a rough peel which is bitter and very aromatic. The pulp is bitter and slightly acid. All bitter oranges can be kept long on the tree after maturity. The following bitter oranges are grown in our gardens.

1. The COMMON BITTER ORANGE. (M = *laring kares* or *zupperit*). This is the typical wild or half-wild bitter orange grown directly from seed, and makes the best stock on which all Citrus trees, including other varieties of the bitter orange, are budded or grafted. The fruit is used for the manufacture of marmalade, and the peel, properly cut and dried, is used in the

production of orange-bitters, and in pharmacy as tincture of orange-peel.

2. The LARGE-CUPPED BITTER ORANGE. This variety is notable for the swollen and fleshy calyx, which at maturity assumes the same orange colour as the fruit. The calyx of fruit which has dropped when young, usually persists on the tree, and continues to grow, in due time taking its peculiar orange colour. The fruit itself is not distinguishable from the preceding and has the same uses.

3. The DOUBLE-FLOWERED BITTER ORANGE. This is another ancient variety, remarkable for its blossoms bearing ten petals or more, in a double row. The fruit rarely reaches the size of the common bitter orange.

4. The VARIEGATED BITTER ORANGE, in which the leaves are partly coloured white or greenish white, and the fruit has similar longitudinal markings, which become deeper orange at maturity.

5. The NARROW-LEAVED or WILLOW-LEAVED BITTER ORANGE, is distinguishable from the type on account of its very narrow and long leaves, often not more than 1 c. m. in breadth.

6. The MALTA-CROSS BITTER ORANGE. The tree is middling in size, with a dense crown of very dark green foliage. The fruit is middling, bearing about eight longitudinal ridges more marked at the navel end, so disposed as to look like a Malta-cross. The colour of the fruit is a very deep orange tending to scarlet. The tree in fruit is very ornamental.

7. The SMALL CHINA BITTER ORANGE. The tree is middling or small, and makes slow growth. The leaves are very small, and the fruit is small, hardly reaching 3 c. m. in diameter, and keeps on the tree for a long time. The fruit is candied whole. This variety when in fruit is very ornamental, and fruits well as a pot plant.

8. The CLUSTER BITTER ORANGE. The fruit is small, usually borne in large clusters.

9. GRENADE BITTER ORANGE. The fruit has a well marked depressed navel, and contains many small segments, often not larger than those of the pomegranate.

10. The VOLKAMERIO BITTER ORANGE. The leaves are small, and the fruit has a navel like that of the lemon.

11. The CURLED-LEAVED BITTER ORANGE, the leaves of which are broad and curiously curled. The tree is almost thornless, and the fruit sometimes is oval.

12. The "BIZZARRIA" ORANGE. (M. = *laring Bizzarrria* or *laring ghageb*). The fruit may be shaped like a lemon, round or elliptical, with peel coloured yellow or orange, with an orange-coloured pulp which may be acid like that of the lemon, or bitter like that of the common Seville Orange, or may be both acid and bitter; or the fruit may be exactly like a Seville Orange in all details, and this varied production is noted not only on the same tree, proceeding from the same bud or graft, but also on the same branch, and sometimes in the same cluster.

13. The SWEET SEVILLE ORANGE. The fruit is only slightly bitterish and is quite eatable. It is often more or less egg-shaped. The peel has a milder flavour than that of the bitter orange.

THE COMMON ORANGE.

(*Citrus Aurantium*, Lin.)

The ORANGE is largely grown for the sake of its delicious fruit. In April and May the fragrance of its pure white blossoms, wafted on the breeze, reminds the visitor who passes through the roads of the villages, that beyond the high unsightly stone-walls which obstruct the view, there are numerous orange-groves in all the pride of spring. The following forms of table oranges are grown in our gardens.

1. The ORDINARY ROUND ORANGE. (M.= *laring ordinariu*). This is the old variety of the edible orange cultivated by our gardeners. Most groves planted in the 17th and 18th century consisted exclusively of this variety, which is still met with everywhere in our groves. It is now hardly ever propagated, and indeed many groves were in the second half of the 19th century, headed back and budded with the blood-orange and the egg-blood orange, and particularly with the mandarin or tangerine which was then fetching fabulous prices. However the ordinary round orange is a very heavy cropper, and its high production more than makes up for its comparatively low price. It is a long keeper, the fruit beginning to ripen in December and continuing on the tree in good condition well into May or June.

2. The MALTA BLOOD-ORANGE. (M.= *laring tad-dem*) The tree is large or middling, slightly thorny, and is very productive, with foliage similar to that of the ordinary orange, but of a deeper green. The fruit is of fair size, round or slightly flattened, with a deep orange peel, which in December begins to take the characteristic blood colouring, at the same time the pulp becoming heavily streaked blood-red, and later on the colouring pervades the whole pulp, particularly its lower half. The juice has a delicious flavour and aroma, is sweet and gratefully acid. The fruit keeps well for a long time and travels well. This is a good commercial orange, and to it was due originally the fame of the Malta orange. The Malta Blood Orange is in all probability a local seedling sport of the ordinary orange, but its origin is wrapped in mystery. It is described and figured in Risso's Natural History of the Orange Tribe, and therefore was well known and widely cultivated before Risso's time. The opinion so often expressed by popular writers that it is due to a cross with the pomegranate, is of course altogether untenable.

3. The LARGE OVAL ORANGE. (M.= *laring fin*,

laring taunali, laring ta Portugal). The tree is large, with dark green foliage, more or less curled and wavy along the midrib. The fruit is large, usually more or less egg-shaped, but sometimes round, and even spheroidal like an ordinary orange. The peel is usually thick and uneven. The pulp contains few seeds, is very juicy and of good flavour. This is probably the original form introduced during the rule of the Order of St. John, towards the close of the 16th century. The fruit is not of good keeping quality, being prone to drop off soon after reaching maturity. It is no longer propagated as a distinct variety.

4. The MALTA EGG-ORANGE. (M.=*laring tuil, laring fin*). This is probably an improved form of the preceding, created by careful selection in budding. The tree is large, fairly productive, and perfectly thornless, with thick dark green leathery foliage, curiously curled or wavy. Fruit large, egg-shaped or elliptical, with rather thin peel, somewhat rough to the touch. The pulp is juicy and of a refined flavour, with a soft and tender rag. The seeds are few, often limited to one only, and occasionally the fruit is quite seedless. This is one of the earliest oranges to come to maturity, but the fruit does not keep well on the tree. It is a good commercial orange, fetches a good price, and is a good shipper when packed not later than the first week of January.

5. The SMOOTH-SKINNED EGG-ORANGE (M.=*laring tuil tal ghafsa*). It is probably a sport obtained by budding from the Malta egg-orange, and develops its best qualities in full sunshine. The tree is middling in size, but sometimes attains the full size of an orange, and under good cultivation it is very productive. The foliage is similar to that of the preceding variety, but is small and less fleshy. The fruit is often paired or in small clusters, and is rather small or middling, uniformly elliptical. The peel is very thin, and is usually smooth

as marble. There is generally a marked depression on the lower part of the sunny side of the fruit, hence its Maltese name "*tal għafsa*". The fruit is of superior quality, keeps fairly well and travels well. The pulp contains few seeds, has a delicious flavour and a refined aroma, and by many it is preferred even to the egg-blood orange.

6. THE MALTA EGG-BLOOD. (M.=*laring tuil tad-demm, tauuali* or *fin tad-demm*). This very superior orange originated as a sport in a small orange grove at Casal Balzan, on a tree of the Malta egg-orange, towards 1850, and the sport was fixed and perpetuated by budding. The leaves are usually curled and wavy as in the egg-oranges, but are often smaller. The fruit is middling or large, oval or elliptical, rarely roundish, the peel is usually thin and smooth, but may be rather thick on trees situated in the shade. In January the blood-red streaks or markings make their appearance in the peel, as well as in the pulp, and later on the lower part of the peel and pulp become suffused with red, but rarely so intensely as in the round blood orange. The pulp has few seeds, occasionally only one, and has a delicately sweet and acidulous flavour, and a distinct aroma. It is at its best in February and March, but is then too ripe to travel well.

The egg-blood orange is generally considered the best of our oranges, and on account of its superior commercial qualities, it is now largely planted in preference to other varieties. Until a few years ago, thousands of young trees were annually exported to other countries bordering the Mediterranean, as well as to America, India, Australia, South Africa etc.

7. The SWEET ORANGE or SWEET CHINA ORANGE, or MALTA VANILLA ORANGE (M.=*laring helu*). The tree grows to the same size, and has the same general appearance as the ordinary orange, and is very productive. The fruit is middling or large, round, often slightly flattened or spheroidal, but sometimes is oval. The rag

is tender, the pulp is very juicy, and very sweet, without any trace of acidity, and on this account it is often disliked. The fruit is already found in the market as early as November, when the peel is just turning yellow. At that time the flavour is flat, the juice tasting merely like water with sugar, but later on it develops an exquisite vanilla-like flavour. The peel has a delicate aroma of its own. There is a form bearing larger fruits, but is not so productive as the type.

8. The BAHIA or NAVEL or SEEDLESS ORANGE. (M.=*laring ta Bahia* or *tal Brazil*.) The tree is middling in size, but very vigorous, with somewhat thorny branches and twigs, and leaves generally winged like those of the bitter orange. The fruit is large or very large, and may be spheroidal in shape or round or slightly oval. There is always a well-marked depressed navel, produced by a folding of the integuments. The peel is often thick, and rather uneven. The pulp is abundant and heavy, but both its substance and the rag which encloses it are quite tender. There are numerous small segments in the lower part of the fruit near the navel. The fruit is really seedless, but sometimes contains one or two seeds. The flavour is exquisite, being sweet and aromatic with a mild and pleasant acidity. The fruit ripens early and travels well. The tree is well productive if allowed to retain a good crown of foliage, and is not unduly trimmed. The round or spheroidal forms are perhaps more productive than the oval form, but this last is a more refined fruit.

9. The GOLDEN NUGGET NAVEL ORANGE. The tree is more vigorous than that of the Bahia orange, and grows to a larger size, but both are alike in habit and foliage. The tree is quite thornless, fairly productive under the same treatment as the Bahia orange, the fruit being very large, round or somewhat oval, and is equal or superior to the Bahia orange as regards flavour and other qualities. It is almost always entirely seedless.

10. THOMPSON'S IMPROVED NAVEL ORANGE. The tree is as vigorous as the Bahia orange, and is thornless. It is well productive under the same treatment as the Bahia orange, the fruit being middling or large, distinctly oval, always with a well marked navel. The peel is perfectly smooth, and though thin is very tough. The pulp is seedless, and of firmer texture than that of the Bahia orange.

11. The GOLDEN BUCKEYE NAVEL ORANGE. The tree is middling, thornless, with smaller leaves than any of the three navel oranges above mentioned. The fruit is oblong, with a very smooth and thin peel, of a yellow or yellowish-orange colour, having narrow longitudinal bands of deep orange. Pulp seedless, aromatic, of a very firm and dry texture. The tree is not very productive.

12. The WASHINGTON NAVEL ORANGE. The tree is middling, but vigorous, and is productive. The fruit is large or very large, usually oval, with an obtuse but well marked navel, and thin smooth peel. The pulp is seedless, with little or no rag, of very fine flavour, sweet and aromatic, fully equal to the Bahia orange at its best.

Other oranges recently introduced in these Islands are Valencia Late, Navelencia, and Joppa Late, but they have not yet fruited.

THE KUMQUAT OR KIN-KAN.

(*Citrus japonica*)

The Kumquat-tree (M = *laring gappunis*, *laring tal ksari*) is small or middling in size, but is fairly vigorous. It has narrow, pointed, dark green foliage. The blossoms are small and white, and usually appear late in spring, and are succeeded by other blossoms at intervals during the summer. The fruits are small, hardly more than 3 c.m. in diameter, with a very tender peel, and a juicy pulp markedly acid, but of fine

flavour. The tree is productive even when quite young, and makes a good pot plant. The fruit is eaten entire, with its peel, this last being very sweet and tender, and therefore makes a good adjunct or corrective to the acid pulp. Two varieties have been introduced recently, and are met with in the gardens of amateurs. The Marumi Kumquat produces round fruits, has smaller leaves and a compact habit of growth which makes it more desirable for cultivation in pots. The Nagami Kumquat has rather larger leaves, with a less compact habit, and produces egg-shaped fruits. Both varieties are equally productive, and the fruit has the same peculiar flavour. The Kumquats do not thrive well when budded on Bitter Orange stock, and in Japan and China they are usually budded on *Citrus trifoliata*. As this stock is not used by our gardeners, and is not obtainable from local nurserymen, the kumquat is propagated by cuttings or by budding on seedling lemons, on which they seem to do well.

THE SHADDOCK AND THE POMELO.

(*Citrus decumana*, Murr., and *C. decumana hybrida* or *pomelana*).

The Shaddock, also called Grape-fruit or Holland Orange, (M.=*Xaddock*, *laring tar-rius*, *laring ta Olanda*), is more ornamental than useful. The tree is middling in size, with a rather straggling habit of growth. The leaves are large, winged, fleshy and leathery, and more or less curled or wavy. The blossoms are very large, of a dirty creamy white colour. The fruit is very large, round or oval, with a yellow peel, which is very tough and even, but slightly chagrined owing to the protruding glands. The pulp is dry and firm, creamy yellow, often streaked with orange and crimson; the rags or membranes are tough and leathery. The seeds are very large and numerous, and the flavour of the

pulp is bitter and slightly acid. The tree is grown chiefly for its striking and ornamental character when in fruit, but its fruit is hardly eatable, and is only occasionally used for marmalades.

The Pomelo, more often called Grape-fruit. (M. = *pomelo*, *xaddock tal ichel*), is a hybrid of American origin, and has developed several distinct forms or varieties. In size and habit the tree resembles a shaddock, but the twigs are thinner, the leaves are smaller and of a darker green, and the blossoms are much smaller and of a purer white. The fruit is large, round or oval, shaped like a shaddock, but much smaller. The peel is yellow or deep yellow, very smooth and shining, much less tough than that of the shaddock. The pulp is yellowish and juicy with a tender rag, the flavour is slightly bitterish with a pleasant acidity and aroma. There are now several varieties cultivated in our gardens, but nowhere on a commercial scale. The fruit is consumed as a dessert fruit, the juice requiring to be corrected by the addition of sugar or some liqueur in order to be more palatable. The bitterish juice of the pomelo contains an alcaloid allied to aurantin, which is similar to quinine in action.

The following are the Shaddocks and Pomeles grown in our gardens.

1. The ROUND SHADDOCK, long known to our gardeners. The fruit is round, often exceeding 15 c. m. in diameter.
2. The OVAL SHADDOCK, is a more recent introduction. The fruit is oval, its long diameter often exceeding 18 c. m. The pulp is heavily streaked with red.
3. The PERNAMBUCO POMELO. The fruit is oval and large, and is probably the best of its class. A seedling of this variety exists at San Antonio Gardens, which seems to be more productive than the type, and earlier to ripen.

4. The ELLEN POMELO. The fruit is round fairly large. The tree is very productive.

5. The DUNCAN POMELO. The fruit is round or slightly flattened, large. The peel is more tough than that of other pomelos, and the fruit keeps a long time on the tree. The tree is very productive and a vigorous grower.

6. POMELO SAN ANTONIO. This is a very recent local variety obtained at San Antonio Gardens and has fruited for the first time in 1917. The tree is vigorous, with small foliage, and is somewhat thorny. It is very productive. The fruit is perfectly oval, of the same size and appearance as the Pernambuco Pomelo, but the pulp is more yellowish orange and has a more delicate flavour. It is very juicy and contains comparatively few seeds, which are flat and round like those of a Shaddock, but of course much smaller. This is probably the best Pomelo in cultivation.

THE MANDARIN ORANGE.

(*Citrus deliciosa* Tenore, or *C. nobilis* Lour.)

The Mandarin Orange. (M.= *Mandurina*). Is a native of China, and was introduced in our gardens in 1811, but began to be cultivated extensively only towards 1850. The tree is large and has a spreading habit. The twigs are thin, and the foliage is small, elongated and pointed. The flowers are small, pure white. The fruits are more or less flattened, convex towards the stalk and depressed or concave on the opposite side. The peel is orange-coloured, thin, is thrown into folds near the stalk, and separates easily from the segments which are loosely adherent to each other. It is thickly studded with large glands which contain much valuable essential oil, of a delightful and peculiar fragrance, which can be easily extracted by

hand pressure on a sponge. The pulp is clear orange-red, sweet, with a pleasant acidity and delicate aroma.

The mandarins are distinguishable into two classes, (a) the true mandarins having an orange-coloured peel and flesh, and (b) the tangerines in which the flesh and peel are of a deep orange or red colour. These last are not grown in these Islands.

The mandarin orange is rarely affected by gumming, and as it grows freely from seed, it may be budded on own seedlings, but our gardeners bud it invariably on sour-orange stock, for the reason that this stock is more handy, and also on the supposition that by budding on the sour orange the fruit improves in size and flavour. Bud sports of the mandarin orange are numerous. Thus, we have the large-fruited mandarin often miscalled tangerine, the round mandarin, and the pear-shaped mandarin in which the fruit is markedly elongated towards the stalk-end, but they are never propagated as special forms, the common type being considered more commercial. The mandarin is a heavy cropper, instances of full-grown trees producing a crop of 250 dozen being frequent. The Satsuma Orange is a true mandarin introduced a few years ago, but its colour is a deeper orange than the mandarin. The fruit is seedless, and the tree is entirely thornless. It is best budded on seedlings of the mandarin orange, as it is said not to do well when budded on the bitter orange, but it may be rebudded on plants of the ordinary mandarin.

DISEASES OF CITRUS TREES.

Citrus trees are liable to the following non-parasitical diseases.

1. CHLOROSIS. (M. = *mard irkik*). Is the disease of non-adaptation or of disagreement of the tree with its environment, and is a disease to which all plants bearing

chlorophyll are more or less subject. In Citrus trees, the disease may be due to a state of malnutrition brought about by defective physical or chemical qualities of the soil and subsoil, or to a faulty situation, or to stagnant moisture in the soil or to the loss of foliage in winter. The foliage assumes a yellowish sickly hue, the young twigs are thin, small, sickly and poorly clad with leaves, which are small and undeveloped, and soon dry up and fall off. The upper branches begin to die off, and then the larger ones, and after an attempt at revival which is manifested by the formation of a number of sickly shoots on the trunk, the tree dies a lingering death. The disease generally takes from one to five years to run its course. Young trees recently transplanted succumb more rapidly, but adult trees are liable to the disease only when some new factor supervenes to alter the former status. In its first stages the disease is easily cured by good treatment, and by the early removal of the adverse factor. Trees which have been severely affected by bad weather often show well marked signs of incipient chlorosis in the spring, the first symptom consisting in an over-production of blossoms unaccompanied by foliage (*anthomania*), soon afterwards followed by the characteristic small chlorotic twigs, but usually recover with good cultivation. Recovery is difficult or improbable when the disease has been allowed to remain long, and when big branches have already died off.

2. SUNSTROKE OR SUNBURN. (M.=*lupa*). This is often a disease of considerable gravity, and may make its appearance at any time from May to December. It may start very insidiously and much injury may be caused in a very short time. The disease may be caused directly by the sultry and dry winds blowing from the S.E., S., or S.W., or by a sudden change to W. or N.W., after a prolonged spell of calm and hot weather. In both cases the cause is the same, namely the break of equilibrium between the absorbing power of

the roots and transpiration or evaporation from the leaves, by which the foliage is deprived of its moisture at a greater rate than the loss is made good. As a result the leaves curl and dry up, and soon drop off, at the same time the tree shedding most of the young fruit along with the foliage. Very often many twigs and branches are killed in the same manner, and in graver cases entire trees are severely mauled or killed outright. These cases of sudden death are fortunately very rare. They are known by the name of *brontesis*, but the term is also applied indiscriminately to cases of death by lightning and to cases of equally sudden death caused by root-trouble, in which an apparently healthy tree succumbs in a day or two, to an insidious attack of root-fungus (*Armillaria mellea*) or of gummosis of the roots.

Citrus trees are more liable to "sunstroke" after a prolonged drought, or if they have been suffering at all from want of irrigation. It often happens that an orange-grove which in the morning showed no trace of this disease, is found to be severely affected in the afternoon, with shrivelled twigs and dried up leaves, which give the impression that the trees had been exposed to the hot blast of a furnace. In less severe cases only the leaves are killed, the twigs remaining green and forming new foliage soon after irrigation. The bitter or sour orange, the mandarin orange and the shaddock are less liable to this disease than other Citrus trees, and it is very exceptional to have a slight attack of this disease within three or four days after irrigation, and no severe attack ever takes place within the first week.

3. CARPOPTOSIS. All Citrus trees set considerably more fruit than they are able to bring to maturity. At the end of May or in the first days of June, the small fruit begins to drop off, and by the end of June a certain amount of selection will have taken place; but this shedding of the young fruit continues until the first week of August, after which time it is stopped completely.

This is only a physiological process, but may become pathological when a sudden heat wave in May or June deprives the tree of all its fruit, or when without any apparent cause the fruit is shed off almost entirely before the end of June. This unhealthy condition of the tree without an apparent cause is known as *carpoptosis*, and is ascribed to a weak or defective fertilization, as it occurs more frequently when the blooming season had coincided with a long spell of wet weather, which washes off the pollen and interferes with the beneficial action of bees and other pronubal insects. It has been long known to our gardeners that orange groves in which bee-hives are kept are always more productive than those in which there are no bee-hives, or which are not much visited by bees, and therefore our gardeners are glad to see the bees busily humming on the orange trees in bloom. It is not easy to establish accurately by experiment what is the actual increase of production due to fertilization by bees, but it is generally believed to be 15 to 20 per cent, and may be much more in certain circumstances. The honey obtained from the orange grove, though fine in quality and very light in colour, is lacking in flavour, and on this account it is often allowed to remain in the hive to be used by the bees, in order not to have to feed them artificially for a considerable part of the year.

4. DISEASES CAUSED BY PARASITIC FUNGI. Citrus trees are subject to a legion of fungous parasites which have been so ably described and most of them figured in Otto Penzig's work "*Studi Botanici sugli Agrumi*". But on account of their comparatively innocent character, or of their mild attacks, many of them never attracted the attention of cultivators, and are economically unimportant. A knowledge of the following diseases will be found sufficient by the practical grower.

Gummosis or *gumming*,—the *mal della gomma* of the Italians is an infective disease due to the presence of

a microbe, *Bacterium gummi*, Comes. When attacking the trunk or branches the disease is usually accompanied by an exudation of gum. The disease usually has a latent beginning. The bark on a certain spot in the trunk or branches becomes darker and shining, as if covered with a thin layer of varnish. In a week or two a small crack is formed in the bark, and a semi-liquid gum of a reddish brown hue oozes out in variable quantity, and is more abundant after irrigation. In a few days more the gum becomes more liquid, clearer, and of a lighter colour, sometimes perfectly colourless. The dark shining spot increases in size till at last a large part of the perimeter of the trunk is infected. The bark around the fissure dies soon after the gum begins to ooze, and is easily separated from the wood, which is found to be dead all around the fissure. New points of infection develop above and below the first, and when the tree is approaching its end, the gum again oozes out in a semi-solid state, torpid and brown. By this time several of the large branches will have died and the tree reduced to little more than a stump.

When the disease appears on a large branch sometimes no gum is formed, but the bark dies, cracks, and separates, leaving a long patch of dead ashy coloured wood, usually upon the upper surface of the branch. When the disease attacks the roots or the base of the trunk gum is rarely formed, but ashy spots are developed on the bark of the roots or trunk, and underneath them the wood is dead, ashy-grey, and often in a half-rotten state. The dead roots are commonly covered all over by the silvery root-like mycelium of a saprophytic mushroom, of *Agaricus Citri* or of *Armillaria mellea*. The growth of these mushrooms near the base of the trunk of a Citrus tree should be looked upon with suspicion, —it is a hint that some roots may have been destroyed by gummosis or by root-rot.

Gummosis generally takes from three to eight years

to kill a Citrus tree. The tree dies slowly, but in early autumn death may be sudden, the leaves and small fruits dry and remain hanging on the tree, and but for the presence of half-rotten roots or of a complete ring of black shining bark around the trunk, the disease is easily mistaken for *brontesis*.

Not every case of gummosis is necessarily fatal. When the disease attacks a bitter orange-tree or a bitter orange stock, it is often checked by the robust growth of the tree. In this case a new layer of healthy bark grows out, and covers the dead wood in the same manner as when it closes upon a wound. Of all the Citrus trees, the lemon tree is the most subject to gummosis, and suffers most severely from it. The citrons and the sweet orange or China Orange are less liable than the lemon, but more than the ordinary or common orange and its varieties or forms. The mandarin orange is occasionally liable to a dry form of gummosis in which gum is rarely produced. The Seville or bitter orange is the least subject to gummosis and is also the most resistant to the disease, recovery taking place in about 70 per cent. of the total cases. Even when the disease attacks the roots of the bitter orange,—a form known as *mal della cagna* by Italian writers, new roots may be developed, and the tree may continue to flourish and to produce large crops for many years.

In the lemon, the citron and the common orange, gummosis may attack also the twigs of a year's growth. In this case the twig dies, but the tree suffers no further injury if not already infected lower down. As a measure of precaution it is advisable to remove and burn the diseased twigs, cutting them some distance lower down the point of infection, upon the healthy wood.

The predisposing causes of gummosis are want of moisture in the soil and subsoil, an excess of unfermented manure, lesions or wounds of the trunk, the branches and the roots, abrasions or punctures of the

young wood caused by insects or by the thorns of the branches, deficient drainage in winter, and the close presence of the roots of other large trees, such as the walnut, the fig and the olive. Deficient irrigation in a dry year is sure to be followed by an outbreak of gummosis; and a clayey retentive soil, with defective drainage, is a frequent cause of gummosis in young trees.

As a preventive it is advisable to plant only trees budded on the Seville or bitter orange, and not to allow the trees to suffer from want of water. An excess of humidity or stagnant moisture in the soil or subsoil should be remedied by drainage. The use of unfermented stable manure should be strictly avoided, and if the percentage of potash in the soil is too low, wood-ashes or chloride of potassium should be distributed evenly over the ground early in spring, or in autumn, at the first digging or tillage, to make up for the percentage. All large wounds on the trunk, the branches and the roots should be painted over with tar. When a tree is infected with gummosis, the diseased bark may be cut off, and the dead wood scooped out. The wound should then be washed out with a 5 per % solution of sulphate of copper, and when dry it should be painted over with tar to prevent re-infection. When a diseased branch is to be dealt with, it is better to cut it off to prevent the infection from spreading to the trunk. Rotten roots should be removed, the wound heavily painted with tar, and the large roots close to the diseased ones, though apparently healthy, should be washed with lime-milk or with fresh ash-lye. Well-rotted manure and wood-ashes should be applied in moderate quantity to the tree in a circular ditch 60 c. m. to 1 metre away from the trunk. If a tree is found to be infected at several points upon the trunk it is useless to try to prolong its life, but should be removed, the roots carefully dug up, the soil changed and a young tree planted in

its stead, or the soil left fallow for two or three years. When an orange-tree or a lemon-tree budded on Seville orange stock is badly infected with gummosis and the stock is healthy, it may be cut down or pollarded in spring a little below the graft line, and the vigorous shoots which are thrown up during summer, may be budded in the following spring.

Another disease which is often met with on clayey low-lying soils is the *root-rot*, which attacks and destroys the roots of Citrus trees. It is ascribed to a fungus, *Rhizoctomia violacea*. The generative zone or cambium of the roots is killed by the branching mycelium of the fungus, the bark becomes soft, of a dark purple colour, and easily separable from the wood. The wood deprived of its cambium dies in its turn, and on its surface may be seen the dark purple filaments of the old mycelium. The tree attacked by root-rot ceases to grow, its leaves assume a yellowish colour as in chlorosis, the usual undoubted sign of impaired health. Large branches die one after another, and shortly afterwards the tree succumbs. The disease usually appears sporadically, but at times it may assume the form of an epidemic, particularly in very wet years. When the disease is surprised at its beginning, it may be possible to save the tree by cutting off and removing those roots which show signs of infection, painting the wounds with tar, and replacing the earth about the roots with fresh earth taken from a sunny part of the grove, at some distance from the infected tree. At the same time, the tree should be isolated by means of a circular ditch about 50 c. m. deep, and about 2 metres away from the trunk. Drainage should be promoted and stagnant humidity avoided.

A large wound however well protected, if it fails to close in a few years, is sure to give rise to *canker*. The genesis of this common disease is very imperfectly known. Several fungi were found in the rotten wood,

and it is not yet settled whether they are saprophytes or really parasites. Probably they partake of the nature of both. They may commence as saprophytes feeding on the thin layer of dead wood over the surface of the wound. After some time the poison which they develop destroys the healthy wood, and death travels down the trunk, the fungus keeping equal pace with it, killing first the duramen and then the soft alburnum. Canker alone will kill the tree after many years, but generally gummosis supervenes and death ensues in a few months. Exposure to rain-water causes the canker to take a more acute form. To avoid this many cultivators cover the cankered wound with cork, and fill the interstices between this and the bark with a mixture of equal parts of resin, bees wax, tar and powdered clay, melted together over a fire. Others perforate the trunk at a level with the bottom of the cavity produced by canker, so as to prevent the accumulation of rain-water.

The sooty mould of the Citrus trees, *Meliola Penzigi*, Sacc., or *Capnodium Citri*, Berk., (*Fumago vagans*) appears early in autumn as small black spots upon the leaves, and gradually develops into a sooty crust covering the upper surface of the leaves, the fruit, and the green bark of the twigs. The black mass consists of bottle-shaped conidiophores imbedded in a thick mycelium. This fungus and its congener the *Meliola Citri*, Sacc., appear with great activity on those trees which are suffering from a bad attack of scale insects. These insects exude a thick sugary juice which sometimes besmears the upper surface of the leaves and fruit (called *melata* by Italian writers), and offers a suitable ground for the growth of the sooty mould. Want of proper ventilation, the vicinity of high walls, and the presence of exuberant foliage favour an attack of the sooty mould. A Citrus tree attacked by this fungus assumes a gloomy aspect, only partly relieved by the few green leaves which have escaped infection, and the unsightly fruit is sold with difficulty or fetches

low prices, but it does not interfere in any way with the keeping quality and aroma of the fruit, although it may cause some injury to the tree by depriving the green tissues of the influence of air and the direct rays of the sun. In late spring the fungus shrivels and separates in crusts, and the leaf if not past its age, continues to keep its hold on the twig green and apparently healthy as before infection. Spraying with Bordeaux mixture or any other approved fungicide may be attempted by way of prevention.

Another well-known fungus having a history similar to the preceding is the *Meliola Citri* Sacc. or *Apiosporum Citri*, the *mal di Cenere* of Italian orange growers. Like the preceding it lives on the leaves, twigs and fruits of Citrus trees, covering the same with ash-coloured crusts, which turn darker with age. On removing these crusts with the finger, the leaf is found to retain its green colour, and does not appear to have suffered much from the thick crust of mycelium which covered it. It is rarely seen in Citrus groves in these Islands, although very common all over Italy. The conditions which favour the growth of *Meliola Citri* and of *Meliola Penzigi* are identical, the first being possibly a mere variety of the second, and the same preventive treatment is applicable to both. But the best way to prevent the attacks of *Meliola* is to combat the scale-insects, and to rear the trees on tall trunks in order to favour the circulation of air all over the grove.

Fomes obliquus, Cooke, (*Polyporus obliquus*, Pers.) is a true parasite often found on the trunk and the undersurface of large branches of Citrus trees. Its mycelium lives at first at the expense of the cambium, and then enters the wood killing it, feeding upon it, and transforming it into a friable brown mass. In due time the sporocarp buds out as a round or oval flat mass of a chocolate brown colour, having its surface covered by minute holes or pores, set thickly and obliquely, from which

the spores proceed forth to propagate mischief. The fungus destroys the branch or trunk upon which it grows, but death may be delayed for four or five years, each year the sporocarp increasing in size. The fungous outgrowth should be removed and burned: the dead wood harbouring the mycelium should be cut off, the wound washed with a 5 per cent. solution of sulphate of copper, and thickly painted with tar. But if the fungus attacks a branch and not the trunk, it is safer to remove that branch and burn it, painting with tar the resulting wound. *Polyporus fumosus*, Pers., is much rarer, and can be combated in the same manner.

Agaricus Citri which is not known to exist in these Islands, and *Agaricus Hesperidum* are two saprophytic mushrooms which thrive on the rotten roots of Citrus trees, which have been separated from the tree during careless tillage, or which have been killed by gummosis of the roots (*mal della cagna*). Some writers consider these fungi as capable of real parasitism on living roots. Anyhow, it is advisable to gather and burn them as soon as they appear above the ground, before the formation of spores. *Agaricus Citri* grows in clusters; the stipes or stalk may be white, yellow or reddish, about 5 c.m. in height. The pileus or cap is of the size of a crown or a little larger, having a waxy white margin, the rest being yellowish half hidden under a mealy powder. *Agaricus Hesperidum* has the same habit as the preceding. Its stipes is 7 or 8 c.m. in height, white and hollow. Its membranous waxy cap may reach 4 c.m. in diameter. They are more or less similar to *Agaricus melleus*, Quèl (*Armillaria mellea*, Vahl) already referred to, which is a much more deadly species.

A small fungus often met with in vast clusters at the base of the trunk is *Psathyriella disseminata*, Quèl, with caps hardly exceeding 1 c.m. in diameter. This species is purely saprophytic, living on the dead mosses and organic detritus at the base of the trunk, but is quite harmless,

although its presence may mean that there is too much stagnant moisture in the soil around the tree.

Colletotrichium gleosporioides, Penz., and *Phyllosticta citricola*, Sacc., are two fungi found more or less frequently on the leaves of Citrus trees. A severe attack of *Phyllosticta* towards the close of summer may deprive an orange-tree of most of its foliage, but this is a rare occurrence and both diseases are easily kept in check by inducing vigorous growth through proper tillage and well regulated irrigation.

Many species of Lichens, belonging to the genera *Rinodina*, *Roccella*, *Dirina*, *Caloplaca*, *Xanthoria*, *Physcia*, etc. are commonly found growing on Citrus trees, and may impair their health by preventing the trunk and branches from getting their due share of air and light. Certain species, such as (*Ramalina Duriei*, Bagl) may be directly injurious, their rhizoids penetrating into the bark and feeding upon it. Trunks and branches thickly covered with these lichens show distinct signs of impaired health. No new shoots are formed, and the branch finally dies, and the lichens continue to flourish, feeding on the dead bark and wood.

Various methods have been tried to get rid of the lichens, all of which consist in applying a highly alkaline watery solution over the bark infested with them. The alcalies kill the lichens and set free the bark. Lime wash is a good remedy, always at hand, but it has the disadvantage of imparting a ghastly appearance to the trees. Lime water either used alone, or mixed with an equal quantity of ash-lye and applied over the bark with a common brush will be found to give good results. Ash-lye prepared from wood-ashes fresh from the fire, if the solution is too strong, may cause injury to the bark, especially in young trees. When treated with alkali the lichens are killed and become very brittle, assuming a reddish brown colour. They may then be rubbed off with

a piece of cloth, or brushed away with a wire brush or a chain-glove.

HAVOC AND DISEASES CAUSED BY ANIMALS. A great deal of havoc is often caused to the ripe fruits by rats, particularly by the brown rat. During winter when there are no other fruits and no ripening crops to allure them, the rats resort in large numbers to the orange groves, and their presence is soon made evident by half-eaten oranges and empty peels hanging on the tree. The rat rarely contents itself by feeding on the dropped fruit, but usually takes to the tree, selects a fine fruit, gnaws off a hole in the peel and scoops out the pulp, and ordinarily finishes off that fruit in the following night before attacking another. This habit affords a ready means to destroy the vermin, and by throwing a pinch of arsenic into the half finished fruit, next night the rat will find a poisoned mess for its repast.

The common snail *Helix aspersa* eats off in the peel circular holes large enough to admit the tip of a finger. The fruit thus damaged cannot remain long on the tree and is unsaleable. The havoc is sometimes considerable, and the crop of a tree may be destroyed entirely in this manner. The snails may be picked up early in the morning, and crushed or thrown in water with some paraffin. The common hedgehog, which feeds upon snails with avidity, will be a useful auxiliary when present.

Coleoptera. None of the Coleoptera is really injurious to Citrus fruits in these Islands. The two beetles *Epicometis squalida* Scop. and *Leucocoelis funesta* Poda, as well as the beautiful chafer *Potosia metallica* F., are occasionally found feeding on the blossoms of Citrus trees, but the injury caused by them is too slight to merit consideration. We have no wood-borers of Citrus trees. Other beetles prey upon the twigs and leaves of the orange in America. Hubbard in his work on the insects affecting the orange-tree, mentions two species of Coleoptera, *Chion cinctus*, Drury, and *Oncideres*

cingulatus, Say. The first is a borer of the roots, and the other amputates twigs about 2 c.m. in thickness by making a circular notch around them after having laid its eggs close to the buds above the notch. He describes and figures also *Elaphidion inerme*, Newman, whose grub bores into the dead wood. *Brachys ovata*, *Artipus floridanus* and other beetles prey upon the leaves but only to a very limited extent. None of these beetles has as yet found its way to our groves.

On the other hand we have several species of small beetles (*Coccinellidae* or Ladybirds) which prey upon the scale-insects and other parasites, and help to keep them in check. Their beneficial action will be referred to later on.

Among the Hymenoptera, the ants are the only insects injurious to Citrus trees in these Islands. They gnaw the tender leaves into an elaborate lace-work, and gnaw asunder the growing ends of young twigs. The injury caused to young trees, and especially to newly budded stock is often considerable. Ants sometimes attack the blossoms and devour the tender ovary. A colony of ants may form its nest into the trunk of a Citrus tree, and by means of the formic acid which they secrete may cause the death of the tree. These colonies may be destroyed by pouring some petroleum upon them, and stopping the door-way with a piece of cloth dipped in the same liquid. Ants may prove troublesome in another direction. When a colony of *Toxoptera* appears on a twig, the ants are sure to disseminate it all over the tree, carrying the young aphid in their mandibles from one twig to another. They also help to disseminate the scale-insects in the same manner, for the sake of the honey dew which is secreted by the aphid and by the scale-insects. Spraying the trees with a diluted insecticide, such as lysol, etc., or with a diluted solution of sulphate of iron (green vitriol) helps to keep away the ants. Wool or cotton tied round the stem entangles the ants which attempt to pass and acts often as an

effective barrier. A band of insecticide glue painted round the stem is also useful.

The locusts (Order *Orthoptera*) never gave any reason for complaint to the local orange grower. Occasionally two or three species make their appearance in the groves, but in very limited numbers. Their green larvae may be seen in spring and early summer skipping upon the weeds and beds of tender vegetables growing near orange trees. The adult insect as well as the larva feed on the same vegetables, but sometimes a few stray individuals may regale themselves upon the tender leaves of Citrus trees, which they seem to relish. These few grasshoppers should always be searched for and killed, to prevent them from multiplying to a dangerous extent, especially in low lying districts with thick vegetation. The migratory locust is known to be decidedly injurious to Citrus groves in several countries. Solitary specimens and sometimes small batches of this locust are occasionally seen in our groves, but no real swarms are ever met with.

Among the Lepidoptera there are three species, *Acrolipia Citri*, Mill. et Ragg., *Albinia Gnidiella*, Mill et Farg., and *Eupithecia pumila*, H.B., which have proved very injurious to Citrus groves in Italy. The commonest of these butterflies is *Acrolipia* which is found in Northern Italy, Corsica and Sicily. Their larvae feed upon the blossoms, preferring the blossoms of the lemon tree. A single grub may destroy three or more blossoms, and at times the havoc is so great that the entire crop is lost. The chrysalis hibernates beneath the leaves which it rolls with its web, or in the irregularities of the bark along the trunk and branches. To gather and kill the grubs while on their work of destruction is the only measure which may be recommended; petroleum or kerosene emulsion has been tried with doubtful results. Fortunately, none of these butterflies has as yet found its way to these Islands.

The caterpillar of a beautiful butterfly, *Papilio cresphontes*, Cramer, feeds upon the leaves of the orange-tree in the southern states of North America. Hubbard also describes and figures four species of moths, *Lagoa opercularis*, *Empretia stimulea*, *Phobetron Pithecium* and *Limacodes scapha*, along with several species of bag-worms which prey upon Citrus trees in the United States but so far these insects are unknown in these Islands. The larva of the well known moth *Zeuzera pirina* or *Z. Aesculi* was found once tunnelling through a branch of an orange-tree in a local grove, but this is a solitary instance of this moth attacking an orange-tree.

A small moth, a species of *Dacruma* or *Thalpochara*, common enough in our groves, wages a successful war against the scale insects and will be referred to again later on.

Diptera. Of all insects affecting Citrus trees, that which causes the largest amount of havoc to the crop, is the fruit-fly. Two species of fruit-fly, improperly called orange-fly, are known in the Mediterranean region, viz: *Halterophora capitata* Rondani or *Ceratitis citriperda* Uied, and *Halterophora hispanica* or *Ceratitis hispanica*. The home of the first is India, and is a great deal more common than the other. In favourable years there may be a fly for each fruit. It is long about 6 m. m., a little smaller than the common house-fly, with a white head having a yellow line across. Its antennae are yellow with white hairs; its thorax is black with four white lines; its abdomen is made up of white and yellow bands; its wings which are always kept outspread, have brown spots and yellow lines above, and brown dots lower down near their insertion. The other fruit-fly, *Halterophora hispanica*, is smaller than the preceding. It has yellow legs and greenish grey body, having brown spots hardly visible on the wings. Unlike its congener it avoids the sun, posting itself upon the trunk and large branches, and seeking the fruit only to deposit eggs.

The fruit-fly attacks not only the orange but many other fruits. The peach, the nectarine, the fig, the pear, the apricot, large sorts of plums, the custard apple, the prickly pear, and sometimes the quince and the apple, are subject to the attacks of this pest. It has four broods in the year. The hybernating brood appears in autumn, from the last week of September to Christmas, and from this brood the orange grove suffers severely. When the fruit-fly is about to brood, it chooses the fruit which is exposed to the full action of the sun's rays, because it ripens early and has a thinner peel, which enables the fly to perforate it through its whole thickness by the ovipositor, and often right into the pulp. But in other fruits,—peaches nectarines, pears and prickly pears—the fly generally chooses that side which is shaded from the sun, because the rind is softer. With the ovipositor at the end of its abdomen the fly pierces the peel, and within the hole thus made, it drops from four to twelve or fifteen eggs which are white and as small as a needle's end. If the sun is shining the small puncture is soon clogged by the juices of the fruit, but on a cloudy day or if the puncture happens to be made in the evening, there oozes out a drop of yellow gummy substance. This oozing takes place within a day or two, and with it the fruit tries to expel the eggs which it contains, which are often seen sticking on the gummy substance exuded from the puncture. If the puncture does not extend beyond the peel and especially if the puncture is followed by the formation of the drop of gummy substance, the eggs do not hatch and the fruit is saved. In the orange, the puncture after some days acquires a yellow colour, afterwards becoming reddish, and is surrounded by a yellowish areola, which disappears completely only when the fruit at maturity acquires its deep orange colour, but the puncture itself is easily recognized in the ripe fruit on account of its paler hue. The fruit pierced by the insect ripens or rather assumes a yellow colour

before its time, and if the tree is suffering from want of irrigation or from protracted drought, a certain proportion of the punctured fruit soon drops down, even before the young larvae are hatched. In hot weather with southern winds and dewy mornings, the eggs are hatched in about a week, and the young grubs soon reach the pulp, and in a few days more the fruit drops and rots. If cold weather sets in, the eggs are not hatched, and linger under the peel to hatch in the first hot days of spring, although considerable numbers of eggs are generally killed by the cold weather.

The larvae, which are very similar to cheese maggots, when arrived to maturity, pierce the peel and if the fruit is still hanging on the tree, they let themselves drop to the ground, and bury themselves in the soil to the depth of 1 to 6 c. m., and in about six hours become transformed into a pupa or chrysalis, having the form and colour of a grain of wheat, but much smaller. If hot weather continues, the pupa in five to eight days develops into a perfect insect, which issuing from the ground, proceeds with great alacrity to copulate and to renew the havoc. But if cold and damp weather supervenes many of the pupae die, and only a small percentage manage to keep alive till next spring, when the perfect insect issues forth to destroy the remaining fruit in the orange grove. The eggs of the fruit-fly which have hybernated are hatched by the warmth of the first days of spring. So that in spring there are really two broods, one from the newly laid eggs represents the first brood of that year, the other represents a part of the last brood of the preceding year, the eggs having been dormant during winter, more or less effectually protected from the cold by the thick peel of the fruit. The larvae of the first brood mature about the close of spring, and after going through the stages already described, the fly leaves its underground abode and proceeds to lay a second brood. The sufferers

from the second brood are the precocious figs, known as St. John's figs, early varieties of peaches and nectarines, and sometimes the late lemons, the early apricots and the loquat.

The warmth of summer causes a third brood to form in quick succession, so quick indeed that the third brood is often included in the second, but it can be proved experimentally that there is a distinct brood at about one month's interval from the second. The third brood is developed (1) on figs, particularly the reddish and brown sorts, the black, the violet and the white varieties being apparently less frequently attacked, (2) on peaches and nectarines and on the late large-fruited apricots, of which often not a single fruit is left in a well-stocked orchard, (3) on pears, quinces and sometimes on apples, (4) on prickly pears and late ripening sorts of plums, as well as on the custard apple and on the Kaki or Japanese persimmon.

From the larvae of the third brood are produced the flies which attack the Citrus grove in autumn, where the fourth and last brood is developed. When the fruit of the round varieties of the orange is attacked by the fruit-fly towards the close of autumn, the attacked fruit may rot on the tree without dropping, and then the larvae may complete their metamorphosis within the fruit, which though quite dry and mouldy, may thus be an unsuspected hiding place for the hibernating pupae throughout the winter.

The mandarin orange on account of its thin rind is very liable to suffer from attacks of the fruit-fly; the sweet orange and the egg oranges are more subject than the round oranges and the seedless oranges. The bitter or Seville orange is more subject than the lemon, and both are more often attacked in spring than in autumn. Mandarin trees growing in sheltered and warm situations are often deprived of all their fruits, particularly in dry and hot autumns.

Rain and wet weather is the worst foe of the fruit-fly, a good shower being enough to destroy the fly before it has time to take shelter under the leaves. In wet weather the fly becomes torpid and is washed down by the first droplet of rain that falls upon it. Wind only disturbs it and postpones its deadly punctures. Cold weather kills it, but by that time it has already provided for an ample posterity. In the stomach of the redbreast, the redstart, the stonechat and other insectivorous birds, have been found the remains of the fruit-fly; such as wings, thorax, feet etc. Birds, lizards, frogs and ants pick up many grubs when the fruit falls from the tree. The fly is not known to have any parasite belonging to the Ichneumonidae or Encyrtidae, and this fact accounts for its appalling numbers in years of drought.

The fruit-fly is a lazy insect and never takes a long flight, but is very alert, and on the approach of danger flits away to a neighbouring branch, to return soon after; but when engaged in laying eggs it is so absorbed in its work that it is easily crushed by the finger. It was proposed to touch with the finger besmeared with honey a few oranges or other fruit in each tree, and then with a sharp blow with the finger to destroy the fly while intent on sipping the honey. However when about to brood the insect cares not for the honey, and although numbers of insects have been caught with this simple proceeding it is not applicable for extensive orchards. Small boards 10 c.m. square, besmeared with honey and turpentine and hung on the tree answer the purpose better, and require no constant attendance;—the flies flock to the honey and are caught by the other sticky substance. It is also possible to poison the fly by means of a mixture of honey or molasses and arsenite of sodium (in the proportion of 50 parts of honey to 3 parts of a strong solution of arsenite of sodium) applied on small boards as above. All dropped fruit containing

the grubs should be collected daily, in order to give no time to the grubs to hide within the ground, and it should be disposed of in a manner so as to destroy the grubs effectually. The rotten fruit may be collected in a heap, sprinkled with petroleum and burned ; or it may be thrown into a ditch or other reservoir and covered with water, taking care to raise the water well over the uppermost layer of fruit, otherwise the grubs will get to this layer and undergo their metamorphosis. It is also recommended to bury the rotten fruit in a deep ditch covering each layer with quicklime, taking care not to bury any fruit within 30 c.m. from the surface of the ground. After six months the ditch may be opened and the rotten fruit will be found to make an excellent compost for the orange grove. There is little doubt that if these preventive measures were widely adopted, in a few years the havoc caused by the fruit-fly will be greatly reduced.

The pupae hiding in the ground are brought to the surface by frequent tillage and are then picked up by birds or destroyed more effectually by cold weather. Oranges still hanging on the tree in April can be protected by enclosing them in small bags of cheap cloth, taking care that the bag is wide enough not to close tight upon the fruit, otherwise the fly may reach it with its ovipositor through the meshes of the cloth. By this means many an orange grower is permitted to keep a certain number of oranges well into the summer, when they will realize very good prices, and the same bag if well cared for may be utilized for several years in succession. For oranges as well as for other fruits paper bags are often used, but these are liable to cause burns on the fruit, and though cheaper are of short duration.

The Hemiptera include a large number of parasites of Citrus trees, most of them remarkable for their prodigious power of increase. One of the Hemiptera, *Siphonophora citrifolii* or *Toxoptera Aurantii* is the Orange-

Aphis, which is often an implacable foe of young Citrus trees. The insect usually makes its appearance early in spring on the new shoots and also on the blossoms. When young it is of a rusty green colour, becomes dark green in adult life and again assumes a rusty green or dingy colour with age. The biology of the Aphidae and their curious phenomenon of parthenogenesis are well-known and require no repetition here. As in other plants, the Orange-Aphis prefers the under surface of young leaves, the petioles and the twigs where the sap is in active circulation. A particularity worth mentioning is that the winged and wingless female individuals are always found together on the same twig. The winged individuals are of a darker green, nearly black, and the larvae of this form may be distinguished when quite young from those of the wingless form on account of their darker colour and the longer tubercles on the upper part of the body, from which tubercles eventually the wings bud out. The length of the adult insect varies from $1\frac{1}{2}$ to $2\frac{1}{2}$ m.m. This insect checks the growth of the new shoots; the blossoms fall without blooming, the very young leaves are destroyed, and the others are stunted in their growth, become curled and deformed, and the young tree may fall into a chlorotic condition which may end in death. Were it not for its numerous enemies the Orange-Aphis would prove very disastrous to the Citrus grove. Its principal enemy is a small gnat-like insect belonging to the Chalcidae, whose name is *Trionyx testaceipes*, Cresson. The larva of this insect, a small white grub, lives within the body of the Aphis, feeds upon it and at last kills it. In dying the Aphis becomes distended, assumes a globular shape and a brown colour and clings firmly to the undersurface of the leaf upon which it fed. The Tryonix completes its metamorphosis within its host, and finally makes a small puncture on the back of the Aphis reduced to a brown shell, and issues forth a winged insect ready to continue a successful war for the benefit of the Citrus grove.

Other powerful enemies of the Aphis are the so-called Aphis-lions,—*Chrysopa Citri* and *Chrysopa perla*. They are Neuropterous insects about 1 c.m. in length. They are of a lively green colour having four lacy transparent wings of the same size. They have green antennae, red eyes and patches of silvery lustre on the thorax. Their green nimble larvae as well as the perfect insects are very voracious and feed with great complacency on the Aphis, going over from one twig to another in search of their victims. Their greenish white eggs are born on stalks or pedicels $\frac{1}{2}$ to 1 c.m. in length, laid in lines along the margin of leaves on twigs infested by the Aphis. Hubbard mentions *Chrysopa oculata* having the same habits as the foregoing, devouring the Aphis and larvae of scale-insects in the orange groves of North America. *Hemerobius* and *Psocus* are two other Neuropterous insects having the same habits as the *Chrysopa*, but are of rarer occurrence. The ladybirds which will be described later on, particularly *Coccinella septempunctata*, are useful allies against the Aphis, in the same way as against the scale-insects. When the ladybirds make their appearance on a tree infested by Aphis we are sure to see the parasites disappear in a few days. Spraying with petroleum or kerosene emulsion, with tobacco decoction, wood ash-lye, or dusting with sulphur containing 5 % of sulphate of copper, have been tried with success. An excellent preparation for this purpose is Schloesing's precipitated sulphur with nicotine, particularly for young trees badly infested. Dusting once or twice with this preparation soon clears all traces of the Aphis, without causing the least injury to the tender growth.

The *cotton-stainer* of the United States, *Disdercus suturellus*, punctures and destroys the fruit when ripe. It is really a parasite of the cotton plant, and takes to the orange groves after the cotton harvest. It is not present in Europe.

The SCALE INSECTS, a class of true parasites, have acquired an evil celebrity all over the world. Trees, shrubs and plants are equally subject to their parasitism. The same scale insect may be found on several species of vegetables, and the same tree may be liable to the attacks of several species of scale insects. They are a numerous and prosperous class of very easy propagation. The damage caused by a single scale insect may be overlooked, but they derive their dangerous qualities from their vast numbers. When first imported into a new region they are slow to establish themselves, and if remedial measures are immediately taken we may hope to suppress them, as has been the case lately with *Diaspis pentagona* imported from Sicily along with some ornamental shrubs. But if they happen to obtain a footing and to become established, nothing can prevent them from extending in every direction. Were it not for their numerous enemies, the cultivation of Citrus trees, as well as of many other fruit and ornamental trees, on a commercial or extensive basis, would be impracticable, and no country ever succeeded, either by natural or by artificial means, to stamp out entirely any kind of scale insect after it had been fully established. There are no less than 24 species of scale insects affecting Citrus trees. Twelve of them are present in Malta, with great probability of fresh additions, but with no hope of seeing this number diminish.

Chionaspis Citri Comstock, has a minute somewhat fan-like scale of a blackish brown colour, with a gray margin; the first shield is brownish yellow. This parasite exists in Louisiana and neighbouring states. It has not been noted in Malta, although we have other species of *Chionaspis* on the Pine and other Conifers.

Diaspis Monserrati Colvèe, is another scale whose presence was first noticed in the Botanical Gardens at Valenza in Spain. The scale of the female is slightly oval, sometimes perfectly round, of a grey colour. But

in the centre if round or at one end if oval there is a darker spot of reddish brown, which is the first scale, and has a mesial ridge which divides it into two parts. The scale of the male is much smaller and elongated ; it is white having a reddish brown shield at one extremity as in the female. This scale is now common on the trunk and branches of Citrus trees growing in the shade.

Diaspis Colvei Penzig, is probably only a variety of the preceding and is found along with it.

Aonidia Gennadii Targ., appears to be a native of Australia and New Zealand, whence according to Comstock, it has been imported into California. It bears the name of Mr. Gennadius who found it in 1880 upon the leaves of the lemon tree cultivated in Greece. It has a round scale of a dirty greenish colour, having a central prominence of the same colour and pellucid margin. The scale of the male is elongated and irregularly oval, with the pointed oval first shield situated at one end, instead of being central as in the female. This insect has not been seen in our orange groves. In California it is a common parasite upon the orange and lemon. In Greece it seems to prefer the lemon.

Aspidiotus Hederae Val., or *A. Ceratoniae* Signoret, is another species similar to the preceding. Its colour is greyish, having the central protuberance or exuviae of a dull orange colour. It is very common on the Carob and on ornamental trees and shrubs, particularly on the Oleander or Rose-bay tree, on Ivy and on Acacias, but is rarely met with on Citrus trees.

Aspidiotus Limonii Signoret, is not very prevalent in our Citrus groves. It is usually seen upon young lemon trees situated in shady and sheltered situations. It is a small round white scale as large as a pin's head, having a flattened conical protuberance of a yellowish colour in the centre, due to the body of the insect

which is under it, the scale itself being almost translucent. When this insect is very numerous its scales coalesce and may be separated in large flakes sticking together. It is probably a mere variety of the preceding.

Aspidiotus Ficus, Ashmead, or *Chrysomphalus Aonidium* L., the red scale of Florida, is also a circular scale of a reddish brown colour and somewhat larger than the preceding. It is found in Cuba and other islands of the West Indies, and also in some States of North America especially in Florida. So far it has not been noticed in Malta. It attacks not only Citrus trees but also many fruit trees, ornamental trees and shrubs. Young trees and shrubs are often killed by it, but adult trees do not seem to suffer much, beyond having the fruit and the leaves disfigured.

Aspidiotus Aurantii Maskell, the red scale of California, is of the same size and shape as *Aspidiotus Ficus*. The scale is translucent. The reniform body of the insect which gives its colour to the scale which covers it, is yellowish to reddish brown, so that the outer $\frac{2}{3}$ of the scale appear as a broken ring of reddish brown enclosing a white dot, which represents the mass of waxy filaments that covered the insect soon after it ceased to be a larva. The native land of this species is Southern Australia and New Zealand. It has not yet found its way to these Islands. In all species of *Aspidiotus* the scale of the male is much smaller, nearly elliptical in shape and of a lighter colour. After the third moult the male insect leaves the scale in the shape of a winged fly.

Chrysomphalus dictyospermi Maskell, a red scale similar to *Aspidiotus Ficus* has been introduced in Malta from Catania (Sicily), in 1911, on rose-bushes and other ornamental plants, and in three or four years it has spread with marvellous rapidity to most groves and gardens in the Island. The scale is round as in other

species of *Aspidiotus*, and is of a uniform rusty red colour, with a shining yellow dot or navel in the centre. This scale is one of the most dangerous. It increases enormously, covering with its red scales the old stems as well as the green branches, the foliage and the fruit. Rose-bushes and other ornamental shrubs are soon exhausted and killed, even by a comparatively mild attack. In sheltered and sunny situations an attack of this insect on Citrus trees often assumes a character of great virulence, and is usually followed by the death of large branches, and of the tree itself.

Parlatoria Pergandii Comstock, the chaff scale, is a round or slightly oval scale, hardly reaching $1\frac{1}{2}$ m.m. in length, of a light brown colour. It has at one of its ends a small elliptical shield of a darker colour, which is the first larval skin. The upper surface is marked by small ridges forming a series of ellipses one within the other, the first shield being their common focus. Under the first shield is found the head of the insect with its beak embedded in the green tissues. The male insect has a much smaller elongated scale of a white colour, but the first shield is dark as in the female. This scale lives upon the trunk, the large branches and the twigs, but seldom on the leaves and the fruit, and does not appear to be very virulent. The chaff scale has now spread to most groves of the Island, but so far has not given cause of complaint.

According to Hubbard an unknown species of *Aphelinus* eats the eggs and sometimes the body of the chaff scale, and by this means a high percentage of the scale is destroyed. When the *Aphelinus* completes its metamorphosis, it eats away a hole in the scale and issues forth to winged life. It is very likely that the chaff scale in these Islands is kept in check by some such beneficial insect.

A far more dangerous insect pest is *Parlatoria Lucasi* Targ-Tozz., or *Parlatoria Zizyphi* Lucas, a native

of Algeria and Northern Italy. It appears that the original host of this scale insect was the jujube-tree, *Zizyphus sativa* Gaertn., although in this Island jujube-trees growing in the midst of infested orange-trees enjoy perfect immunity. Perhaps the *Parlatoria* finding that Citrus trees being evergreen are a more desirable host for its requirements, has forsaken its original host and adapted itself to the new host, a not infrequent event in the life history of insects. This scale insect appeared for the first time in Malta in 1892, in certain orange groves at Casal Lia, having been imported from Palermo along with a collection of ornamental varieties of Citrus trees. Its dissemination was overlooked for the first three years, but soon after the infection began to spread rapidly, and orange merchants refused to purchase the unsightly fruit. *Parlatoria Lucasi* is a small oval-shaped scale insect of a black colour, surrounded by a narrow rim of white wax, which also covers the surface of the scale and gives it a dark blue shade. Its length is about 1. m.m., and at one end it has a small round or oval scale which is the first larval skin. The male insect is smaller; it is covered only by the first black shield and by a white elongated scale of wax, the large black scale being absent. After the second moult the larva of the male passes to the pupa stage, and finally becomes a winged insect, lacerates the waxy covering, and goes out to winged life.

Parlatoria Lucasi has certainly four broods during the year. The first appears early in spring, perhaps earlier than that of other scale insects. The young are seen in April already covered with their larval skin on the new shoots and sometimes even on the blossoms before blooming. The tiny pale-coloured larvae hardly discernible without the aid of a lens, may be seen crawling upon the leaves, especially along the nerves where a slight depression is forming. After a few hours of a wandering life the larva chooses a place where to

establish itself, and fixes its beak-like mouth, consisting of two mandibles and four bristly appendages, into the green tissues, and in a few hours more it loses its limbs and secretes a mass of white filaments with which it covers itself. In five days it forms the first larval skin, the smaller round or oval black scale already mentioned. This skin gets surrounded by a rim of wax, and very soon follows the formation of the second shield or scale, and when the insect is undergoing the third stage a broad rim of wax is formed all around it. *Parlatoria Lucasi* like most scale insects, is parthenogenetic and viviparous, and the larvae of the second brood creep out of the mother scale in June. In the first days of August appears the third brood, and the fourth is produced towards the middle of September or a little later, but generally in the first days of October all the larvae of the fourth brood are fixed in their chosen abode. In October the male insects appear in great numbers and the impregnated females after running through their term of life die, leaving a multitude of eggs sheltered beneath the scale, and ready to hatch in the first warm days of spring.

Parlatoria Lucasi, in Maltese, *miscta seuda irkika*, is rarely seen on twigs whose bark has lost its green colour but in sheltered situations all the green parts of the tree and the fruit are literally covered with the parasite. Badly infested trees suffer considerably, and large branches may be killed. The fruit is made very unsightly and unsaleable, and is not allowed to attain its full size, but its aroma and keeping qualities remain unaltered. The adult insect is not known to have any parasite similar to those of the larger scale insects, and the short term of the free existence of the larva is another favourable condition for its prodigious increase.

The "purple scale", *Mytilaspis citricola* Comstock; (Maltese = *Miscta giulglienia*) is another scale insect

established in these Islands since 1870-73. It is a dark brown or rusty coloured scale, shaped like a mussel or a comma, somewhat curved at one end, surrounded by a narrow rim of wax, and measuring 4 or 5 m.m. in length. The first shield under which is found the head of the insect is of a darker colour. The three shields representing the three moults are easily distinguishable in the female. The scale of the male insect is smaller, and has only two shields; it is rarely crooked and is generally deep purple brown in colour. The purple scale has three broods in the year. Sometimes it has a fourth brood, but as its larva does not develop so fast as that of the *Parlatoria*, many larvae of the fourth brood are washed down by rain. This scale insect prefers the leaves shaded from the sun, and swarms in the depressions on the undersurface of the leaves. Having very powerful suctorial organs it sets thickly upon the larger branches and sometimes on the stem, and exhausts the tree to a greater extent than the *Parlatoria*. When this parasite first made its appearance in Malta, it caused a great deal of uneasiness, many groves suffering severely and becoming unproductive, and numbers of young trees as well as trees in full bearing were killed or became too much exhausted to be retained.

Mytilaspis fulva Targ-Tozz. is of the same form as the preceding, but is slightly larger, and is of a lighter colour, its margin on the concave side as a rule presenting a marked undulation. Its variety, *M. flavescens*, is distinguishable chiefly on account of its very light or straw colour. It is found along with the species, and both are found mostly on the undersurface of the leaves and in shaded situations, but are much less numerous than the purple scale.

The "long scale insect" of North America, *Mytilaspis Gloverii* Ashmead, has a long narrow scale, perfectly straight or only slightly curved. It has nearly parallel sides. Its colour is brownish, and has the same

habits as the purple scale, but it is not found in the orange groves at Malta.

The Lecanidae are represented by three species of scale insects, viz: *Lecanium hesperidum* Lin., *L. hemisphaericum* Targ., and *L. Oleae* Bernard, the last two being found also on many trees, shrubs and plants. They have a soft covering which hardens with age, and therefore are more open to the attacks of their enemies than the armoured scale insects already mentioned. *Lecanium hesperidum*, the Turtle-back scale, (Maltese=*miscta kambija*) is fairly common in our groves. It has a greyish lucid covering of an oval form, shaped like half a hemp seed, but somewhat larger, and spotted all over with black. When young it is pale grey, and becomes wrinkled and deep brown with age. It is met with more often on young trees, and occurs in thick colonies covering completely the twig and leaves. It is almost always accompanied by a number of ants busily sucking the honey dew which it secretes abundantly. Young trees infested by this parasite are checked in their growth, and become stunted and sickly, the insect often reappearing on the same tree for two or three years in succession.

Lecanium Oleae, the black scale, (Maltese=*miscta seuda hoxna*) has a round black covering with a marked ridge in the middle, and is from 4 to 5 m.m. in diameter. Its black wrinkled covering makes it look like a grain of black pepper. The young larva is dark red and is easily visible with the naked eye. This scale is very common everywhere in our groves, and is also found on the Olive, stone-fruit-trees, and many ornamental trees and shrubs, as well as on Capsicums and other annuals. Severe attacks are frequent, and result in momentarily checking the growth of the tree and favouring the development of *Limacinia Citri* (Briosi et Pass.) Sacc. and of *L. Penzigi* Sacc. the sooty fungus above mentioned.

Lecanium hemisphaericum (Maltese=*miscta hamra hoxna*), has a round, hemispherical covering of a red-

dish brown colour perfectly smooth and smaller than that of the preceding. Its margin is surrounded by a rim of waxy filaments. The young insect is yellow and slightly oval. This scale is rarely found on Citrus trees, and is much more frequent on certain ornamental trees, such as *Schinus Molle*, and on ferns growing in the open air.

Lecanium Citri may be only a variety of *L. hesperidum*.

The Lecanidae like other scale insects are parthenogenetic. The Black Scale is rarely found on the leaves or on the fruit, but is very common on the twigs and branches. The Hemispherical Scale is never found on the leaves exposed to the full action of the sun. In autumn the impregnated females of *Lecanium* die leaving their scale filled with a mass of eggs numbering from 400 to 600. These are hatched in spring, and the young larvae soon quit their mother scale in quest of a new abode.

The genus *Ceroplastes*, so called on account of the thick waxy scales which cover the insect, numbers three species, which have been noticed on the orange tree.

Ceroplastes floridensis Comstock, is about 3 m m. in length, oval-shaped, having a rounded prominence in the centre surrounded by six or eight smaller ones. These prominences are white and the depressions between them have a pinkish tinge due to the colour of the insect under the scale. The eggs, about 100 in number, hatch under the shelter of the scale, and the young larvae escaping from beneath the scale disperse in all directions. When they begin to secrete their waxy covering they move only by night, and as they advance in age most of them assemble on the twigs and branches.

Ceroplastes cirripediformis Comstock, the Barnacle scale, is a little larger than the preceding. Its covering consists of one central convex plate surrounded by six lateral ones, each plate having its proper nucleus; the

general colour being white or dirty white. The larva is dark brown, and when it begins to form the waxy covering, it attaches itself definitely on the twigs and branches. These two species are common in North America upon Citrus trees, the Quince, the Holly and other shrubs. The second, *Ceroplastes cirripediformis*, has been introduced in these Islands probably towards 1905, and sometimes is common on the false pepper (*Schinus Molle*) and on the quince, but has not been noticed on Citrus trees.

Ceroplastes Rusci Targ., the fig-scale, (Maltese = *miscta tat-tin*). This is of about the same size as the Barnacle scale. The mature insect has a convex and thick scale of white wax, consisting of a large central prominence surrounded laterally by eight smaller ones, much like the shell of a tortoise. When young the prominences are better defined as white dots on a pink ground due to the red colour of the body of the insect. It has three broods, the most numerous being that which takes place in July or August and is the second brood. It has a large red-coloured larva, quite visible to the naked eye. Fig-trees often suffer severely from this scale, which is also very common on the custard-apple. It is sometimes found on the quince, the apple, the pear, the mulberry, the vine and the lemon. Orange trees appear to be perfectly immune ; a curious fact, when it is remembered that in Italy this scale is a common parasite in the orange grove.

The Coccineae or Mealy Bugs, include two species which are very injurious to Citrus trees, viz: *Dactylopius Citri*, and *Icerya Purchasi*.

Dactylopius Citri Signoret, or *D. destructor* Comstock, the orange mealy bug, is fairly common especially upon lemon trees. It is a scaleless insect, about 3 or 4 m.m. long, of a brownish yellow or pink colour. Its body is covered by a mealy powder, and tufts of white waxy filaments, and has a series of short

white threads or filaments along its sides. The larva is of a paler colour. The male insect is a tiny two-winged fly, which is occasionally seen hovering among the lemon trees late in summer. The female constructs a mass of cottony filaments of wax where to lay its eggs. When the young are hatched they may be seen straggling out of this mass of filaments and dispersing upon the twigs and leaves. They seek the undersurface of the leaves along the midrib, the axillae of the leaves and the persistent calyx of the fruit. This insect is common on young lemon trees, but is comparatively rare on the orange, it is very injurious to Citrus groves in Southern Europe, Sicily and North America, but it cannot be described as very destructive to our groves where the many enemies which prey upon it have prevented it from increasing to a dangerous extent, though this may not be a complete explanation for its want of activity. The mealy bug is very common upon the Leguminosae, and towards the close of summer large masses of mealy bugs thickly covered with their cottony web, may be seen clinging to the stem and branches of *Erythrina* *Corallodendron* and other trees of the same order, as well as on *Euonymus*, *Ipomaea* etc.

Icerya Purchasi Maskell, known as the Cottony-cushioned Scale, or the Fluted Scale insect, is another dangerous pest of the Citrus grove. Its native land is Southern Australia and New Zealand, and its original host seems to have been the Acacias and Wattles very common in Australia. From Australia the insect passed to California in 1875, attacking all fruit trees, particularly Citrus trees. Now it is established in most temperate regions of N. America and Europe, as well as in South Africa. In 1896 it was introduced in the province of Lisbon, Portugal, and soon afterwards it found its way to Sicily and Portici, Naples. In 1907 the fluted scale was imported from Sicily to Malta, on some ornamental plants, and made its first appearance in certain gardens at

St. Julians, whence it spread to Sliema. This insect attacks not only the orange-tribe but also many other fruit and ornamental trees, whether evergreen or deciduous, and many shrubs and annuals as well as vegetables in the kitchen garden. Fortunately it is kept thoroughly in check by its natural enemy, *Novius* (*Vedalia*) *cardinalis*, but for which the cultivation of Citrus trees would become commercially impossible.

The mature females of *Icerya Purchasi* are mostly of an orange red colour, with white and green patches. They have six black legs, and two nine-jointed antennae of the same hue. The eyes are black. The dorsal surface is always covered with a white or yellowish mealy powder. Tufts of yellowish waxy filaments are secreted upon the back and along the sides. Between the dorsal and lateral masses of tufts, the body is naked, so that on both sides there is an orange red line which breaks the yellowish hue of the tufts. On the posterior half of the margin of the body there is a row of tubercles, from each of which a cottony cord is secreted. These cords are prolonged backwards simultaneously, and parallel to each other, and the whole form a spacious bag into which the orange red minute ovoid eggs of the insect, numbering about 500 are deposited. On the under-side of the body, between the first pair of paws is found the beak or sucker deeply fixed into the bark. The adult insect rarely stirs from its place, although it does not lose its legs as the armoured scale insects. The insect and its bag may measure from 1 to 2 c.m. in length. The young larva is very active, and of a pale red colour, but when it begins to secrete the tufts of waxy filaments all its activity ceases. The *Icerya* lives upon the stem and branches up to the smallest twigs upon which it assembles in clusters, completely hiding the twig. Like other scale insects it is parthenogenetic and has three or four broods in the year. The male insect appears only in autumn, and is a minute

fly having a red body, six legs and a pair of long transparent wings.

The scale insects have numerous enemies which prey upon them during all the stages of their growth. Thus the Coccinellidae or ladybirds, a tribe of Coleoptera are the great friends of the orchard. Their larva as well as the perfect insect wage a relentless war on the parasites. In this Island we may find the following ladybirds.

Coccinella septempunctata Lin. Is oval-shaped, the size of a half pea. Its colour may be orange-yellow, orange-scarlet or blood-red. It has seven black spots, three upon each forewing or elytrum, and one in the middle, near the thorax. Thorax black with white spots. It is very common throughout the summer on trees and plants infested with aphids.

Coccinella undecimnotata Lin. A little smaller than the preceding and of the same form. Its elytra are yellow with eleven black spots, 5 on each side and one in the middle near the thorax. This species and the following are rare insects.

Halizia decempunctata Lin. Is a little smaller than the preceding with 10 black spots on the elytra, which are yellow.

Chilocorus bipustulatus Lin. Has a black shining round body, about 3 m.m. long, with two red transversely elongated spots on each forewing. This species and the following are the two most common ladybirds in our Citrus groves, and prey chiefly on the larvae of armoured scales.

Exochomus quadripustulatus Lin., is somewhat larger than the preceding, and is of the same colour, but has four red spots on the elytra, two on each side.

Adalia bipunctata Lin., is oval, black or dark brown with a large red spot half way on the outer margin of the elytra, on each side. It is about 3 m.m. in length,

but being oval-shaped looks much smaller than the *Chilocorus*. There are also several lesser species of *Scymnus* which are of frequent occurrence.

Novius (Vedalia) cardinalis Koeb. This is the natural ladybird enemy of the fluted scale in Australia, whence it was imported in 1889 into the United States, where the fluted scale was causing considerable havoc in the orange groves of California. From America this ladybird was sent to South Africa, Egypt, Portugal and Italy, and was introduced in Malta from Portici (Naples) in 1911, and was set free in the infested gardens at St. Julians. This ladybird is oval-shaped, 3 or 4 m.m. in length, of a uniform red colour with 4 black blotches, two on each side of the elytra, the two posterior spots coalescing along the margin with a narrow black stripe, in the middle between the elytra. The larva is red with black dots, almost as large as the larva of *Coccinella septempunctata*, and both the perfect insect and its larva feed voraciously on the *Icerya*, in a few days clearing a badly infested tree. For the first years after its importation it was considered advisable to cultivate this ladybird artificially, in order to have it always at hand, but now it is perfectly established in most orange groves of the Island, and its artificial breeding is continued only as a measure of precaution, and to secure early broods in March and April.

Rhizobius ventralis is another ladybird about the same size as *Novius cardinalis*, and feeds on *Lecanium Oleae*. This is a European species, but does not exist in these Islands, *Lecanium Oleae* being here kept in check by the other ladybirds above mentioned and also by the scale-moth, *Thalpochares Scitula*, and by the little chalcidid fly *Scutellista cyanea* Motsch, and also by other Hymenopterous insects.

The larvae of the *Syrphus* flies, a Dipterous genus, feed upon the scale insects and the Orange aphids, but this genus is not known to exist in Malta. *Bacca babista*,

Walk, *B. lugens*, and *B. cognata*, Loew., are three Syrphus flies which perform good service in the Citrus groves of North America.

Among the Hymenoptera there are many valuable though minute enemies of the scale insects. Thus a large percentage of *Lecanium Oleae* and *L. hesperidum*, sometimes as much as 75 per cent. if examined late in autumn, will be found to have a minute hole on the summit of the scale or covering, and sometimes near its margin. On removal, the scale is found to be a mere shell, the insect and eggs having disappeared. They have been eaten by the grub of *Scutellista cyanea* which is often quite common in our groves, and also by the grubs of *Coccophagus Lecanii* Fitch, *Coccophagus cognatus* How., and *Encyrtus flavus*, How. The grub of *Comys bicolor* How., and *Tomocera californica* How., are the equivalents of these beneficial insects in North America. In the body of *Mytilaspis citricola* and *M. Gloveri* have been found *Aphelinus aspidioticola* Ash, *Signiphora flavo-palliata* Ash, *Aphelinus fuscipennis* How., and *Aphycus flavus* How., these last two being present in Malta. *Encyrtus inquisitor* How., *Leptomastix Dactylopii* How., and *Chiloneurus Dactylopii*, How., have been found feeding upon the mealy bug in America. A species of *Encyrtus* somewhat larger than *E. inquisitor*, has been found feeding on *Dactylopius* in Malta. Whole colonies of *Aspidiotus Hederae* were found in our gardens with the scales perforated by a species of *Aphelinus*, probably *Aphelinus aspidioticola*. A fungous disease is common on *Lecanium Oleae* in local groves, particularly early in winter, and probably has an important share in keeping this scale in check.

Aleyrodes citri Riley and Howard, the white fly of North America, is nearly allied to the scale insects. It infests the Citrus groves, as well as certain ornamental shrubs, and is now fairly common on greenhouse plants in Europe, but so far has not found its

way to our groves. In its first stages of growth the white fly looks like a very small whitish round scale, thickly disseminated on the undersurface of the leaf. Both sexes emerge to a winged life, in their final stage, and are then a very small gnat-like insect, with four milky white wings. When in its scale-like stage it sucks the sap of the leaf, and checks the growth of the plant or tree, being therefore directly injurious, and also exudes much honey dew in the same way as a scale insect, and upon this honey dew the sooty fungus develops in autumn and winter. The white fly requires the same treatment as the scale insects.

Phytoptus oleivorus Ashmead, the rust mite of the orange is common on the orange in Florida. This mite is present on both the leaves and the fruit. Its presence on the leaves is often overlooked, but on the fruit it extracts part of the essential oils and causes a hardening or suberification of the peel, which becomes paler in colour and often somewhat rusty. Oranges thus affected are said to stand shipment better, owing to the toughened peel, and are also said to be more juicy and to acquire a better flavour. This mite attacks also the lemon, and is then called silver mite of the lemon. The green lemons become partly white, or greenish white, a particularity shared also by green oranges when attacked by the same insect. However, in the case of the lemon the peel becomes useless for the purpose of extracting the essential oil. Dusting with flowers of sulphur on a dewy morning, or spraying with sulphur mixed with ash-lye has been found a good remedy against this disease, provided that the spraying or dusting is repeated several times, at intervals of 10 to 15 days, to kill the young as they hatch. This mite as well as the six-spotted mite (*Tetranychus sexmaculatus* Riley), have originated in North America, and so far do not exist in our groves.

TREATMENT OF CITRUS TREES INFESTED BY SCALE INSECTS. In the case of the fluted scale (*Icerya Purchasi*) no treatment is necessary beyond colonizing a few Australian ladybirds (*Novius cardinalis*) which is its natural enemy, and fortunately a very efficient one. If the infestation happens to be of old standing, and very severe, this ladybird will establish itself the more readily, and perform its work more thoroughly.

Other scale insects have of course other natural enemies, and these are often sufficient, but severe attacks which threaten the trees with exhaustion, such as a generalized attack of *Chrysomphalus* or *Mytilaspis* or *Lecanium* or *Parlatoria*, will require energetic treatment. A scale insect newly established in a district, is at first unmolested by the natural enemies which keep the other scale insects in check, and therefore often assumes an alarming virulence, and may cause much injury both to the tree and to the fruit, before the natural equilibrium is restored. In these cases the cultivator should not wait inactive to see the outcome of the struggle between the tree and the parasite, the result of which is always disastrous to himself.

It will be a tedious and useless task to describe the many methods of treatment which have been recommended against the scale insects, as many of them have never been adopted on a considerable scale, and others have been tried with indifferent results. The following summary of the more rational and practical measures will be found sufficient for a work of this nature.

To begin with, the vigour of the trees should be kept up by good cultivation, by the proper use of manure and fertilizers and by careful irrigation. The grove should be submitted to a fairly heavy pruning, reducing the number of twigs in order to admit air and light into the interior of the tree, at the same time sparing large branches and avoiding large wounds.

This thinning out of the twigs and foliage is especially needed in very sheltered situations, where owing to defective circulation of air and the superabundant foliage the larvae of the scale insects are not easily shaken off the tree by the summer breezes. Pruning will also protect the tree from the excessive exhaustion provoked by the attack of scale and will ensure a speedy recovery.

It is known that a shower of rain when a brood is hatching will wash down many thousands of larvae from the tree, and therefore as a rule severe infestations in spring or autumn are rare if the weather has been showery. Accordingly, it was proved that a good spraying with water, repeated for each brood, has the effect of reducing greatly the number of scale insects particularly of the armoured scales, whose larvae cannot find their way back to the tree. This method may be recommended wherever there is available a water service under pressure, as apart from the initial cost of installation, the expense for each treatment would be negligible.

Perhaps the methods of treatment which are receiving increasing attention in all the Citrus growing countries consist in spraying the trees with liquid insecticides, and of these the sulphur-lime wash is that more generally used and gives the best results against the armoured scales, such as *Chrysomphalus dictyospermi* Mask, *Aspidiotus Hederae* Val., *Parlatoria Zizyphi* Lucas, and *Mytilaspis citricola* Mask. The mixture made according to the directions of Prof. L. Savastano is generally known to be very efficient against the scales and quite safe to the tree. It is easily prepared by the cultivator, and contains the maximum percentage of sulphides, which are the active element of the mixture. It is first necessary to prepare the condensed mixture, which is made by dissolving 10 kilog. of quick lime (unslacked) in 100 litres of boiling water, over a fire, and then adding 20 kilog. of flowers of sulphur, in the

meantime stirring the mixture continuously until the whole takes a uniform yellowish white colour. The preparation should be made in an iron receptacle of the capacity of from 150 to 200 litres, that is large enough to prevent the mixture from being blown out during ebullition. The receptacle is filled with 100 litres of water, and the level of the water marked by means of a stick, the loss of water by evaporation being made up now and then by fresh additions of water, in the course of preparation. The receptacle is then placed on a fire, with only 25 litres of water, and as soon as the water becomes lukewarm, the pieces of quick lime to the weight of 10 kilog. are thrown into the receptacle. When the lime is dissolved and the boiling point is reached, the sulphur (20 kilog.) is thrown in gradually but continuously, at the same time stirring the mixture with a stick or wooden ladle and adding some water if the mixture becomes too thick. The sulphur should be passed through a sieve of copper or brass gauze before use. Stirring should be thorough and should be continued until the mixture takes the uniform yellowish white colour as above mentioned. The quantity of water is then made up to 100 litres with a further addition of 10 to 15 litres to make good the loss by evaporation. The mixture should then be kept boiling for three quarters of an hour or for an hour, stirring now and then with the wooden ladle or stick, until the mixture passes from a dirty orange colour to chocolate and becomes perfectly liquid. Boiling is continued until no sulphur is left floating on the surface of the liquid, and the formation of froth has ceased. The mixture will then present the appearance of a reddish liquid, with yellowish mealy particles moving in it. It is then allowed to cool and is ready for use, mixed in the proportion of 5 to 10 litres to 100 litres of fresh water. The condensed mixture can be kept in closed receptacles in good condition for some months, but it is always preferable to have it fresh whenever required. For summer use the strength of the spray

should be in the proportion of 5 litres of the concentrated or condensed mixture to 100 litres of fresh water. For winter use the proportion may be 8 or 10 litres of the condensed mixture to 100 litres of water.

Crude carbolic acid or oil of creosote dissolved in strong alcalies or solutions of soap, make a good emulsion which is a very efficient remedy against the scale insects, but should be prepared and used with great caution. If globules of either carbolic acid or of oil of creosote are allowed to remain not emulsified they will scorch the foliage and also the bark of the green twigs. To prepare this emulsion dilute the oil of creosote or the crude carbolic acid with twice its volume of soap solution made by dissolving 1 kilog. of common soap in 10 to 15 litres of hot water, and mix thoroughly to dissolve the oil. When about to be used add 20 parts of water to one part of this solution and apply in a fine spray. The strength of this solution is one in sixty.

Hubbard gives a good formula for kerosene emulsion which he considers as the best for general use. It consists of 2 gallons of kerosene, half a pound of common soap and one gallon of water. The soap is dissolved in the gallon of water, and added boiling hot to the kerosene. The whole is thoroughly mixed for 10 minutes, and a creamy emulsion is formed which thickens on cooling. For use, dilute the emulsion with water in the proportion of one to nine. This formula gives 3 gallons of emulsion and makes, when diluted, 30 gallons of wash. The application of this wash is said to be not injurious to the tender growth of the tree, when applied in a cloudy day or in the evening. It is much used in the United States and is said to be very effective against most species of scale.

Pythelein, a soluble oil of tar, is readily mixable with water in all proportions, forming a homogeneous milky liquid of great stability which is said to be very effective against the scale insects. The line of treat-

ment according to Berlese is to give five sprayings from the middle of June to the middle of September, using the 1 per cent. aqueous solution of this substance. For the *Dactylopius* or mealy bug an invernal treatment may be undertaken with a 3 per cent. solution.

The petroleum emulsion is a well-known remedy for scale insects in general, and is still much used in all Citrus-growing countries. Petroleum will not readily unite with water and therefore is associated with soap to form an emulsion, soap itself being also a powerful insecticide. To prepare the petroleum and soap emulsion dissolve 1 kilog. of common soap in 10 litres of hot water. Add the boiling liquid to 20 litres of petroleum, and mix thoroughly till the whole acquires the appearance and consistence of cream. Mix one part of this creamy emulsion with 10 parts of cold water and the milky mixture which results is the petroleum emulsion ready for use. In spraying Citrus trees with this mixture, as well as with other mixtures, it is advisable to begin from the top, so as to economize the liquid which trickling from the upper twigs goes to disinfect the lower ones.

The gassing method is used extensively in North America, South Africa and in many other Citrus-growing countries. It is much more expensive than spraying, but gives more satisfactory results, one good gassing being sufficient to keep the tree comparatively clean for two or three years, as the gas will reach all parts of the tree and is sure to penetrate the dense masses of foliage. The tree is covered by a tent of strong and dense material, the texture of the cloth being made almost airtight either when woven, or by the subsequent application of chemicals, and should be propped up above the tree on stout poles, the margin of the tent being in direct contact with the ground, or better earthed up all round the tree, if possible. The fumigation should be carried out preferably in calm weather, and the capacity of the tent in cubic metres should be carefully calculated.

The gas employed is of course, hydrocyanic acid gas which is evolved by sodium cyanide when acted upon by diluted sulphuric acid. The proportion of chemicals for one good gassing should be 5 grammes of sodium cyanide to 15 cubic c.m. of commercial sulphuric acid or oil of vitriol diluted with at least an equal volume of water, for every cubic metre (stere) of space enclosed by the tent. The required quantity of sodium cyanide, broken in small pieces or roughly powdered is placed under the tree in a strong earthenware receptacle, and the sulphuric acid properly diluted poured into the receptacle. The fumes of this gas are highly poisonous, and the operator should step out of the tent at once after pouring the acid into the receptacle. There are now appliances by which the acid and the cyanide may be mixed together when the operator is outside the tent, in order to prevent the possibility of fatal mishaps. It is also possible to have the hydrocyanic acid gas prepared and condensed in strong metallic cylinders from which the flow of gas into the tent may be regulated by the operator standing on the outside. The gas is allowed to perform its work for about one hour, after which it becomes partly absorbed, and the tent after having been duly opened and ventilated may be removed and the process repeated for other trees.

THE OLIVE TREE.

Olea europaea L —OLEACEAE

Maltese=*Żebbuġa*. Italian=*Olivo*. French=*Olivier*.

This evergreen tree is native of the Mediterranean region and the East, and may be found growing wild or half wild here and there in the valleys and ravines of these Islands. According to the best writers of local history, the cultivation of the olive tree was introduced in these Islands by the first Phoenician settlers, and was largely extended under the Roman and Byzantine domination. It is generally supposed that our olive groves suffered severely from wholesale destruction at the time of the conquest by the Saracens, in the ninth century; but in the fifteenth century our olive groves were more flourishing than ever, and quantities of olive oil were exported every year, so that the Island came to be called "caricator d'olio" or "exporter of oil." The best lands were then planted with olive trees, and villages and towns took their name from the large plantations of olive trees which surrounded them. In the eighteenth century there was a brisk demand of cotton from Spain, with the result that many olive groves growing on the best lands were removed to make room for the cultivation of cotton. It is stated by contemporary writers that 80,000 trees were destroyed at that time, and henceforth the cultivation of the olive tree for the production of oil ceased altogether, the remaining olive groves being retained to furnish green or ripe olives to be pickled or salted.

It is known that the olive tree lives to a great age and it is generally admitted that no olive tree ever dies of old age, but succumbs to wilful or accidental injury, or to some unfavourable change in its environ-

ment. The typical wild olive (*Olea europaea* var. *Oleaster* Hoffmann) is a tall growing tree with a more or less twisted trunk, and small narrow leaves, greyish green on the upper surface. The fruit is produced in great abundance, but is small and has a comparatively large stone. The fruit furnishes an inferior sort of olive oil and is used pickled or salted by the poorer classes. The wild olive or Oleaster is a fine tree for avenues and grows quickly, and in suitable situations attains a large size, as shown by the gigantic wild olives growing in San Antonio Gardens. The wood, particularly the heartwood at the base of the trunk, is very beautifully veined and takes a high lustre, and should be used more frequently by cabinet-makers.

SOIL AND SITUATION. The olive tree grows in all soils and in all situations, but like most other trees it falls into a chlorotic condition and soon succumbs if there is stagnant humidity at the roots. It is also liable to become chlorotic and sterile on soils which are excessively dry. It thrives best in the red soils overlying a porous and moderately moist subsoil. When planting on clayey or retentive soils it is necessary to provide for a proper drainage, by the construction of trenches 2 metres wide, 1 to 2 metres deep and 6 to 8 metres apart, laid in the best direction to facilitate the flow of water. The bottom of the trench is filled in with rubbish or other loose material, overlaid by a layer of soil at least 1 metre in thickness. In very shallow red soils, with a broken rocky subsoil, it is advisable to construct pits or pockets in the rock, at least 2 metres in diameter and deep enough to provide for a total depth of 1 or $1\frac{1}{2}$ metres of soil. In situations too much exposed to the north and west winds the olive tree is liable to injury in spring during the flowering period, the best situations being those sloping towards the east or south. In situations which are too close or badly ventilated the olive tree

is more liable to fungous and insect parasites, which may check its growth and affect its fertility. The olive tree planted on good soils, grows rapidly and fruits regularly, the production of fruit being considerably increased if the tree is irrigated twice or thrice during the summer. For dry-land arboriculture the olive tree is at least as suitable as the vine, the fig-tree and the almond, provided that the land is properly tilled and kept perfectly clean of weeds and all herbaceous vegetation from April to September inclusively; but heavy cropping of the land in winter should be avoided when the trees have reached adult size and are in full bearing. This system of cultivation is followed in the few olive groves which are still in existence in these Islands, and is at present followed most carefully and on a very large scale in the extensive olive groves around Sfax in Tunisia.

PROPAGATION. The olive tree can be multiplied by seed, cuttings, layers, rooted suckers, pieces of the base of the trunk or truncheons, or by grafting or budding.

The olive tree comes more or less true from seed, and this partly accounts for the comparatively small number of varieties under cultivation. Propagation by seed is done by sowing the fruit or its stone, as soon as it is ripe. The germinating power of the seed deteriorates rapidly by keeping, and therefore if it is not possible to sow at once, the fruits or their stones should be stratified and kept moderately moist. For this object they may be packed in boxes or pans, in alternate layers with common garden soil mixed with some leaf-mould, then covered with a layer of the same material, and the boxes or pans placed in a cellar or in a corner of the garden, and occasionally sprinkled with water to keep them moderately moist. The seed bed should be situated in a cool and shaded place, the soil liberally mixed with well-rotted manure and leaf-mould to a depth of at least 15 c. m., and the seeds or stones

dibbled down to a depth of about 3 c. m., and the same distance apart. Sowing of stratified seed is done in February or early in March, but the ripe fruit or its stone is best sown in November as soon as it is picked from the tree. The soil is kept perfectly clean of weeds, and moderately moist by frequent spraying. Germination takes place in March or April, and watering is continued with regularity throughout the summer. With all the care bestowed upon them, olive stones will not germinate freely, and it sometimes happens that quite a small percentage of seedlings are obtained. At the end of a year or two the seedlings will be strong enough to be planted out in the nursery. This is best done in January or February. The seedlings are taken up with as many roots as possible, the tap-root is shortened, the lower lateral twigs removed with a clean cut, and the seedlings planted out $\frac{1}{2}$ to 1 metre apart. The seedlings are budded when their stem is about 2 c. m. in thickness, but if allowed to remain too long in the nursery, they are liable to suffer severely when transplanted. Transplanting is done with a ball of earth early in autumn, at the same time pruning back rather severely, to re-establish the equilibrium between the roots and the foliage. Propagation from seed is rarely resorted to except for the purpose of raising quantities of the wild olive or Oleaster as budding stock for the cultivated varieties. In the first years of its life the olive when raised from seed, usually assumes a bush-like habit, with a profusion of small twigs, often twisted downwards, but sooner or later one or more strong shoots are thrown up, one of which is selected to become the trunk of the tree.

Propagation by cuttings is done in January or February. The cuttings are selected of well-ripened wood, 1 to 3 c. m. in thickness, and about half a metre in length. The cuttings are planted in a cool and shaded situation, in a soil well-prepared with

rotted manure, 20 to 30 c. m. apart, leaving only about 10 c. m. of the wood above the ground. They must be kept constantly moist during the first summer. Propagation by layers can be done at any time of the year, but is hardly ever practised, except in the case of trees with drooping branches which can be layered without much trouble. In any case layers do not root properly before two years, and when transplanted require to be severely cut back removing all the foliage.

Propagation by rooted suckers is the method more generally adopted by our gardeners, being the readiest and surest way by which the tree can be propagated on a considerable scale. The olive tree naturally throws up suckers from the base of the trunk, either above or below the surface of the ground, and those above the ground are earthed up to favour the emission of roots. The suckers may be of any size from 1 c. m. to 5 c. m. or more in thickness, and they are removed by a sharp stroke with a pickaxe along with a portion of the gnarled base of the trunk from which it grows, varying in thickness from 5 to 20 c. m. or more, according to the size of the suckers, taking care to reserve as many rootlets as possible, although no sucker without rootlets should be discarded on that account. The sucker is then shortened to 50 c. m. or up to 150 c. m. according to its size, by a clean cut just over a likely bud, preferably removing all small twigs and all foliage. Thus prepared the suckers are then planted out about 1 metre apart in the nursery, taking care to place no manure in direct contact with the large fresh wound at the base of the sucker, or they may be planted at once at their final destination, at a distance of 5 to 7 metres apart. They should be planted deep enough to have their base covered by at least 20 c. m. of soil when the trough is made around them for watering, and the earth is pressed firmly around them to favour the absorption of moisture

until the new roots are formed; and to prevent any movement by the wind. This operation is best performed from December to February, and with due care there should be very few failures. It is important not to allow the suckers to dry too much by exposure to air before planting, and if planting cannot be done at once it is advisable to cover well their bases or truncheons with moist earth until they can be transferred to their destined place in the nursery or in the grove. In the first year they should be watered regularly, and usually they make slow growth in the first year or two, but after two years they become established and make rapid progress.

Propagation by truncheons or pieces of the base of the trunk, is another method in favour with gardeners anxious to increase rapidly their stock of young trees when few suckers are available, or when it is desired to utilize the bases of trunks of old olive trees on being cut down or removed. Truncheons may be as large as half an orange, or up to 30 c. m. in diameter and should have one or more protuberances or latent buds from which suckers are likely to sprout. They are partly sawn off or cut out with a pickaxe or chisel. A bed is prepared in a cool situation, and the truncheons are planted 50 c. m. apart, with the protuberance directed upwards and are covered by 5 to 10 c. m. of soil mixed with well-consumed manure and leaf-mould, taking care that no manure is in touch with the fresh wound on the undersurface. The bed is kept moderately moist throughout the summer, well clear of weeds, and the surface is occasionally scratched with a rake to keep the soil soft and friable until the suckers are thrown up. This operation is best done from December to March, and the truncheons may be planted directly at their final destination in the grove, but in this case they should be planted about 30 c. m. deep, covering them to a depth of 5 to 10 c. m. by

a layer of soil mixed with old manure or leaf mould, and filling up gradually the hole after a year or two, when the suckers are strong enough. The young plants obtained by this method are generally very well-rooted and make fine, sturdy trees in a few years.

Propagation by cuttings, layers, suckers or truncheons has of course the great advantage of reproducing exactly the mother plant, and hence all suckers etc. afterwards obtained from the young trees will reproduce the same variety. Suckers or truncheons obtained from budded trees of course reproduce the stock on which the tree is budded, and if the stock belongs to the wild type or to an inferior or undesirable sort, the young trees raised from it must be budded with the required sort, when they are strong enough to receive a bud. The olive tree is hardly ever grafted, budding being always preferable, as in the case of the orange tree. Very often seedlings or suckers of the wild forms of the olive are used as stock, trees budded on this stock being supposed to make sturdier growth than when grown on own roots, and to be more productive. Budding may be done in the nursery where it will be easier to look after the budded plants and train them properly. The operation of budding can be performed at any time from March to September provided that the stock is in active vegetation and the sap is in movement. The bud should be selected from a healthy strong growing twig, as a bud from a weak twig is more prone to develop the well-known tubercle of the olive, which too often infects the bud and destroys it before it has formed the first shoot.

CULTIVATION. Olive trees of any size from a yearling sucker to a tree with a trunk 20 c. m. in thickness, can be transplanted either with or without a ball of earth, at any time from October to March. The roots should be carefully handled to avoid unnecessary bruising; badly contused stumps of roots should be

corrected by a clean cut, the surface of the wound being directed downwards whenever possible. Except in the case of two or three-year old suckers, all branches should be cut back rather severely, leaving very little if any foliage which would exhaust the tree before it has time to emit fresh roots. It is well to replant at least 10 c. m. deeper down than the former level in order to favour the formation of roots from the base of the trunk. Newly transplanted trees should have a dressing of manure just above the roots, and should be watered regularly in dry weather during the first year, the larger trees requiring more careful attention to help them to recover.

The olive grove should be hoed at least three times during the year, in November-December, January-February, and March-April, the object being to keep down weeds and to favour the absorption of rain and the retention of moisture. It is possible to grow certain field crops in the olive grove, such as green barley (*ferrana*), winter vegetables, beans, peas, vetches, lentils and bitter vetch; but those crops which exhaust the soil or dry it too much such as wheat, barley, sulla etc, and any crop which is an obstacle to the regular tillage of the soil in spring should be avoided. All summer crops requiring irrigation can be grown in the olive grove, as the shade cast by the trees is hardly ever so thick as to interfere seriously with the due development of the irrigated plants, and any loss sustained on this account is amply made good by the increased yield of the olive trees, as a consequence of the liberal use of manure and of the irrigation necessary for the crops of vegetables. Every sixth or eighth year the olive grove should be trenched and manured in the same manner as an orange grove, but of course should be manured more frequently in the interval by surface dressings if the ground is cropped regularly. The olive tree being usually grown from

suckers and truncheons, has no tap-root, and is essentially a surface feeder, and it is therefore advisable during the operation of trenching, not to trench too deep and not to cut too many of the surface roots in order not to impair the full cropping capacity of the trees. Deep ploughing within 2 metres from the trunk is very injurious to the root-system, and if often repeated may result in the death of the tree. Green-manuring is very recommendable, but as it implies the loss of a good crop of vetches it is more economical to apply instead a dressing of stable manure at the time of the first hoeing in autumn.

The olive tree will bear much hard pruning without serious injury to its health, but this peculiarity is too often abused to the detriment of the crop. The common practice is to prune the olive tree early in spring, during the week preceding Palm Sunday, to utilize the twigs for those festivities. The twigs are tied up in small bundles and sold at twice or thrice the price which they would fetch if sold as firewood at another period of the year. There would be no ill consequences if some thinning is done every third year, with the above object in view, but unfortunately most cultivators are unwilling to lose the opportunity of immediate profit, and therefore they mostly prune their trees every second year, and sometimes every year, with the result that the tree is allowed no chance to recuperate as a fruit tree, the fruit being produced chiefly, not on the strong upright growth, but on the thin loosely hanging twigs formed in the preceding year. Autumn pruning is performed soon after the crop is gathered and presents the advantage that it can be performed without undue haste to catch the market for green twigs, and without the temptation to cut as many twigs as possible for sale. On the other hand spring pruning is often delayed until the approach of Palm Sunday so that the trees may be already showing the flowers and the

new foliage, when the operation is necessarily attended by the risk of an irregular growth and of a poor crop. The ordinary roughly hemispherical shape is that usually given to the tree, and this shape being the natural one is always easy to obtain, and answers well from the point of view of productiveness, but as the foliage of the olive tree is not so thick as to be an obstacle to the production of fruit on the twigs situated more or less within the tree, the vase shape is found to be more productive, as it affords a greater surface and a better opportunity for the formation of sprays of the loose fruit-bearing twigs above mentioned. This shape is best obtained by training four or more branches of the young tree, and afterwards regulating their growth in a manner so as to prevent any of them from unduly developing and becoming a leader to the detriment of the others. Trees which are carefully trained to the hemispherical or umbrella shape or to the vase shape are found to be more productive, and their shape is best retained by pruning every year, the use of the knife being limited to the thinning of the twigs, avoiding as much as possible the removal of big branches and the formation of large wounds which exhaust the tree and are difficult to heal, ultimately becoming the starting point of canker. The production of the olive tree is known to have a three-year rotation, the first year yielding an abundant crop, a fair crop in the second year, and a poor crop in the third year ; but by moderate and careful pruning, along with proper attention to other cultural details, the tree can be made to give a regularly sustained production every year.

The large-fruited varieties of the olive tree are often sterile or partly sterile, and besides the presence of a considerable proportion of undersized fruit, there is almost always a large number of very small fruits, not larger than a pea or a hemp-seed, which either have a diminutive aborted stone or no stone at all. These

defects are due to a weak pollination at the flowering period, and are best guarded against by planting here and there in the grove a few olive trees of the small-fruited varieties which approach to the wild type and are capable of inducing a vigorous cross-pollination.

As in the case of most other fruit trees, I am decidedly in favour of a specialized olive grove, that is a grove containing no other fruit trees but olive trees of the same variety or perhaps of two varieties mixed together to assist cross-pollination. A specialized grove is always planted with greater regularity, which ensures a thorough exploitation of the soil, and is on the whole more carefully cultivated than mixed groves, and therefore gives better results. However, the olive tree can be associated with other trees such as the almond, the pomegranate and the fig, and to a less extent with the carob, the mulberry and the prickly pear; but the most desirable company for the olive tree is that of the vine. In fact whether an olive grove is planted in the square system 6 to 7 metres apart, or in the quincunx or hexagonal system at a distance of 5 to 6 metres from tree to tree, the ground may be planted with vines in regular rows, to within two metres from the stem of the young olive trees. Gradually as the olive trees grow to adult size, the vines are removed or die off, until only one row of vines is retained, alternating with the rows of the olive trees. The fruit of vines growing in the olive grove perhaps cannot always attain full size, but will be rich in sugar and therefore specially suitable for the press; and on the other hand the advantages of the higher cultivation required by the vines will be shared by the olive trees.

Besides the typical tall-growing wild olive or Oleaster above mentioned, which is chiefly planted in ornamental gardening, and the small box-leaved wild olives of our valleys, the following varieties are cultivated in our groves.

a) The MALTESE OLIVE. (*Zebbug Malti*). The tree is of fair size and of very strong constitution. The leaves are broad and deep green on the upper surface. The fruit is elliptical in shape, blunt at the lower extremity, rather small or middling in size, with a fairly large stone, and turns to a dark violet at maturity in November-December. The taste is bitter, but improves considerably when the fruit is pickled or salted. Both the pulp and the stone are highly oleiferous, producing oil of fairly good quality. The tree is a constant bearer, and with good cultivation often yields enormous crops. This is the most common variety of the olive in our groves, and as it suckers freely, and rooted suckers are always readily available, it is invariably grown on own roots. It is highly probable that in the halcyon days of the olive tree in these Islands, this variety constituted the bulk of our olive groves.

b) The "BITNIA" OLIVE. (M=*Zebbug Bitni*, It=*morella* or *morinella*.) The tree is a vigorous grower and of strong constitution. The leaves are broad and rather short, of a lively shining green colour on the upper surface. The fruit is very small, nearly elliptical, with a comparatively very small stone, and turns to a beautiful shining dark violet at maturity, which takes place towards the close of October or early in November. It is very rich in oil of excellent quality, but the fruit though very small is often pickled or salted and has a rich flavour free from bitterness. The fruit is produced in clusters, and the production is sometimes astonishing, the tree becoming literally black with fruit. The tree and its fruit are very resistant to disease, the fruit presents also the advantage that it is never attacked by the olive-fly *Dacus Oleae* and is therefore always allowed to ripen on the tree. This is the variety which seems the best suited for large plantations, with a view to the production of oil. At Bitnia near Uardia, hence the name, there are a few colossal trees of this variety, the remnants of an ancient large plantation.

c) The MARSALA OLIVE. (M=*Zebbug ta Marsala*. It=*nocellara* or *nucidolara*.) The tree is middling in size with rather broad leaves, dull greyish green on the upper surface. The fruit is almost round, or very bluntly elliptical, rather large, with a small stone, and is very oleiferous, producing oil of very good quality. It is less liable to the attacks of the olive-fly than the Maltese variety. The tree is well productive, and is a good sort to plant with the Maltese and the Bitnia varieties for the production of olive-oil. The fruit is also a good pickling olive, with a pleasant bitterish flavour.

d) The SICILIAN OLIVE. (M=*Zebbug ta Skallia*. It=*prunara* or *caloria*.) The tree is middling or large, and vigorous. The leaves are narrow and long, dull greyish green on the upper surface. The fruit is large or very large, rather bluntly elliptical, and turns to a brown violet when ripe. The stone is small compared to the size of the fruit. This is essentially a table olive (*oliva da guazzo*), to be used pickled or salted, for which purpose it is specially suitable on account of its size and flavour. The tree is a prolific bearer when properly cultivated.

e) The VERONA OLIVE. (M=*Zebbug ta Verona*, It=*rizzolone* or *basciona*.) The tree has the appearance of the Sicilian Olive, and the leaves are slightly narrower, with their margin turned down on the undersurface. The fruit is of the same shape and quality as the Sicilian, but is generally larger, being often as large as a fair-sized walnut. The tree is not a regular bearer, but the fruit fetches a good price owing to its fine appearance.

f) The "FRANTOJO" (Press) OLIVE. (M=*Zebbug tal Mahruk*, so-called from the locality near Notabile, where there is a large grove planted with this variety. It=*Frantojo*.) The tree is large and resistant to drought; the leaves are rather broad, of a very dull green colour; twigs short, more or less erect. The fruit is oblong, or heart-shaped, plump, and pointed at the

end, middling or large in size, and matures in November-December turning to reddish violet. The tree is fairly productive, sometimes producing very heavy crops. The fruit is very rich in oil of excellent quality, and is apparently not very liable to the attacks of the olive-fly. It is also a good pickling olive, but keeps badly and should be consumed as soon as possible.

g) The FRENCH OLIVE. (M=*Zebbug Francis*. It=*Ghiandara* or *Franzone*). The tree is large, and particularly resistant to drought. The foliage is of a duller green than that of the Sicilian variety, and is longer and narrower. The fruit is large or very large, much elongated, acorn-shaped, and turns to reddish violet at maturity in November-December. The stone is small, thin, elongated and acutely pointed at both ends. The fruit is a first class pickling olive, and keeps well. The tree is fairly prolific, and also a fast grower under good cultivation.

h). The WHITE OLIVE. (M=*Zebbug abjad*. It=*biancolilla* or *oliva bianca*) so called because the fruit becomes very light green at maturity, occasionally mottled or shaded purple. The tree is middling in size, and is fairly productive. It has the appearance of the "Frantojo" olive. The fruit is of the size of the Marsala olive, but is usually elliptical, and slightly pointed at the extremity. This is a table olive of fairly good quality, but does not keep well. The White Olive of Attica (Greece) is a distinct variety, with smaller fruits, more decidedly white, and so far has not been introduced in these Islands.

i). The SPANISH OLIVE. (M=*Zebbug ta Spanja* or *ta Sivilja*. It=*Sivigliana*, *Spagna*). The tree is middling or large, of fairly strong constitution, resistant to drought and fairly productive. The leaves are deep dull green, broad and rather short. The fruit is large or very large, more or less heart-shaped, roundish or slightly oval, acutely pointed at the extremity, with the point

usually curved on one side, and turns to a dull brown purple at maturity in December-January. This olive is fairly oleiferous, but yields oil of inferior quality. It is a first class olive for the table.

j). LARGE ALMOND-SHAPED OLIVE. (M=*Zebbug ta Marsilja*, *Zebbug tal pickles*, sometimes also *Zebbug francis*. It=*la grossa*, *gambettone*? *mandorlino*?) The tree is of large size and very vigorous, it is also very productive. The foliage is of a dull whitish green colour. The leaves are very long and narrow, almost linear towards the stalk, and often curved at the tip. The fruit is very large, on a solitary stalk, heart-shaped or almond-shaped, elongated, with a prominent but obtuse extremity. Stone small for the size of the fruit, which at maturity in November-December, turns to a purple colour, often blotched white. This is a very desirable table olive of excellent quality and keeps fairly well. The tree is cultivated in single specimens in many gardens, but should be grown more extensively.

Numerous small-fruited forms of the olive tree approaching more or less to the wild types, or to the Bitnia Olive, are met with occasionally in local groves, but they are of little importance to the cultivator. There are also certain variations of the large-fruited varieties, which may have originated from seed or by bud mutation and which may be important if they happen to possess valuable qualities representing an improvement on the typical form. Moreover, the quality of the soil and the method of cultivation generally have a well-marked influence on the productiveness of the tree and on the size and quality of the fruit.

The fruit of the olive tree is generally picked by hand, and where the use of ladders is not possible, it is shaken down by a pole or reed, and is received on pieces of canvas spread beneath the tree. The use of the pole or seed by export hands is not attended by the danger of

bruising or breaking too many twigs, as the strokes are delivered sideways or directed from the inside of the tree to the outside. The olives attain maturity in November-December, but with the exception of the fruit of the "Bitnia" variety and allied forms, the fruit of all other sorts is hardly ever allowed to ripen on the tree, and is picked in October, when it has nearly reached full size, but is still green. This is done to anticipate the attacks of the olive-fly of which the earlier broods make their appearance as early as August, but the attack is almost sure to become very acute towards the close of September. A good shower of rain a few days before harvesting, or in the absence of rain, a good soaking of water, greatly improves the appearance of the fruit, which becomes plump and soon acquires a healthy clear green colour which precedes maturity. The green fruit when pickled or salted keeps better than the ripe fruit, but of course cannot compare with it in point of flavour or digestibility.

DISEASES OF THE OLIVE TREE.

Of all diseases to which the olive tree is subject the most important is by far the havoc caused by the olive fly (*Dacus Oleae*, Rossi; also known as *Musca Oleae* or *Stomomus Keironi* order of Diptera). With the only exception of the "Bitnia" olive and closely allied forms, all other varieties of the olive are unfortunately infested by the fruit-fly more or less every year. Normally 25 to 50 p. cent of the olives become infected by the olive-fly, but in bad years the infestation may extend practically to the entire crop, hardly any fruit escaping the unwelcome visits of this pernicious insect. The olive-fly is about half a centimetre in length, being about half the size of the common house-fly. The head is orange-yellow with blue-green eyes, and a yellow front with two black dots; the body is hairy, the thorax is black with two greenish stripes in front, and yellowish spots on each

side. The abdomen, the antennae and the feet are yellow. The larva is half a centimetre in length, white or dirty white, with two moveable hooks at its head, with which it gnaws its way into the pulp of the fruit. The pupa or chrysalis is about 4 millimetres long, at first dirty white and then dull yellow. The female insect has an ovipositor at the end of the abdomen with which it perforates the rind of the green fruit and deposits an egg in each fruit; but the same fruit may be visited by two or more insects and therefore may contain two or more larvae. The insect flits on from one fruit to another depositing an egg in each, until it has laid between 50 and 150 eggs, destroying as many fruits. According to some writers the number of eggs laid by one insect may even be 300 or 400. In two or three days the eggs are hatched, and the larvae after tunnelling into the pulp and feeding upon it, reach maturity in 14 to 20 days and drop down from the fruit, or come out of it, if in the meantime the fruit has dropped from the tree, and hide themselves in the earth or in the crevices of the bark of the trunk and transform themselves into pupae. From these in about 12 days emerge the perfect insects, so that the olive-fly takes from 28 to 35 days to develop from the egg to the perfect insect, and as the insect begins laying eggs in July and continues in activity until late in autumn, there may be three or four broods every year, in the meantime the havoc increasing more or less in geometrical proportion.

After a severe winter or a prolonged cold spring the attack of the olive-fly is usually slight, as most of the hibernating pupae are killed by the cold; and an attack which was particularly threatening in August may be greatly mitigated by successive heavy showers of rain in September, which wash down and kill the flies of the 2nd or 3rd brood before they have time to lay eggs. It is also noticed that on irrigated lands the olive is less liable to the attacks of the olive-fly, probably because

the pupae in the soil are killed by frequent irrigation and tillage, and as the olive-fly does not attack other fruits, there is not the possibility that the insect may come over from orchards in the neighbourhood.

The remedies proposed against the olive-fly are the following:

A. *Remedies directed against the winged insect.* In 1762 it was proposed by Seuve to attract and poison the fly by means of a sweet and poisonous mixture moistened with water. As a poison Seuve proposed orpiment in powder (sulphide of arsenic). The Royal Experimental Station of Florence proposes a mixture of treacle or molasses 70 parts (by weight), water 28 parts and arseniate of sodium 2 parts. The water is raised to the boiling point, and the arseniate of sodium is dissolved in it, the molasses are then added gradually, constantly stirring the mixture to obtain a uniform distribution of the poison. Instead of water others recommend the use of the juice of grapes in the proportion of 50 parts of molasses, 48 parts of juice of grapes and 2 parts of arseniate of sodium. The mixture may be sprayed on the tree duly diluted but is best used by daubing it here and there on the large branches by means of a brush. This method is said to give fairly satisfactory results.

B. *Remedies directed against the larva and the chrysalis.*

1. Pick up at once all dropped olives giving no time to the larva to come out and hide in the ground.

2. Dig the ground under the trees deeply at least twice during the breeding season of the fly, the object being to bury the larva and the pupae at a depth whence the winged insect will have little chance to come up.

3. Scrape away all the dead and fissured bark of old trees, and cover the trunk and large branches with a strong solution of sulphate of iron (green vitriol), 1 to 2 kilos of green vitriol to 100 litres of water, applied by

means of an ordinary plasterer's brush. This operation is best performed in winter, at the time when the pupae are hibernating in the crevices of the bark.

It should be remembered also that many small birds such as the redbreast, the redstart, the buntings etc. which are fairly common early in autumn, during their stay in the olive grove consume large numbers of the olive-fly. However the best preventive remedy against this insect is certainly the anticipated harvesting of the fruit, by which the fly is deprived of the scope for its exertions. Harvesting should be as complete as possible, as a few olives allowed to remain dispersed over the trees are sufficient to afford a breeding place for the last brood whose pupae are destined to hibernate throughout the winter.

The larva of the olive-moth (*Prays oleaellus* Standt, order of Lepidoptera) is frequently the cause of much injury to the tender foliage and young shoots, especially on young trees recently planted. The presence of the larvae of this moth is easily recognized by the netting of cobwebs usually covering the damaged twigs and leaves. When no cobwebs are present then it is probable that the damage is due solely to the attacks of the olive-flea (*Psylla oleae* Ious, or *Euphyllura oleae* Forst, of which both the larva and the winged insect cause damages almost identical with those produced by the larva of the moth. In any case, the treatment is the same. Spray the trees with strong watering solution of tobacco juice, or with an infusion of tobacco stalks. All well-known insecticides in properly graded solutions, are equally useful, such as lysol, hypnol, carbolineum, plantol etc. Spraying with Bordeaux or with Burgundy mixtures, or with paraffin and soap emulsion or with the mixture of arseniate of lead, also gives satisfactory results, one or two sprayings being usually sufficient.

The olive tree borer (*Phlaeotribus oleae* Fab., order Coleoptera) is often troublesome. The larva of this

small beetle, as well as the beetle itself, penetrate beneath the bark and into the wood of the branches and twigs, preferably in the axil of the leaf, or just above a cross twig, producing ramified tunnels killing the bark and seriously injuring the wood. Many small branches and twigs dry up in consequence of this attack, and on the larger branches appear blotches of gum-resin exuded by the tree, which are a sure sign of deep injury. Remove all dead twigs, on which the insect generally lays its eggs, and scoop out the dead and diseased wood from the larger branches, and disinfect the wound by painting it over with liquid tar.

Among the various scale insects affecting the olive, the worst are the black scale (*Lecanium oleae* Valk) and the small round white scale (*Aspidiotus villosus* Targ., which is probably only a form of *Aspidiotus Hederae*). Both of them multiply prodigiously and exhaust the tree, checking its growth. These scale insects exude a sugary substance which covers the foliage the twigs and branches and affords the necessary feeding ground for the development of the soot-fungus (*Fumago*) which imparts to the tree the appearance as if it has been sprayed with a thick solution of soot. This result is particularly noticeable on young trees. The scale insect *Philippia Oleae* Costa, is rather uncommon, but is met with sparingly everywhere. Spraying with soap and paraffin emulsion or with sulphur-lime mixture is a good remedy against these scale insects; but in bad cases of long standing it is often necessary to prune back rather heavily, towards the close of winter, before spraying, in order to induce the tree to push out strong healthy growth.

Cases in which the larva of the moth-borer (*Zeuzera pirina*) tunnels into the branches of the olive-tree, are frequent, but call for no special treatment.

The worst of the fungous diseases affecting the olive is the "tubercle" caused by *Bacillus Oleae*. The tubercle is a cancerous outgrowth on young twigs, branches, stems

and sometimes also on the roots. A protuberance is developed from the size of a pea to that of a walnut, within which the woody tissues are soft, and are in a state of rapid growth; sooner or later the bark splits irregularly, the outer part of the woody tissues dies, while the inner part continues to develop, producing often a large jagged and cancerous wound. The disease is common everywhere the olive tree is cultivated, but is always less severe on budded or grafted trees, although it is known that the tubercle often forms on the wound soon after budding, killing the bud or preventing its development. The disease is more prevalent in badly ventilated groves, and in the summer following a winter with severe hailstorms. Small wounds made by hail or by any other mechanical injury are too often the starting point of infection, where a tubercle will develop sooner or later. Unfortunately, against this disease, as well as against other cryptogamic disease, such as the "blotch" of the foliage, etc. there is no remedy of practical utility, beyond good cultivation and regular pruning. Certain fungi of the genus *Polyporus* etc. sometimes attack the olive tree, and the infection is checked by removing the decayed wood washing the wound with a solution of sulphate of copper (5 p. cent.), and when dry painting it over with liquid tar.

Triblydiella oliveforum Sacc., and *Macrodiplodia oleaginea* Sacc. are frequently found on dry twigs, but may be only saprophytic. *Macrophoma Oleae* (D.C.) Berl. et Vogl. is found on dead leaves but is of no pathological importance. The huge irregular pileum of *Polyporus biennis* (Bull.) Fr. has been found growing out of the cankered trunk of old olive trees.

THE CAROB TREE.

Ceratonia Siliqua L.—LEGUMINOSAE.

Maltese=*Harruba*. Italian=*Carrubo*. French=*Caroubier*.

The Carob tree is native of the warmer regions of the Mediterranean, not far from the sea, and is met with wild or half-wild or self-sown in ravines and rocky places in these Islands where its cultivation has been largely extended during the last century. It is an evergreen tree of low spreading habit, often attaining large dimensions with a trunk measuring 4 metres in girth at the base. The tree grows best on the red soils overlying the calcareous Globigerina beds, but grows well also on the porous upper coralline formations, and on the hard limestones of the lower coralline beds. The Maltese name "*harrub*" literally *devastator*, is expressive of its habit of establishing itself in the fissures of rocks and gradually pushing the rocks apart or upheaving them to make room for itself, until it reaches the underlying beds or pockets of rich red soil. The carob tree thrives also on stiff clayey soils provided they are well drained, but on these soils the tree is never very prolific, and produces beans of inferior quality. The best situations for this tree are the terraced hill-sides looking towards the east or the south. A situation exposed to the north or north-west winds is unfavourable. In deep shady valleys the tree assumes a tall and erect habit, and becomes quite picturesque.

The carob tree is polygamous, certain trees bearing only unisexual female flowers, others only male flowers with abortive pistil, and in others the flowers are hermaphrodite and perfectly bisexual. The flowers are

formed in clusters of several racemes on the stems and branches. They make their appearance in August and bloom in September and October. Trees bearing only male flowers are termed "*baghal*," master or lord, and their habit is distinctly more robust. They are usually chance seedlings and are allowed to grow ungrafted in order to utilize the catkins of male flowers for the fertilization of seedlings or grafted varieties bearing only female flowers, and also to improve the fertilization of varieties bearing perfect or bisexual flowers.

PROPAGATION. The carob tree can be propagated by cuttings consisting of a twig with a heel of the old wood. Layers can be made in spring, and must be kept moderately moist throughout the summer in order to root. In the regency of Tunis the best sorts of carobs are now propagated by cuttings, taken in February, and made of straight twigs or branches, 2 to 10 c. m. in thickness and 30 to 50 c. m. long, with the lower section cut very clean just below a bud. The cuttings are planted in holes about 70 c. m. deep and filled with sand or with a light sandy soil, and they are put in in a perpendicular position and deep enough to leave only one or two buds above ground. Watering is done at first every week, and afterwards at longer intervals as may be necessary, and with due attention it is said that as many as 75 to 90 p. cent of the cuttings will strike root. Trees grown by this method will fruit when they are three or four years old.

In these Islands the carob tree is exclusively grown from seed, as the cheapest and easiest way of propagation. The seed may be sown in place in early spring or in autumn, by dropping two or three seeds in a small hole made in the soil. After a year only the strongest seedling is allowed to remain, the others being pulled out, and the place kept clear of weeds. In the 4th or 5th year the plant is strong enough

to be budded with a good productive variety, and henceforth the young tree makes rapid progress, if the locality is at all suitable. When rearing carob trees in pots the seed may be sown in March in small pots, leaving only one plant in each pot; afterwards the plants are shifted into larger pots every year, until they are strong enough to be planted out in place. This is best done early in autumn, loosening the roots without injuring them, and planting deeply so that the root-system may not get dry during the long drought of summer. A less laborious way of growing young carob trees in quantity consists in sowing the seeds in large shallow pots or pans, and the young seedlings are then potted off singly in the following March, discarding the weak seedlings which are unable to produce trees of strong constitution. It is possible also to sow the seed in beds in the open ground and the seedlings are potted off, or planted in place, when they are one or two years old. The operation is best performed in March if the seedlings are transplanted in pots, but may be done soon after the first rains if they are to be planted in their final abode. Young carobs allowed to remain in their seed-bed for more than two years are liable to suffer severely when transplanted, even if the operation is performed with all due care to spare the roots.

It is always advisable to graft or to bud the seedlings with a variety of an approved quality, as the probability of getting productive trees directly from seed is small indeed, and as a seedling will require from 8 to 12 years to fruit, much time is lost in waiting for the chance that the tree may turn to be a good sort. Grafting may be performed early in March, just before the sap begins to move, but is rarely resorted to, as the tree being an evergreen, it is easier and safer to adopt budding instead of grafting. Budding is done throughout the spring and summer, from April

to September. It is preferable to bud the young tree when it has established itself at home, and the stem has reached the thickness of 2 or 3 c. m., but the seedlings are often budded with good results when they are still in pots, with a stem not thicker than a lead pencil.

The beans or pods ripen in August and are plucked when they turn to a chocolate colour, about mid-August. The use of a rod or reed to strike down the beans may result in injury to the young blossoms which at harvest time are already visible. Harvesting should not be delayed much longer beyond the end of that month in order to avoid the possible wet weather and dews of September which will affect adversely the keeping quality of the pods. These should be then exposed to the sun for a few days, turned over now and then and thoroughly dried before storage.

There are several local varieties of carobs which are remarkable for their productiveness, beyond which however they have little to recommend them. The "*Gidri*" so called on account of the very gnarled appearance of the stem and branches produces long and thick pods of a dark chocolate colour. They are of poor keeping quality, and are mostly fed soon after harvest. The "*Ahmar*" yields light chocolate or rusty-coloured pods, which keep much better, but are often too thin and leathery. The "*Ghasli*" has long, narrow and moderately thick pods, of a dark chocolate colour and very sugary, which keep better than the "*gidri*," but the tree is not very productive, or rather the pods are more easily injured and destroyed, when young, by bad weather in winter, and by various cryptogamic pests.

Of the various foreign sorts now cultivated, the best is the Cyprus carob, which is fairly productive, the pods are very long and thick, very sugary and

keep well. The Avola carob is a good Sicilian variety, producing broad pods, rather short and thick, of a light chocolate colour. This variety keeps well for a long time, and is productive. The Candia carob has the same appearance and keeping qualities of the Cyprus carob, but is less sugary and often thinner, although generally more productive. Unfortunately these foreign varieties, and others lately introduced rarely produce pods of the same rich quality as those imported from their respective native country.

DISEASES OF THE CAROB TREE.

The Carob tree is very liable to *canker* of the heart-wood, but fructifications of the fungi concerned are rarely met with. Four species of Polyporus have been found on the carob in these Islands, viz. *Polyporus sulphureus* Fr. var. *Ceratoniae* Risso, *P. frondosus* Fl., *P. lividus* Leys. or *Ganoderma lucidum* Karst. and *P. ignarius* (L.) Gillet.

Polyporus sulphureus var. *Ceratoniae* was first found at Kala (Gozo) and afterwards at Ghain il Gbira, and develops as a large branching mass of a sulphur yellow with orange-red markings. It is poisonous. *P. frondosus* was found at Rabato near the Catacomb of Saint Agata, and produces a huge mass of dirty creamy white fructifications in the cavity of the trunk of cankered trees. It is very friable, with a floury appearance and odour. *Ganoderma lucidum* was found several times at Uied Incita, Krendi and Boschetto. It has a large flat pileum, oval in shape, inserted sideways, about 15 c. m. in transverse diameter. It has a corky consistence, and is smooth and shining and of a violet-purple colour on the upper surface, chocolate brown on the undersurface which is studded by pores. This fungus has a well-marked and characteristic odour of carob beans. *P. ignarius* was not seen by me, but has been reported on the carob tree

by Zerafa and Gulia. The best preventive treatment against canker consists in painting heavily with liquid tar all large wounds, renewing the operation every two or three years until the wound is healed.

Phyllosticta Ceratoniae Berk. produces roundish brown blotches on the surface of the leaf, on which minute black dots are subsequently developed. This fungus causes an early defoliation, and is sometimes rather troublesome. *Phoma Ceratoniae* Sacc. attacks the weak ends of the twigs which had lost their foliage in severe winters. The twigs die, and the minute black fructifications develop in the course of the following summer and autumn. *Septoria Carrubi* Pass. is another fungus which attacks the green foliage of carob trees in valleys and sheltered situations. It is also found on the young green pods, which dry off in consequence of the attack. *Cercospora Ceratoniae* Sacc. produces irregular reddish brown blotches on the leaves, and checks the growth of the tree. However the worst cryptogamic disease of the Carob is *Oidium Ceratoniae* Comes, which is common everywhere on the young foliage as well as on the old, and is particularly injurious to the young pods. The attacks of this fungus are often so virulent that not a single pod remains unaffected. These diseased pods generally wither off when still young, but may survive, and then assume an uneven shape with greyish and fissured spots. Unfortunately there is no real remedy against this disease, but dustings with sulphur, soon after the blooming period, may prove useful if the weather is not too wet.

Two scale insects are met with everywhere on the Carob tree, viz. *Aspidiotus Hederae* Vallot. (*A. Ceratoniae* Signoret.) and *Chionaspis Ceratoniae* P. Marchal. The first is the usual round white scale of the Ivy. The second is also white, but is smaller, and is elongated and pointed at one end, or mussel-shaped. Both are equally injurious to the Carob in valleys and close situations, but

are generally kept in check by the ladybirds and other beneficial insects. The ripe or dry pods are subject to the depredations of the larva of certain small moths, some sorts being more liable to suffer than others, and it is by no means a rare occurrence to see the carob beans already moth-eaten when still hanging on the tree, in August. Hence our farmers are sometimes compelled to anticipate the harvest, the green or half-green pods being used immediately to feed livestock on the farm. The large beetle *Oryctes nasicornis* Fb. develops in the rotten heartwood, but is not really parasitic. Rats are very partial to the bark of the carob tree, and during winter many branches and sometimes whole trees are killed by being barked all round by these animals. If the injury is noticed in good time, the rats may be deterred by painting over with tar, or with a lime-wash charged with 3 to 5 per cent of blue vitriol or of Paris green.

THE FIG TREE.

(*Ficus Carica*. L.—URTICACEAE.)

Maltese=*Tina*. Italian=*Fico*. French=*Figuier*.

The Fig tree is native of the Mediterranean region, and grows in a wild or half-wild state in our valleys, rocky wastes, walls of fields, clefts on precipitous cliffs etc., where it is disseminated chiefly through the agency of birds. It is probably the first fruit tree cultivated by man in subtropical countries when he ceased to lead a wandering life, and therefore has given origin to numberless varieties, and has become one of the trees most amenable to cultivation. It agrees well with all soils and all situations, provided that the soil is free from stagnant humidity, and at least in our climate its cultivation is most easy. The fig tree has a powerful root-system which extends far and wide, often to a considerable distance from the trunk, and on this account it delights on deep soils especially where there is a deep broken or porous subsoil, or in old stone-quarries with a moist rock and deep ground made up of stones and rubbish. Nevertheless, the fig tree is a surface feeder, and where it is allowed free scope in the upper layers of the soil, the tree may lose in vigour but becomes very productive, and the fruit is of superior quality.

PROPAGATION. The fig tree like most fruit trees which have become more or less deeply modified by long cultivation, hardly ever comes true from seed, and therefore its propagation by direct sowing of seed is never attempted. Self-sown seedlings are very frequent in gardens, valleys etc. but these are usually budded or grafted with one of the cultivated varieties, although of

course chance seedlings often turn out good fruiting trees, producing fruit of good quality often equal to the best cultivated sorts and therefore worthy of propagation as a new and a valuable variety. However, the large majority of seedlings produce uneatable fruits, partaking of the nature of the caprifig, and often real caprifigs, and therefore are destroyed, or if growing in a suitable place are transformed into a good sort by budding. Budded or grafted trees are usually more vigorous and produce finer fruit, than trees grown on own roots from layers or cuttings.

The fig tree normally throws up numbers of suckers around the base of the trunk, and these afford a ready means of propagation, being almost always provided with a few rootlets. Suckers produced by trees growing on own roots naturally reproduce the same variety as the mother tree, but when the tree is budded or grafted on a seedling the suckers of course belong to the wild type, and require to be budded with the desired variety as soon as they have established themselves in their new home. As the suckers must be removed from the mother tree in order not to exhaust it and not to interfere with its fruiting capacity, it is convenient to perform this operation from November to March, when the suckers provided with rootlets can be planted out as rooted plants. Having no tap root, they should be planted at least 30 c.m. deep to give them a better hold on the ground and to favour the formation of more roots along the stem.

Propagation by layers is frequently practised by our gardeners. Owing to the drooping habit of the tree, the lower branches often touch the ground or are close to it. These are layered all round the tree during winter, and become rooted in the course of spring. The rooted layers can be transplanted in the following autumn or winter, but are usually allowed to remain for two years to become strong plants.

Cuttings of the fig tree root with the greatest ease, and this is the most popular method of propagation. Cuttings can be taken at any time from midsummer until spring. When meant to be planted where they are to remain, it is better to select cuttings about 30 c.m. long, removing the lateral spurs or shoots if they have any. The cuttings are planted in a somewhat slanting position, leaving only about 5 c.m. of the branch with its terminal bud above the ground, and pressing down the soil firmly around it. Cuttings planted at midsummer should be stripped of their leaves as soon as they are cut from the tree, and should not be allowed to remain long exposed to the air before planting; they also require to be watered liberally soon after planting, and subsequently should be watered regularly every week or ten days until the ground becomes well soaked with the first rains. Cuttings planted in summer as a rule root at once, and push out new growth within a week or two after planting, and usually become well rooted and established before winter.

Cuttings intended for planting out in nursery beds or in pots should not be more than 10 to 15 c.m. long, cutting them off across a node or with a heel of the old wood, stripping them of their leaves, if the operation is done in summer. Straight spurs proceeding out of the old wood make ideal cuttings. They are planted deeply, leaving only about 3 c.m. with the terminal bud above the soil, and in a year or two they will be strong enough to be transferred to their final destination with a ball of earth, if transplanted in summer, or without it if transplanting is done when they are leafless.

Fig trees can be budded at any time from March to September; grafting is best done in February or March. Budding is generally preferred as it involves less risk, and also on account of the facility of budding high up enough to ensure a tall stem which would compensate for the naturally drooping habit of the branches.

In good soils where the fig tree is expected to attain full size, the distance from tree to tree should not be less than six metres. Adult trees in good situations often spread their branches for five metres or more around the trunk, but on poor soils or in exposed situations a distance of four to five metres will be sufficient. It is always desirable to train the tree as standard on a single stem. Trees so trained are more productive, are more easily manageable, and do not encumber the surface of the ground in a manner as to exclude the cultivation of catch crops during winter, and also in summer if there are facilities for irrigation.

CULTIVATION. The fig tree is not at all exigent as regards cultivation. No manure is required beyond that supplied to the soil for the cultivation of catch crops. The ground should be weeded and kept clean in order not to draw too much on its resources, both as regards nourishment and moisture. One good digging towards the end of March or in April is sufficient. The fig tree thrives well without watering, and accordingly it is never purposely watered except for the first year or two when newly planted. However where the ground is irrigated in connection with other cultivations, the fig tree grows luxuriantly and fruits heavily, often producing five fruits or more on each twig, although the fruit may not be of the same luscious quality as when grown on unirrigated land.

Pruning is necessary to correct the drooping tendency of the tree, and its habit of producing too many twigs. The lower drooping branches are often too much shaded off by the upper ones, and therefore become unproductive, besides being in the way for the proper cultivation of the soil; and the thinning out of the upper branches and twigs is indispensable to admit air and light and to favour the proper development of the fruit. The fig tree is pruned in winter, during the period when it is leafless. Pruning is performed every two years, but

careful cultivators thin out the twigs every year, and so insure a more marketable crop. Any wounding of the stem or branches during active vegetation causes a flow of "latex" or milk, and if prolonged or carried to excess may exhaust the tree and impair the crop. Owing to the soft texture of the wood large wounds are always dangerous because they become invariably the starting point of decay. The practice of removing most of the foliage late in summer after harvesting the crop, to collect forage for goats and other animals, is objectionable on the ground that the tree thereby loses the means to elaborate the material necessary for next year's vegetation ; besides incurring the risk that the tree may be induced to start fresh growth with the first autumnal rain, which growth will be weak and unsuitable for the next year's production of fruit. The foliage of the fig is liable to cause, at all seasons but chiefly in autumn, a troublesome eruption of the skin to those who handle it. The eruption begins with an itching of the skin on the back of the hands, arms and face wherever the skin came roughly in contact with the leaves and particularly with their margin. The itching commences within 24 hours after contact with the leaves, and is followed by redness and the formation of small vesicles filled with serum, which dry up in a week or two.

Fig trees grown in pots are with us only an object of curiosity, but all varieties grow well in pots, and fruit regularly. This cultivation is sometimes followed for the purpose of forcing the plants into an extra early production or into a late one. When placed in a fairly warm glasshouse in November or December some time after the shedding of the leaves, they soon start growing again and produce fruits which ripen towards the close of winter or early in spring. It is also possible, when the young wood has ripened sufficiently by the end of July, to remove the green fruits and to gradually withdraw water to cause the leaves to turn yellow and to shed.

When this is done the plant is given a good dressing of manure, and liberally watered. The plant will react at once to this treatment, starting fresh vegetation and producing another crop of fruits which ripen late in autumn or during winter, if the plant is then placed under glass.

A very interesting and important cultural operation required by most varieties of the edible fig is the time-honoured practice of *caprification*. Under ordinary circumstances a considerable proportion of the green fruit, often the great majority, drops off when it reaches the size of a hazelnut, and this loss is greatly reduced and sometimes entirely eliminated by means of caprification. The operation is simple enough, and consists in hanging the ripe fruit of the caprifig, strung together in twos and threes, to the branches of the edible fig when its fruit has reached the size of a hazelnut, that is when its flowers are blooming. The practice is of immemorial antiquity and probably originated with those consummate agriculturists, the ancient Phoenicians and Carthaginians. From them it passed to the Greeks who owed their progress in agriculture as well as in the arts to those enterprising and highly cultured nations. Theophrastus is the oldest writer who makes reference to caprification, and his work written in accordance with the theories of his age, gives us the first insight into the sexual differences of plants. Pliny the Elder gives an elaborate description of caprification, alludes to the antiquity of its practice, and acknowledges its application in those regions of the Mediterranean basin where the fig tree was cultivated. The practice of caprification continued uninterruptedly down to the present, and notwithstanding its condemnation by several modern writers, who on theoretical grounds, condemned it "as a tribute paid by ignorance to prejudice", without having an adequate knowledge of its theory and still less of its practice, its practical utility is too real and too well

known by all cultivators of the fig tree to allow it to fall into disuse. The following is a summary of the information necessary to understand the practice.

The so-called "fruit" or *syconium* of the fig tree consists of a pear-shaped receptacle, bearing the flowers along the inner surface, the orifice at the extremity being protected by small semicircular scales, by which as a rule it is closed up almost entirely, except at the time when the flowers are ripe for pollination and again at the time when the fruit approaches maturity. The flowers situated near the orifice are male or polliniferous, but may be more or less neutral. The other flowers covering three-fourths or more of the entire cavity are female or pistilliferous, but in some varieties may be mixed up in varying proportion with the male flowers all over the cavity. The structure of the flowers as is the case with many species of the order Urticaceae to which the fig tree belongs, is of the simplest type. The male flower consists of one or two, rarely six, stamens supported by two or three small ciliated leafy scales upon a short peduncle. The female flower consists of a unilocular ovary, containing only one ovule, and supported on a short filamentous stalk, which in the common fig becomes fleshy when ripe. The female flowers are of two sorts, or rather may be perfect flowers more or less uniformly mixed up with imperfect ones. The perfect female flower has a long well-developed stigma, and in due course its ovule becomes a seed ; but the imperfect flowers have a short and abortive stigma, unsuitable for the reception of the pollen and for the formation of the pollen tubes, and are therefore incapable of producing seed. In the process of caprifigation these imperfect flowers become galls, and hence are called gall-flowers.

The fertilizing agent is a small winged insect, *Blastophaga grossorum* of the order Hymenoptera, not larger than a sand-fly, which comes out of the orifice of

the ripe or nearly ripe caprifig, and flies to the young fruit whose orifice is partly open, its flowers being ready for pollination, enters or squeezes itself through the orifice, often in its hurry losing its wings which remain sticking to the scales which surround the orifice. The male insect is wingless and never leaves the interior of the caprifig where it has developed, but as soon as it comes out of its gall it proceeds to copulate with the female insects just as they are coming out of their own galls, so that these are already fertilized before they leave the caprifig to seek the young figs where to lay their eggs. The female *Blastophaga* has a short ovipositor with which it perforates the stigma of the pistilliferous flowers, depositing an egg in each. However, owing to the shortness of the ovipositor, the *Blastophaga* can only reach the ovule of the gall-flowers whose stigma is very short or abortive. In the perfect female flower, with their long stigma, the egg is laid in the substance of the style, about midway between the stigma and the ovule, and the larva which hatches finding no nourishment soon dies, leaving the ovule to proceed with its development into a seed. The *Blastophaga* having deposited all its cluster of eggs, dies within the young fig. The egg deposited within the ovule of the imperfect female flower, soon develops into a tiny larva which feeds upon the ovule, and sets up an irritation in the nucellum or shell of the ovule, causing it to grow markedly more than it would have done if it were the shell of an ordinary seed, and transforms it into a gall from which in due time the perfect insect emerges.

The caprifig tree fruits three or four times every year. The first crop, by far the most abundant, appears along with the foliage, in March, coming out of the fruit buds on last year's wood, in the same way as the well-known precocious figs or St. John's figs, and mature in June. This is the crop which furnishes the caprifigs (Maltese = *duccar*) for the fertilization of the edible figs.

The insect from this crop fertilizes the second crop of caprifigs (Maltese—*nannu*) which is less abundant and appears early in June on the young wood, at the same time as the edible figs. The third crop (Maltese=*ciarru*) is formed in August, and the fourth crop (Maltese=*barru*) is formed in September or October soon after the first rains of Autumn. The third and fourth crops are often indistinct, being merged together and consist of only a few fruits. The caprifigs of the second, third and fourth crops are never used for caprification but are allowed to remain on the tree in order to afford scope for the *Blastophaga* to breed, so that the caprifigs of the first crop may be found well provided with galls when picked for use. The caprifigs intrinsically are useless for caprification, their value being dependent on the galls which they contain. In fact when the third and fourth crops are very scarce it will happen that the caprifigs of the first crop may have few galls, and some of them may have none, in which case of course they are useless.

The *Blastophaga*, when it issues from the ripe caprifig, carries with it some of the old pollen from the decayed male flowers near the orifice of the fruit, and when it squeezes itself into the orifice of the young edible fig, it further becomes powdered with the pollen of the male flowers whose anthers are just then in dehiscence. When the *Blastophaga* proceeds to lay eggs in the stigma of the female flowers, it is therefore acting as a pollen carrier ensuring pollination with the new pollen of the young fig, and also cross-pollination with the old pollen from the caprifig. Further, the presence of one or more *Blastophagas* in the cavity of the young fig, and the irritation which is set up as a consequence of the development of the galls, act as an incentive to intensify nutrition, so that within a few days the young fig becomes plump, assumes a healthy glaucous green colour, and there is no longer any danger of its being shed off. When the edible fig

is approaching maturity the moist sugary secretion of the fleshy fruit stops the further development of the galls and kills the larva within them, so that the *Blastophaga* hardly ever reaches its adult stage within them, and when it does it is invariably killed and then pushed out of the orifice by the sugary secretion of the ripe fig.

The practice of Caprification is carried out in the following manner. In June, it will be known that the caprifigs are mature because they become somewhat soft to the touch and the *Blastophagas* are seen emerging from them. They are then picked at once and are strung together in twos or threes by means of a needle and cotton thread, and are carried in baskets and hung to the branches of the fig trees. The operation is best performed early in the morning, so that the insect emerging during the heat of the day, is not handicapped by the dew, and proceeds at once to the young figs around it. If the caprifigs are of good quality, that is if they are well provided with galls, twelve clusters will be found sufficient for a large tree, but if their quality is poor it will be necessary to put more. Moreover, as the young figs are not all mature for pollination at the same time, it is advisable in order to avoid some loss of the later figs, to procure some late ripening caprifigs from caprifig trees growing in cool situations or on exposed hilly ground, and as a rule two or three clusters of these late caprifigs are enough for a large tree as a second or subsidiary caprification. Some growers make use of bulrushes or other material in stringing caprifigs, but ordinary cotton thread is the best for this purpose. In fact ants which are very partial to the *Blastophaga* and will prey upon it if they are allowed a chance, do not easily climb down a slender cotton thread. For this reason it is important to hang the caprifigs by a single thread, carefully avoiding touch with the branches or foliage, so that the alert ants may not find a bridge to reach the coveted prey.

With the exception of the black and the white Bourgeassottes, for which caprification is altogether unnecessary, all other sorts are benefited by the operation and for many sorts it is really indispensable as without it a large proportion of the fruits will fail to set and to arrive to maturity. The white, green, yellow or ruddy colour figs, in general, require caprification, as without it at least three fourths of the crop is lost. On the other hand all dark violet or black figs can do without caprification, but most of them are benefited by it, and if caprificated will acquire the habit, so that if caprification is discontinued the majority of the crop is lost for several years in succession until the trees become accustomed to the new conditions. Moreover, as the *Blastophaga* can fly over considerable distances especially if favoured by the direction of the wind, it often happens that a fig tree undergoes caprification as a natural process, without the assistance of man. This is particularly noticeable where there are caprifigs in the neighbourhood, whether self-sown or planted. It is the general custom to plant a few caprifig trees in every new plantation of fig trees, so that caprifigs may be had close at hand when required, instead of purchasing them often at a considerable cost. It is considered sufficient to have one caprifig tree for every ten or twelve edible fig trees.

The question arises, why does it happen that without any caprification a fig tree will set a few fruits? This is easily explained not only by the possibility that there may be an unknown spontaneous caprification as above mentioned, but it is also a fact that some figs, especially those which are the first to bud out, are naturally of a stronger constitution and are better provided with the male element, and that the irritation provoked by the presence of the galls may be imitated or substituted by the action of other insects or other agency. Accordingly, it is well-known that a slight prick with a pin at

the orifice or on the side of the young fig, will cause it to set almost as well as if caprificated.

Certain varieties of figs, such as the St. John's, the long violet, and the long white, habitually produce a crop of early or precocious figs, which make their appearance in March or April, at the same time as the foliage, and mature in June, and it is noteworthy that the early St. John's figs do not require caprification—and there are no capriffs available at that time—but the main crop of the same tree which buds out on the young wood toward the close of May or in June, will not set without caprification. On the other hand the main crop of the other two varieties mentioned is caprificated, but the early crop is not, and accordingly many or most of the early figs of these varieties, which are of exquisite quality, drop off when half grown. This does not happen when there is a caprifi tree close by, having a few figs of the third or fourth crop (*ciarru* or *barru*), from which the *Blastophaga* proceeds to visit the capriffs of the first crop (*duccar*) just out, as well as the early figs of those two edible varieties.

The following are the best known sorts of fig trees grown in these Islands.

1. The CAPRIFIG (*Ficus Carica Caprificus* Lin.) A considerable proportion of seedlings, especially those originating from the white or light-coloured edible varieties produce uneatable fruits, and when they produce several crops, they are called capriffs, and their fruit may be used as such. However, the fruit of the true capriffs is always more or less dry, becoming soft at maturity but never fleshy or luscious as the edible figs. A "dry" caprifi is essential for the proper development of the *Blastophaga*, and therefore good sorts of capriffs are always propagated by cuttings or layers, or budded on seedlings. The two best known capriffs

are the so-called white caprifig (*duccar abjad*) and the red caprifig (*duccar ahmar*). The white caprifig is that most frequently met with. Its fruits are whitish green, with red scales at the orifice. The red caprifig is smaller, round or somewhat flattened, of a uniform rusty greenish red colour; it is "drier" than the white variety, and is preferred whenever obtainable.

A late variety of green caprifig, producing long fruits, (M=*duccar bzenguli*), which mature their galls about three weeks later than the other sorts, is much valued for the caprification of late or secondary crops of figs which otherwise would be lost.

2. The BLACK BOURGEASSOTTE (Maltese=*Parsott issued*, Italian=*brogiotto nero*). The leaves are frequently almost entire, or imperfectly lobed with obtuse segments. The tree is often middling in size, but is vigorous and very productive. The fruits are broad, top-shaped or flattened, with a short and slender stalk, and ripen slowly. They are dark violet, almost black at maturity, with circular netting or fissures of the skin. The pulp is dark red, very luscious and sweet. The first fruits ripen about mid-August, and maturation is prolonged until October or even later. The tree does not require caprification. This is one of the best figs for the table.

3. The WHITE BOURGEASSOTTE (M=*Parsott abjad*. It=*Brogiotto bianco*). The tree and its foliage are very similar to the preceding, but the leaves are of a lighter green, and their petioles are white without any shading of red as in the black variety. The fruit is also similar in shape, but more rounded at the orifice, and takes a whitish or yellowish green colour at maturity, with circular netting as in the sister variety, but maturation is not so prolonged. It is an ideal fig for the table, and is also a very good sort for drying. This is the only white fig requiring no caprification, and like the black variety never sheds off any green fruit.

4. The LONG VIOLET FIG (M=*Farkizzan* probably from Ficarazzi, in Sicily). The tree grows to a large size and is a fast grower. The foliage is large and well lobed with some ruddiness on the undersurface; the petioles are also ruddy. The fruit is large, of a beautiful oblong shape, with vertical or longitudinal fissures or netting. The pulp is soft and watery, lively red, sweet and of excellent quality. This beautiful fig is one of the best sorts for the table, but is not suitable for drying, being too watery. The tree is very productive, and the fruit is probably the earliest to ripen, and maturation is hardly ever prolonged beyond the middle of September. The fruit will do without caprification, but is greatly improved by it, and shedding off is reduced to a minimum.

5. The SMALL BLACK FIG (M=*parsott salvagg*). The tree grows to a large size and the foliage is large and well lobed. The fruit is small, shaped like a bourgeasotte, with a dark red pulp, which is luscious and very sugary. Ripens late and maturation is sometimes prolonged well into December, when the tree is already leafless. It is not esteemed either for the table or for drying, but is enormously productive if caprificated.

6. The LONG BLACK FIG (M=*Bzengul isued*.) The tree grows to a large size and is a fast grower. The foliage is similar to that of the long violet fig, but is less deeply lobed, and the lobes are more rounded. The tree produces two crops. The early crop, often consisting of a few figs, is produced along with the foliage and ripens in June. These early figs are large, very long, dark violet or nearly black, with fine longitudinal netting, and a long and slender stalk. The flesh is dark red, luscious and of excellent quality. The main crop is fairly abundant, but the figs are rather small, very long and swollen at the stalk-end. They have the same netting and are of the same colour as the early figs, but are far less luscious, and

are fit exclusively for the table. The tree requires caprification.

7. The ROUND VIOLET FIG (M=*tin isued*). The tree is large and vigorous, and is well productive. The fruit is short-stalked, nearly round, and its colour is reddish violet. The flesh is yellowish red, sugary and soft, but of middling quality for the table or for drying. The tree requires caprification.

8. The "DIKKIENA" FIG (M.=*tin tad-Dikkiena*, a locality near Siggieui where it is largely cultivated). The tree has the same habit and appearance as the Bourgeassotte, and the fruit is similar in shape and size, but is tan-coloured or rusty red. The flesh is light red, very sugary and melting. This is a good table fig and is also suitable for drying. Will do without caprification, but is improved by it.

9. The LARGE BROAD RED FIG (M.=*tin ixheb ciatt* sometimes called *tin ta San Sidori*). The tree attains a huge size, with large well-lobed leaves, and is fairly productive. The fruit is very large, shaped like a Bourgeassotte, with a long slender stalk, and is very broad and flat. The colour is greenish fawn or rust, the skin having a fine circular netting. The flesh is yellowish red, thick and luscious, and very sweet. It is a fine table fig, and is also good for drying, but is too liable to the ravages of birds and of the fruit-fly and fig-fly perhaps owing to its excessive sweetness. Requires caprification.

10. The GREENISH RED FIG (M=*tin ixheb tat-takdid*.) The tree is large but growth is rather slow. The leaves are very deeply lobed. The fruit is shaped like a Bourgeassotte, but is of a greenish red colour, with red flesh of thick texture and great sweetness. It is much esteemed for drying, and often dries on the tree spontaneously, and is gathered dry. The tree is very productive and requires caprification.

11. The ROUND RED FIG (M.=*tin ixheb tal meida.*) The tree is large and vigorous, with leaves slightly lobed. The fruit has a round shape and is very short-stalked. The colour is ruddy shading to claret. The flesh is light red, rich and melting. It is a good table fig, but ripens too simultaneously, and is rather poor for drying. There is a form with very large fruits of fine appearance, with flesh of a lively red colour, but is of inferior quality. Both sorts require caprification.

12. The ST. JOHN'S FIG (M.=*tin tal baitar, tin ta San Giuan.*) The tree is vigorous and grows to a large size ; the leaves are broad and well-lobed. This variety produces regularly two crops. The early crop, (M.=*baitar ta San Giuan* ; Italian=*fioroni*,) usually very abundant, comes out along with the foliage and matures in May-July. These early figs are very large, short-stalked, top-shaped, greenish brown without any netting. The flesh is of a light pink colour, watery, melting and sugary and of good flavour. The main crop is equally abundant, but the fruits are very flattened and very short-stalked, and are valuable only for drying. The early figs are not caprificated, but the main crop cannot do without this operation. The St. John's fig is very largely planted, being perhaps our most common type of fig-tree, the early figs being much appreciated by all classes of the people. A sub-variety exists producing figs, of both crops, of a greenish white colour, but in other respects is identical with the type.

13. The LONG WHITE FIG OF CALABRIA (M.=*bzengul abjad, tin tal hannieka, tin Calabris*; Italian=*fico dottato bianco*). The tree is very vigorous and a fast grower. The leaves are large, imperfectly lobed and often entire. Two crops are produced; the early figs usually a few in number, come out with the leaves, and are very long, with a long slender stalk, and are whitish green with a few longitudinal fissures or netting. The flesh is very thick, luscious and of exquisite flavour ; it is violet-red

close to the rind, but yellowish red towards the interior. The main crop is very abundant, the fruits are often in pairs at the axilla of the leaf. They are oblong, and become finely netted and yellowish green at maturity. The flesh is thick, yellowish red, with few tiny seeds. They are not much esteemed for the table, but are of first class quality for drying. They are divided in halves and when nearly dry, the two halves are brought together and the figs passed through a string or bulrush, like a necklace, hence the name "*tal hannieka*". This is the fig largely grown in Calabria and Sicily for drying. The tree requires caprification.

14. The SMIRNE FIG (M=*tin ta Smirni*.) The tree is fairly vigorous, with leaves deeply lobed and is very productive. The fruit is large, rather flat, short-stalked; slightly netted, thick-skinned, of a yellowish green colour at maturity. Flesh yellowish, thick, very sugary. This is an excellent fig for drying, and should be more largely grown. Requires caprification. There is a form the fruit of which is of an ashy green colour at maturity, sometimes faintly shaded fawn or brown.

15. The THICK-SKINNED FIG (M=*tin gludi*.) The tree is vigorous, with rounded leaves slightly lobed. The fruit is fairly large, round, well-stalked, has a very thick skin and no netting. The flesh is light red, thick and sugary. This is another good sort for drying. Requires caprification.

16. The GOLDEN FIG (M=*tin isfar*.) The tree is vigorous, but rarely attains a large size. The leaves are large, very deeply and beautifully lobed, with five to seven long lobes, narrow within, and broader towards the tip. The fruit is large or very large, shaped like a Bourgeassotte, but more rounded towards the orifice, has a thick rind without netting, becoming uniformly yellow or chrome-yellow at maturity. The flesh is light pink or yellowish red. This is a fine fig for the table,

but its appearance is better than its quality. Requires caprification.

17. The LUSCIOUS WHITE FIG (M=*tin zibdi*.) The tree is very vigorous and productive, with large well lobed leaves. The fruit is middling in size, rather rounded, well stalked, very finely netted, and whitish green at maturity. The flesh is light pink, very thick and luscious, excessively sweet. This is a delicate table variety, and is also very good for drying. Requires caprification.

18. The LUSCIOUS GREY FIG (M=*tin zibdi irmiedi*). The tree is productive and vigorous, with leaves almost entire or very slightly lobed. The fruit is similar to the preceding in size, shape and quality, but is of a greenish grey or ashy colour, and the flesh is often dark red and very sweet. Caprification is necessary to secure a good crop and large fruits, but the tree being probably derived quite recently from the white Bourgeassotte, will set some fruits without caprification.

19. The COMMON WHITE FIG (M=*tin abjad*). The tree is not vigorous but attains a large size, and is well productive. The leaves are rather small and often imperfectly lobed. The fruits are very numerous but rather small. They are pear-shaped, with a very tender rind, easily bruised, and finely netted or fissured; the orifice is small and depressed and the pulp is yellowish pink, firm and sugary. It is a table fig, but is also dried. Will yield no crop without caprification.

20. The LARGE FLAT WHITE FIG (M. *tin tal bahar*, *tin tal Buschett*). The tree is fairly vigorous, but low in habit, with large deeply lobed leaves. The figs are large, flat, very short-stalked with whitish green rind hardly netted, and dark red flesh, firm and sweet. As a table fig it is fairly good, but has a marked tendency to split. It is good for drying. Requires caprification.

21. The ROUND WHITE FIG (M=*Parsott abjad salvağg*). The tree is vigorous and productive, and grows to a large size. Leaves imperfectly lobed, sometimes entire. The fruit is round, slightly flattened at the orifice, well-stalked, imperfectly netted, with whitish green peel and red flesh, firm, moderately sweet. It is fairly good for drying. Requires caprification.

22. The SMALL WHITE FIG (M=*tin abjad salvağg*.) The tree is very vigorous and grows to a large size. The leaves are large deeply-lobed. Fruits very numerous, middling or small, shaped like a Bourgeoisotte but much smaller, with few nettings, greenish white. Flesh yellowish-red, sweet, with few seeds. It is fairly good for drying, but too small for the table. Requires caprification.

23. The ZONDADARI FIG. (M=*tin ta San Sidori*, being a corruption of Zondadari, the Grand Master of the Order of St. John who is said to have introduced it from Italy.) The tree is large and vigorous. The fruits are light greenish brown, very long and pear-shaped, with longitudinal netting or breaks of the rind. The flesh is yellowish red, sweet and melting. This is a good table fig, but now rarely grown, probably owing to its low production. Requires caprification.

24. The SOUR FIG. (M=*tina karsa*). The tree is very vigorous and grows to a large size, and is very productive. The fruit is fairly large, flat, short-stalked, whitish green shaded brown around the orifice. The flesh is red, luscious and thick, and decidedly sour or acid, although it is also sugary. This tree was formerly much grown in the neighbourhood of Musta, and in careful hands may become the source of some good sorts of table figs possessing an acid flavour. Improves in size and quality by caprification, but will do without it.

25. The LONG YELLOW FIG. (M=*tin langiasi*). The tree is fairly vigorous and productive. The fruit

is long, pear-shaped with a long stalk, and becomes yellow or chrome yellow at maturity, with longitudinal fissures or netting. The flesh is light red, very thick and sugary. Requires caprification. This is a good table fig, formerly grown at Musta, but is now rather rare.

26. The LARGE ROUND WHITE FIG (*M=tin tal Bahria*). This local sort is grown at Bahria, and the tree is very vigorous and productive, with large foliage of the Bourgeassotte type. The fruit is very large, round, greenish white or yellowish white, slightly grey or brown near the orifice with circular fissures. The flesh is deep red, very thick and luscious, and is usually very sweet. Requires caprification. It is a fine table fig, and is excellent for drying.

27. The LONG GREEN FIG. (*M=tin ahdar, tin hadrani*). The tree is very vigorous with large leaves well lobed. The young twigs retain their green colour when over a year old. It is well productive. The fruit is pear-shaped, long-stalked, light green or greenish white, ash-coloured near the orifice, with a fine netting of fissures. The flesh is red, thick and very sweet. It is a good table fig propagated from a chance seedling found at San Antonio Gardens.

28. The SA MAISON FIG. (*M=bzenkul abjad tas-sur*). This is a chance seedling which has grown spontaneously in the wall at Sa Maison Gardens, Floriana, and is being propagated as a drying fig. It is a vigorous grower and very productive. The foliage is large, with three broad and smooth lobes, and the fruit is greenish white or greenish yellow, long, thick-skinned, red-fleshed, and very sweet and luscious, similar in appearance and size to the white fig of Calabria. It is a drying fig of excellent quality, and at least at Sa Maison has ripened its fruit without the aid of caprification.

29. The WHITE LIA FIG. (*M=Tin abjad ta Hal-Lia*). This variety is a local seedling grown in

certain gardens at Casal Lia. The tree is very vigorous, with large broad leaves, smooth-edged and almost entire having the central lobe elongated and pointed. The fruit is large, broad, almost stalkless, like a white Bourgeassotte, but rather flat. The rind is green and fairly thick, but delicate and beautifully netted with fissures, and the flesh is light red or pink, with small seeds, and is sweet and fairly luscious. It is a fine table fig but apt to split, and is also good for drying. Requires caprification.

30. The LARGE DARK RED FIG OF NAXARO. (M=*tina ta Alla u Ommu*, so called because it is grown at Naxaro, in the locality known as "*ta Alla u Ommu*" and at Saline). The tree is very vigorous, with large long-stalked foliage, nearly entire. The fruit is large, or very large, shaped like a Bourgeassotte, with a reddish violet rind. The flesh is deep red, very sweet and luscious, with small seeds. This fig is used for drying, but is a good table fig, and does not require caprification.

31. FIG POPE LEO XIII. (M=*tina tal papa*). A recent Italian variety introduced from Florence in 1903. The tree is of middling vigour, with three-lobed foliage, hairy on the upper surface. The fruit is middling in size, round, short-stalked, but jointed on a woody peduncle about $1\frac{1}{2}$ c.m. long. The rind is greenish white, delicate, beautifully fissured. The flesh is thick, reddish, fairly sweet. It is a good table fig, and requires caprification.

32. The VARIEGATED FIG. (M=*tina mnakkxa* or *tina ta Spanja*). This fig is grown at Marsascala and is said to be of Spanish origin. The tree is vigorous and productive with large, variegated, deeply cut foliage, variegated twigs and longish fruits, greenish white striped yellow. The flesh is light pink, luscious and sweet, with few seeds. Requires caprification. It is a table fig of attractive appearance.

The best figs to grow for the table are the Bourgeassottes, the long violet fig, the luscious white and the luscious grey figs, and the large broad red fig. For early figs, ripening in June, the St. John's fig can be relied upon to give a constant crop. The best figs for drying are the Smirne fig, the Calabria fig, and the white Bourgeassotte; in the second place also the luscious figs, the thick-skinned fig, the greenish red fig, the large broad red fig, and the main crop of the St. John's fig and of its white or green form.

Figs may be dried whole or incompletely divided into two parts down to the stalk. The best sorts to dry whole, are the Smirne fig, and the thick-skinned fig, but the small fruit of other sorts, such as the Calabria fig and the greenish red fig, may be dried whole. All other sorts being too watery, are incompletely parted into two to dry more quickly. The figs are exposed on trays of wood to the full action of the sun for two or three days, and when nearly dry the parted halves are brought together. The dried figs are then put into an oven at a low heat, and in about 10 minutes or a quarter of an hour are taken out again and packed at once, when still warm, in boxes or in casks, or in earthenware or glass jars. Heating in the oven is necessary to destroy any eggs of moths and spores of mould which prey on the dried fruit, and so the dried produce can be kept much longer in good condition. In packing dry figs it is usual to mix with them some leaves of the bay-tree, and roughly powdered or bruised anise seed, as well as sesame seed, to improve the flavour. Some common salt is also added, either directly in a fine powder or better as a spray, dissolved in a liqueur, such as rum, or orange-bitters or *anise-liqueur*. A few sweet almonds are sometimes added, and these are usually included between the halves of the fig when brought together before packing. Dried figs, carefully prepared, are a desirable dessert

in autumn and winter, but they are also a valuable food. Indeed, the vast proportion of our dried figs is used as food in the farmer's household, the price of ordinary dried figs being usually about the same as that of bread. Dried figs are a very mild laxative, and the syrup of green figs is a valuable home remedy possessing the same quality in a more pronounced form. Our farmers generally dry their figs on the stone walls of fields or on the terraced roofs of the farmstead, but this system exposes the drying figs to grave injury from a possible sudden shower of rain in August or September, besides the obvious risk of contamination with dust or dirth.

DISEASES OF THE FIG TREE.

The fig tree is subject to many diseases, but here reference can be made only to those having a practical importance to the grower.

A diseased condition of the fruit commonly met with on trees growing on low-lying and moist lands, consists in an undeveloped condition of the interior of the fruit, which assumes a yellowish brown colour, and becomes insipid to the taste. The seeds are often entirely absent so that the disease may be due very likely to a defective fertilization. This view is further supported by the fact that generally only the fruits which are first to ripen become so affected, and the disease is usually limited to vigorous trees growing on moist soils, the vigour of the growth having prevented the unfertilized fruit from dropping off when young.

It is known that when a fig tree dies a natural death, it is often difficult to replace it by another fig tree, as any young trees planted on the same spot invariably die soon afterwards. It is supposed that the dead roots leave a poison in the soil, which takes

many years to disappear altogether. It is known that trees nearly allied to the fig tree such as the mulberry, the black mulberry and the poplars, behave towards each other in the same manner, so that a mulberry or a poplar will not thrive long if planted instead of a fig tree which had died some time before. It is not clear what is the nature of this poison, but it is probable that the dormant mycelium of a fungus (*Armillaria mellea*) plays an important part in this curious phenomenon. All dead or dying roots of the fig tree or of the mulberry are generally found covered by a thick mesh of this mycelium, living saprophytically. The mycelium is able to remain for long periods in a dormant or semi-active condition, and is capable of spreading to the roots of the new tree, assuming at once a parasitic habit. It is not unusual to find clusters of the fungus *Armillaria mellea* with its honey-coloured pileum or umbrella and its long twisted white stalk at the foot of a dead and decaying stump of a fig tree. The poison left in the soil by rosaceous trees (such as stone-fruits and pome-fruits) seems to belong to a form of *Armillaria mellea* different from that of the fig tree, but it is likely that the loquat which is also a rosaceous tree, is liable to the attack of both forms of the fungus. As a preventive remedy it is advisable to dig up and burn all dead roots, as far as possible, to cart in some fresh healthy soil before planting the new tree, or where this is not possible, to soak the infected soil with a light solution of sulphate of magnesia (Epsom salt) in the proportion $\frac{1}{4}$ kilog. to 100 litres of water.

The fig-blight (M=*Inxief tat-tin*. It.=*Seccume del fico*.) is due presumably to the action of a bacterium or microbe, and is probably identical with the Gummosis or Bacteriosis of the fig as described by Comes and also by Cavara and Petri. The disease is said to be frequent in Southern Italy and Sicily, and is met with

in these Islands on trees growing in cool and close situations, or which have been neglected for a long time. It shows itself in spring by the formation of too many small and sickly shoots, with undersized leaves, many of which soon after become partly or wholly burned up or blighted and drop off, and therefore very little, if any, fruit is produced. In winter the extremity of these twigs with its terminal bud dies off, and the twig gradually dies down to the branch whence it had sprung, and after a sickly existence of several years the tree if left to itself may die altogether. In sea-side localities the disease is often attributed to the action of the sea spray, but in the case of injury by sea spray the leaves and new twigs become uniformly burned on the side most exposed to the spray, and as a rule the vigour of the tree is very little affected, stout shoots being produced in the course of the spring and fruits of good size and quality are obtained. Moreover, in fig-blight the wood of diseased twigs shows reddish moist streaks or veins, often prolonged downwards for some distance into the wood of branches which are apparently healthy; besides the obvious fact that the disease is sometimes seen in places where it cannot be attributed to the action of the spray. The only effective remedy against blight is hard pruning. In bad cases the branches will have to be headed back to the healthy wood. The root system should receive proper attention as regards tillage, and in poor soils a dressing of manure will be necessary. All prunings should be picked up and burned. Saprophytic fungi are sometimes found on twigs which had been killed by the fig-blight, but these of course have no practical importance.

Perhaps the worst fungus attacking the foliage of the fig tree is *Uredo Fici* Cast., which is the cause of "fig tree rust." The attack is manifested by rusty coloured spots thickly dotted all over the under surface of the leaf, often appearing as discoloured or dead

patches on the upper surface. Most fig trees are every year more or less affected by this fungus towards autumn, but when the attack is severer than usual and commences early in summer, the tree is defoliated in such a manner that the bare branches are unable to bring the green fruit to maturity. Against this disease there is no known remedy, but as a precaution the fallen leaves showing signs of infection should be collected and burned or made use of as a bedding for animals.

Among the scale insects the only one which is really dangerous to the fig tree is *Ceroplastes Rusci*, the fig-scale. For a description of this insect see under Citrus trees, page 85. This scale insect is found chiefly on the fig tree, but attacks also the Custard apple and the Quince, as well as the Pine, the Pear, the Apple and the Orange. In a bad attack both surfaces of the leaf, the leaf-stalk, the twigs and the green fruit, become dotted or covered all over with this scale, sometimes in masses sticking close together, and the sugary exudation produced by the insects attracts swarms of ants and flies, which indirectly assist to spread the insect from branch to branch. Moreover the sugary exudation of honey dew is sooner or later followed by an attack of the sooty fungus, so that the foliage, as well as the twigs and the green fruit, and sometimes also the branches and the stem become covered by a thick black crust. When the scale is brushed off from the twig, the suctorial organs remain embedded in the bark, and for some time continue to secrete tiny drops of honey dew, so that if the scale is removed in the morning and the twig inspected again in the afternoon, a droplet of honey dew will be found exactly on the spot where the suctorial organs are embedded. This proves that the honey dew is produced by the action of the suctorial organs on the sap of the tree.

Trees suffering from a bad attack of fig-scale become greatly exhausted, shed off their leaves very

early and as a rule fail to mature the fruits, which even if they ripen will be worthless either for the table or for drying. A good remedy is to prune heavily early in winter, and then to whitewash thoroughly the tree, trunk, branches and twigs, with lime, repeating the operation after about one month's interval. This scale has many enemies among the ladybirds, and is also decimated by the scale-moth *Thalpochares grossi* and *Dacruma coccidivora*, but it is advisable not to rely solely on these natural means to combat the evil.

Considerable damage is caused to the ripe fruit by the omnivorous and ubiquitous fruit-fly *Ceratitis capitata* or *Halterophora capitata*. This fly lays its eggs in the orifice of the fig, but often also makes use of its ovipositor to puncture the side of the fruit. The maggots which develop soon make the fruit useless before it is picked for use. The same fly attacks also the early or St. John's figs and it is commonly on these early figs that the first brood is hatched. The eggs of the fruit-fly are often pushed out of the orifice by the drop of sugary liquid which exudes from the fig when it approaches perfect maturity, in which case the fig escapes, the fly having laid its eggs too late for them to hatch before the commencement of the oozing out of the sugary liquid. Unfortunately, against the fruit-fly there is no remedy but to pick the fruit and dispose of it as early as possible, leaving no dropped fruit to remain on the ground in order to give no chance to the maggots to hide themselves in the soil and undergo their metamorphosis.

The fig is liable to the ravages of another fly, viz., the fig-fly (*Lonchaea aristella* Beck.) which is found all over North Africa and Egypt, and probably also in Asia Minor and Southern Europe. It has been lately detected in Sorrento and Sicily by Prof. L. Savastano. The maggots of this fly are very much like those of the fruit fly, and the damage caused by both flies to the

ripe fruit of the fig tree is much the same. However, the fig-fly attacks only the ripe fig, and is not known to be injurious to other fruits. The fig-fly is frequently met with on our fig trees, particularly on trees growing near heaps of manure, close to the farmstead, and on this account it is supposed that the fig-fly breeds also in decaying refuse or manure, like the common house fly. The fig-fly is about half the size of the common house fly, with the wings closely applied to its back, in a straight line, and not spread out as in the fruit-fly, or partly out as in the house fly. The fig-fly is of a shining black colour, its body covered with hairs of the same colour and its wings are dark brownish black. When the fig is approaching maturity the insect lays its eggs in the orifice, and presumably only there, as it has not the powerful ovipositor of the fruit-fly with which to penetrate its side. It also frequently deposits its eggs on the over-ripe fruit which has dropped from the tree. The eggs hatch in two or three days, and the larvae penetrate into the interior of the fruit and soon destroy it, imparting to it a rotten sour taste. In five or six days the larvae become full grown, and come out of the dropped fruit and hide themselves in the soil where in a few hours they are transformed into a chrysalis, about the size of that of the fruit-fly but of a darker colour. In six or seven days the fly emerges from the chrysalis to renew the evil. The fig-fly has three or four broods in the year, but as the attacks of the later broods are hardly more intense than those of the first and second broods, it is possible that it is kept in check by some natural enemy which so far has escaped detection. While the fruit-fly attacks chiefly the figs on the top of the tree, the fig-fly generally limits its attention to the fruits on the lower branches and those in the interior of the tree. The fig attacked by the fruit-fly becomes sour only when the larvae have almost reached maturity, but the larvae of the fig-fly cause the fruit to become sour very soon after hatching, sometimes when they are still

hardly distinguishable within the rotten pulp. Finally, the fig-fly attacks the early or St. John's figs with equal intensity and with the same results, at a time when the fruit-fly is still scarce, and is just beginning to become troublesome, owing to the yet uncongenial temperature. Against the fig-fly, as against the orange or fruit-fly, we can only react by indirect methods, (see page 72).

The common honey bee, and probably other winged insects, are attracted by the drop of sugary liquid at the orifice of the ripening fig, and by visiting one fruit after another, they inoculate a ferment which sets up fermentation, causing the fruit to become sour and quite uneatable, while it is yet on the tree, and even before attaining full maturity. The damage thus caused to the crop of early figs is often considerable, particularly if there are bee-hives in the neighbourhood ; but as other winged insects help to bring about the trouble, it is not possible to say exactly what is the extent of the havoc due to the activity of the bees. The rotten fruit may contain the larvae of the fruit-fly or of the fig-fly, but too often a most careful inspection will fail to detect any larva whatever, and the rotten and sour condition must be ascribed exclusively to the presence of a ferment.

THE WHITE MULBERRY.

Morus alba L.—MORACEAE-URTICACEAE.

Maltese=*ciausra*. Italian=*gelso*. French=*murier blanc*, *murier*.

The white mulberry or simply, the mulberry, is native of China and its cultivation in Europe dates from the middle of the sixth century, when its seeds were introduced into Constantinople along with the eggs of the silkworm, by two Benedictine monks on their return from the Far East. The mulberry is a large tree, leafless in winter, with alternate cordate and serrate leaves, sometimes lobed and acuminate. The flowers are produced in small and short catkins at the axilla of the leaf on the new twig, and come out along with the foliage. The individual fruit produced by each flower is a small one-seeded berry, the berries being closely packed together so as to form the fruit of the mulberry, this type of composite fruit being known botanically as sorosium. The tree is polygamous like the carob tree; the male and female flowers are produced in the same catkin, or in different catkins on the same twigs, but occasionally trees produce exclusively male catkins or female catkins.

The mulberry lives to a great age, and may have a trunk of one metre or more, in diameter. It agrees with all soils and all situations, but its powerful root system delights in a deep soil, and is not so decidedly a surface feeder as the fig tree. In a deep soil, with a moderately moist and porous subsoil growth is very rapid. The tree like its congener the black mulberry, exudes a yellowish liquid when wounded during active vegetation, and on this account both trees are popularly classed together as "milky trees", and this classification happens to be an accurate one both scientifically and practically. The

heartwood of the mulberry is close grained, yellowish brown beautifully veined with black, and takes a high polish. The tree is among the earliest to ripen its fruits. These are much relished by children and, as an early fruit, the white mulberry is not undesirable for the table, although owing to its sweet pasty taste it is rather flat and insipid to many palates ; but it is quite healthy and can be indulged in without ill consequences.

The tree is propagated by seed and very rarely by cuttings, and valuable varieties are propagated by grafting or budding on own seedlings. Propagation by seed gives the best results, and is that usually followed. The seed should be selected preferably from trees which are well fertilized by the presence of male trees in close vicinity. The fruits are picked when they are perfectly ripe, they are crushed or mashed together without injuring the seed, and the pulp is washed in water, when the seeds will fall to the bottom of the receptacle, and are then collected and dried, the stalks being afterwards separated by a sieve. The seed can be sown at once, or may be stored in small cloth bags to be sown in the following spring. The general practice with our gardeners is to sow at once as soon as the fruits are ripe, and instead of separating the seeds they resort to the following process. The ripe fruits are squeezed together and mixed with some garden soil or sand to form a paste which is spread out to dry in the sun. It is then reduced to a rough powder, and the seed along with the powder is sown in small seed beds which have been well supplied with rotten manure. The seed beds are laid out preferably in a cool situation along the northern side of a wall. They are then covered with dry twigs or foliage to preserve the moisture, and are watered lightly but frequently until germination has taken place, when the covering of twigs is removed. Another process which is still followed by the older gardeners, is to take lengths of 1 to 2 metres of the rough grass cordage used in

binding up dry branches in bundles for firewood, to besmear thickly this cordage with ripe mulberry fruits squeezed to a pulp, and to "sow" by burying this cordage in parallel lines about 10 c.m. apart, in seed beds prepared as above stated. The cords should be just covered with soil, because if buried too deep the seed will not germinate. The seed beds should be weeded frequently, and watered regularly in dry weather.

In a year the seedlings will be strong enough to be planted out separately in nursery beds, about half a metre apart. This operation is best performed towards the close of winter, and in two years the seedlings if encouraged to grow straight and tall by good cultivation will be about 2 metres in height and strong enough to be budded if required. Trees meant for the production of fruit should be always budded either with the large white variety or with the pink one, which are the best two edible forms in cultivation; but if intended for the silkworm industry, it is not necessary to bud them, or may be budded with the male form, which as it produces no fruit is more vigorous and gives a better yield in foliage. Seedling mulberries occasionally produce very good fruit, some varieties being almost as large and as dark coloured as the black mulberry, but they are generally tasteless and cannot compare in flavour with the two cultivated forms above mentioned. Budding is performed at any time from March to September, and the stock may be budded indifferently either close to the ground or as standards 1 to 2 metres high. Grafting gives also good results, but as in the case of the fig tree, it is not favoured by our gardeners. The operation of grafting is best performed towards the close of February or early in March, just when the buds are about to swell.

The white mulberry is rarely propagated by cuttings, chiefly for the reason that the cuttings do not strike very readily, and also because seedlings grow as quickly as cuttings, and give much less trouble. It is possible to

propagate the white mulberry by budding or grafting on pieces of the roots, but this method presents hardly any advantage on propagation by seed. Propagation by cuttings or by root-budding or root-grafting, if desired, can be performed at the time when the buds are about to move in February or early in March.

The following are the best known varieties or forms of the mulberry grown in these Islands.

1. The COMMON MULBERRY. (*Morus alba* Lin. typ.) Consists usually of unbudded seedlings. The fruit is middling or small, and may be of any colour from white and light pink to violet brown and nearly black. The fruit is eatable but too small to be valuable. It is generally shaken down the tree and fed to pigs, which seem to fatten readily on this diet. The foliage is good for the silkworm.

2. The CULTIVATED WHITE MULBERRY is the large-fruited, pure white form of the mulberry, usually propagated by budding as a fruit tree.

3. The CULTIVATED PINK OR DEEP ROSE MULBERRY, sometimes called the LARGE-FRUITED MULBERRY OF LOMBARDY. The fruit is as large as that of the preceding or larger, and is perhaps sweeter. It is propagated as a fruit tree by budding.

4. The MALE MULBERRY. The tree produces only catkins of male flowers which drop off soon after flowering, and therefore no fruit is produced. The tree is much more vigorous than the fruit-bearing mulberries, and as it gives a rich yield of foliage, may be propagated by budding as a foliage tree for the silkworm industry. It is also suitable for plantations along roads, both on account of its vigour and because it produces no fruit to entice children. Seedling male mulberries occur frequently among batches of plants raised from seed. It is noteworthy that the presence of a male mulberry near the fruit-bearing trees is necessary to secure well-

fertilized seeds for sowing. On the other hand, the neighbourhood of the male mulberry is not desirable when the fruit is meant for the table, owing to the fact that well-fertilized seeds are bigger and harder, and are therefore objectionable. At the same time it may be remarked that the presence of the male tree is not necessary to cause the fruit to set properly, although only a small proportion of the seeds will be capable of germination.

5. MULBERRY "ITALIA". Is a variety of Japanese origin, recently introduced in Europe, named "Italia" by the raisers as a compliment to Italy. The variety is propagated exclusively by budding or grafting as standard on ordinary seedlings. The tree is vigorous, with fine thick foliage. The leaves are large and very ornamental, deep shining green, with three to five or more long acuminate lobes. The fruits are small, and become red, and then almost black at maturity. This is in reality an ornamental tree, but the foliage is also suitable for the silkworm.

6. The WEEPING MULBERRY. (*Morus alba pendula*). This variety is propagated by budding or grafting as standards on seedling mulberries, about 2 metres above the ground. The branches curve sharply downwards like those of the weeping Sophora. The tree is very ornamental on account of its strange appearance, but is also very productive in foliage which is most easy to pick, and the tree is therefore recommendable for planting in view of the silkworm industry. The fruits are few and small, turn red and then black at maturity, and are quite worthless for use.

7. The MANILLA MULBERRY. (*Morus latifolia* Poir, also known as *M. multicaulis* Pierrot, or *M. tatarica* Desf., or *M. cucullata* Bonaf.). This shrubby tree is native of the Philippine Islands, and is probably only a variety of *Morus alba*. It is not a fruit tree, and is mentioned here on account of its great value for rearing

the silkworm. It is a low tree or shrub with many stems or branches coming up from the trunk or rootstock at the level of the ground. The leaves are large or very large and tender, and are produced in great profusion. The tree is very easily propagated by cuttings in winter or early spring, but cuttings can be struck almost as easily in summer when the tree is in full vegetation.

When planting mulberries for the silkworm industry it is important to keep well in view the following points, in order to obtain satisfactory results.

a). The plantation should be situated away from dusty roads, as the dust will impair very materially the quality of the foliage.

b). The trees should be planted on good land, to secure vigorous growth and an abundance of foliage of good quality.

c). The trees should be trained low, not higher than two or three metres, so that the foliage can be picked quickly and cheaply, without the use of ladders.

d). The trees should not be less than five metres apart, so that there may be no difficulty to make the land to yield approximately the same field crops as if there were no trees. This of course will greatly reduce the cost of production of mulberry foliage.

e). The fruit-bearing sorts produce less foliage, but the deficiency can be made up financially by feeding the fruits to pigs and poultry.

Defoliation for silkworm rearing should be gradual and systematic, and should be distributed uniformly over the whole plantation, so as to cause no check to the vegetative power of the trees. Old trees with many malformed or unhealthy branches may be rejuvenated by pollarding early in February, and in performing this operation it is better to pollard the main branches than the stem. However, if there is no option the

stem may be pollarded at $1\frac{1}{2}$ metres from the ground, making a slanting cut to cause the rain water to run off easily, and the wound should be thickly painted with tar as a preventive against canker.

CULTIVATION. The mulberry is as easily cultivated as the fig tree. The ground is tilled twice or thrice during the wet season to keep down weeds. Where the land is cropped regularly, the mulberry will be benefited by the fertilizers used for the crops, but special manuring is not needed, at least not oftener than once in eight years, and then the expense is recouped by a better yield of field crops. Pruning should consist in the removal of dead wood and of superfluous branches and twigs, at the same time keeping the tree in shape, and in case of trees meant for the production of foliage, preventing them from outgrowing the limit of height beyond which the picking of leaves becomes difficult and expensive. The weeping mulberry is pruned hard back every year, otherwise the branches will soon touch the ground, with the result that the leaves may become soiled and unfit for the silkworm. As a rule heavy pruning and shortening of the twigs to three or four buds, may be performed every second or third year with a view to increase the vigour of the tree, and the production of foliage and to improve its quality as well as to keep the trees within the prescribed height. Trees meant for the production of fruit should be pruned only sparingly, as otherwise very few fruits are produced, the fruit buds being produced almost exclusively towards the extremity of the twig. However, it is generally admitted that the foliage of small twigs produces silk of finer quality than foliage taken from vigorous shoots which are making fast growth.

The mulberry is best transplanted from the nursery to its final destination when its stem is about 3 c.m. in diameter, but younger trees as well as older trees

will bear transplanting without any difficulty. Trees with a stem fully 10 c.m. in diameter, if transplanted with care and heavily pruned back at the same time, incur little risk of failure. However, the larger the tree, the greater must be the care necessary for the operation, as well as the subsequent trouble as regards watering and attention. On the other hand, very young trees are more easily damaged or broken during the operation of tillage, and require a longer time to establish themselves properly, where the land is cropped. Transplanting is done in winter, from December to February. A pocket or hole is made large enough to receive the tree, the roots are evenly laid all round, any roots which have been severely damaged when taken up from the ground, being removed by a clean cut of the knife, and soil lightly dressed with well-rotted manure is packed carefully between the roots until the hole is filled in. It is advisable to plant the tree about 10 c.m. lower down than its former position in the nursery, in order not to have large roots too close to the surface and therefore constantly exposed to injury when the land is subsequently cultivated for field crops. The soil should be closely packed all round, and if necessary the young tree should be propped to prevent injury from wind when the new shoots are forming. Newly planted trees should be watered regularly during the first two or three summers until they are fully established, and the ground should be kept clean of weeds for at least 50 c.m. around the stem. Fully established trees require no irrigation, but if watered twice or thrice during the active period of vegetation, April-June, will give an increase of about 50 per cent. in the yield of foliage.

Most field crops and garden vegetables can be grown on land planted with mulberries, without any injury to the plantation, but certain field crops such as wheat and barley are liable to be damaged when

the labourers are picking the leaves of the mulberry. For this reason it will be necessary to sow only the open spaces between the rows of trees, leaving the rest for other cultivation. Crops which are lifted or harvested before the time when the feeding season of the silkworm is in full swing such as potatoes, green forages, winter vegetables, vetches etc. of course are not exposed to this drawback; and on irrigated lands summer vegetables can be grown without much trouble.

An adult middle-sized tree produces on an average 10 kilog. of foliage, and as according to the best authorities, from 18 to 25 kilog. of foliage are required to produce 1 kilog. of cocoons, it follows that in order to produce 1000 kilog. of cocoons (one metric ton), it is necessary to have at hand the foliage of 2500 mulberry trees of average size. Considering the question from another point of view, it is generally admitted that in order to feed the silkworms produced by one ounce (30 grammes) of "seed" or eggs from the moment that they are hatched to the formation of the cocoon, from 750 to 800 kilog. of foliage will be required, equivalent to the produce of about 80 adult trees of average size, so that the final production of cocoons per tree works at an average rate of $\frac{2}{5}$ of a kilogram. It is obvious that the production of foliage by very young trees is almost negligible. In the 4th or 5th year after planting the production may be reckoned at about 2 kilog. per tree. The full production is reached when the tree is 25 to 30 years old, and therefore large plantations of mulberries are necessary before it is possible to establish the silk industry on a satisfactory footing.

DISEASES OF THE MULBERRY.

As in the case of the fig tree, the mulberry when grown on lands which are too stiff and badly drained is liable to sudden death, or rather the tree falls into

a sickly condition in the summer and autumn, with yellowish weak growth, and dies soon after the foliage is shed, early in winter. The disease is due in the first instance to the inability of the roots to resist to the unfavourable conditions of the soil, whereupon the rootlets die off gradually, and the main roots thus weakened become an easy prey to the various fungi, chiefly to *Armillaria mellea*, the mycelium of which completes the work of destruction in autumn and winter when the vitality of the tree is at its lowest ebb. If the rootstock of the dead tree is allowed to remain in the ground, there is a great probability that sooner or later, perhaps in the following autumn, the characteristic large clumps of *Armillaria* in full fructification will sprout all around it. The disease may make its appearance also on well-drained red soils of good quality, but in this case the malady has been provoked by repeated and grievous wounds inflicted to the main roots during careless tillage. The mycelium of *Armillaria* at first establishes itself saprophytically on the injured wood of the roots, but soon spreads to the healthy tissues becoming a true parasite and killing the tree. Moreover, it happens now and then to see several mulberry trees situated within a radius of 20 metres around a tree which had succumbed to the disease, become sickly in their turn and die off in the same manner, in the following winter or within a period of three years from the death of the first tree, particularly if the stump of this tree has been allowed to remain long in its place before removal. In this case it is obvious that the mycelium has spread from the dead roots of the tree to the healthy roots of its neighbours. It is also noteworthy that another mulberry or a black mulberry or a fig tree planted in the same place where one of these trees had died from this disease some time before, very generally succumbs to the same malady in a short time after it had become established, the poison lingering in the soil for a considerable

period. It seems that the form of *Armillaria* which attacks the three kinds of trees above mentioned is particularly virulent, because Rosaceous trees, such as the loquat, the peach, the pear, the apple, the plum etc. succumb rapidly to the disease if planted on the spot where a mulberry or a fig tree had been killed by it, but on the other hand, neither the mulberry nor the fig tree are usually affected by the disease if planted on the spot where a rosaceous tree was killed by it. As *Armillaria* attacks many species of trees and shrubs, both fruit-bearing and ornamental, and will be frequently referred to in these pages, a brief description of this fungus will be useful.

Armillaria mellea Vahl. is a gregarious fungus, occurring in clumps of 3 to 5 or in large clusters of 30 to 60 individual mushrooms generally at the foot of a dead tree, or on the underground stump or large roots of a dead tree or shrub. The stipes or stem is 10 to 15 c. m. in height, and 1 to 2 c. m. in thickness, cylindrical, more or less contorted or flexuous, solid, brown below near the base, and lighter or white above, where it is striated and scaly or floccose. There is a well-marked ring high on the stipes and close to the pileum. The pileum is plane, 6 to 12 c. m. in diameter, clear brown or honey-coloured, darker towards the centre, concave at maturity. The margin is irregular and wavy, sometimes bent downwards. The pileum is firmly attached to the stipes, and is dry, almost velvety. The laminae are decurrent on the stipes ; they are white, and the spores are white. This mushroom is poisonous. It is important to collect these clusters of mushrooms as soon as they appear above ground, and burn them to prevent the formation of spores, at the same time it is obvious that no stumps of dead trees ought to be allowed to remain in the ground.

Wounds in the stem of adult mulberry trees heal very slowly. They are liable to set up an exudation

of a viscid dirty brown liquid which soils the wound and the bark of the stem below it. The bottom of the wound whether consisting of the inner bark or of the wood, becomes yellowish brown and of stony hardness. When this diseased condition becomes fully established, the wound hardly ever heals, the cambium being too much exhausted by the continuous exudation to form the usual covering of new tissue over the wound, and after a variable period the wound gives place to canker which destroys the heartwood for a considerable length of the trunk, and ultimately kills the tree. As there is little doubt that the disease is due to a microbe, it is recommended to scrape well the wound until the healthy bark and wood are reached, then to apply repeatedly by means of a brush a strong solution of sulphate of copper (5 per cent.) and when dry, to paint the wound well over with tar.

Polyporus hispidus (Bull) Sacc. is a fungus of woody texture often met with on the mulberry, and also but rarely on the walnut. Its mycelium feeds on and destroys the wood of the stem and branches and in due time its characteristic pileus buds out of the bark, sometimes reaching the size of a horse's hoof. Its colour is dark chocolate brown, with short brown hairs. *Polyporus hirsutus* Fr. is a rarer species sometimes attacking the mulberry. Its pileum is much smaller than that of *P. hispidus*. However, both species seem to be very virulent, their spawn or mycelium spreading rapidly through the wood for long distances along the trunk and branches, reducing the wood to a black crumbling mass, so that when the pileum makes its appearance the disease has already spread beyond remedy. The pilea should be cut off at once as soon as they appear, and burned, in order to save the other trees from infection. The diseased tree may have a lingering life of several years, but ultimately dies, or is blown down by the wind, all its wood being rotten and therefore offering no resistance.

There are two fungi which often attack the leaves of the mulberry late in summer, viz : *Phyllosticta morifolia* Pass. and *Phleospora moricola* (Pass) Sacc., but as they generally appear when the silkworm has already made its cocoon and the fruit season is over, they are not of much practical importance, although of course a severe attack may sometimes interfere with the proper ripening of the wood of that year's growth. However, these diseases would be a serious hindrance against the rearing of certain races of silkworms which have two or three breeds during the summer, but for the fact that the infection is usually limited to the older leaves which are considered too coarse to be fed to the silkworm, particularly in the early stages of its life.

The scale insects are the only important animal parasites affecting the mulberry. *Diaspis pentagona*, Targ. a scale belonging to the Diaspineæ, is common on mulberries and other trees all over Italy. It has been introduced into these Islands in 1912 along with plants brought over from Sicily, but early action was taken and the danger has been completely eliminated, so that this insect which attacks also other fruit trees as well as many ornamental trees and shrubs, at present does not exist anywhere in these Islands. This is a solitary case of an insect parasite introduced in these Islands and stamped out at once by human agency before it could spread and become established. In Japan, the United States, South Africa, Italy and Algeria this scale insect is kept very well in check by *Prospaltella Berlesei* a gnat-like Hymenopterous insect.

Aspidiotus Hederae Vallot var. *moricola*, is a frequent pest on the mulberry, sometimes covering the branches and the stem of young trees by a thick layer of small round white scales, which exhaust the tree and check its growth. Often the leaves become thickly dotted with the parasites, so that only the new or upper leaves on which

the parasites are few or too young, can be utilized to feed the silkworm. A good remedy against this scale is to whitewash thoroughly with lime the whole stem and branches, once or twice during winter. The fig scale, *Ceroplastes Rusci* L. is met with now and then on the mulberry, but the attack is never severe as in the case of the fig tree. The fluted scale (*Icerya Purchasi* Mask.) also attacks the mulberry and, but for the presence of its natural enemy, the small beetle *Novius cardinalis*, which keeps it in check very thoroughly, would prove a formidable obstacle to its cultivation. *Lecanium Oleae* Bernard and *L. hesperidum* Forst occur frequently on the mulberry, but they rarely affect seriously its growth or productiveness. All that *L. hesperidum* usually does is to cover thickly a few growing twigs with its grey-brown elliptical scales, stunting their growth and causing the loss of a few leaves, but the attack is too sporadic to call for special treatment. The attacks of the cottony scale, *Dactylopius Citri* Signoret are sometimes important, but are always limited to plantations growing in very sheltered situations. In bad cases large masses of *Dactylopius* held together by their cottony exudations are formed on the branches and twigs, and sometimes also on the leaves, with the result that the growth of the trees suffers a severe check, and the foliage becomes too soiled with the parasite to be of any use. As a curative treatment the stem, branches and twigs, may be whitewashed repeatedly and copiously from December to February. The whitewash, made of freshly slacked lime, may be applied with an ordinary brush, or may be passed through a sieve of copper gauze, and applied as a spray by means of a garden pump. The attacks of *Aphis* are rare and unimportant even on young trees, and even when the *Aphis* appears early in the season the attack is never so severe as to interfere with the production of tender leaves required for the newly hatched silkworm.

THE BLACK MULBERRY.

Morus nigra L.—MORACEAE (URTICACEAE).

Maltese=*Tuta*. Italian=*Gelsomoro o Gelso nero o Gelso di Spagna*.

French=*Murier d'Espagne*.

The Black Mulberry grows wild in the Caucasus, Asia Minor and Persia, and its introduction in Europe is much earlier than that of the white or common mulberry. In fact although the white mulberry was introduced into Sicily by King Roger from Greece in 1130 where it was introduced from the far east in the sixth century, the black mulberry was cultivated in Palestine in the days of David, and is mentioned by ancient Greek writers, Theophrastus, Dioscorides and Galen, as well as by Virgil and other Roman writers of the age of Augustus. It is probable that the cultivation of the black mulberry was introduced in these Islands as well as in Africa and Spain and other countries bordering the Mediterranean by the first Phoenician settlers, but as the fruit is only useful for immediate consumption, and as the tree could not afford material for extensive commerce, the silkworm being then unknown in the Mediterranean region, it is presumed that no large plantations of mulberries were started anywhere by those early colonists. It is generally supposed that the spread of the silkworm in Sicily and Spain was originally facilitated by the presence of black mulberry trees in those regions, the silkworm feeding almost just as well on the leaves of this tree as on those of the common mulberry. The silk produced by feeding on the black mulberry is said to be of rough quality, but considerably stronger, and for this reason it is stated that the silkworm intended for the production of silk-gut for fishing lines etc. is fed preferably on its foliage.

The black mulberry grows less quickly than the common mulberry, but may attain larger dimensions,

often reaching a height of 10 or 12 metres with an equal spread of branches. The foliage is thick and very shady ; the leaves are dark green, heart-shaped, regularly serrated, and of a thick leathery texture. The twigs are thick, with short nodes and large buds with blackish scales. The branches are more or less tortuous, and the trunk is rarely straight, but is generally tortuous, curved or even reclining on the ground. The tree bears the cold much better than the white mulberry, and unfolds its buds also later, and when in full foliage it is very ornamental. It is probably more resistant to drought than the white mulberry, but thrives best in a deep soil, moist but well drained, and in full sunshine.

Seedling black mulberries are very rare, and as they make very slow growth and are always weak the tree is never propagated by seed. A seedling at San Antonio Gardens has small leaves, deeply three-lobed, and weak contorted branches. When budded or grafted on the white mulberry, the black mulberry grows more rapidly, and produces fruit of fine size, although somewhat late to ripen, but the tree becomes liable to die suddenly after a few years of healthy growth. It seems that the liability of the white mulberry to die suddenly becomes much more pronounced when budded or grafted with the black mulberry, and accordingly it is rare to see a budded black mulberry more than twenty five years old. Grafting should be done early in March or when the buds are beginning to swell, but the operation of budding is best performed in July-September, selecting good buds from the new wood, and though the buds may develop before autumn, they only commence to make good growth in the following spring.

The black mulberry is best grown on own wood, and it is therefore always preferable to propagate it by layers or by cuttings. Layers are made at any time, but if made in the first days of March when the buds begin to swell, they strike root more easily, especially

if the layered branch is notched to induce the early formation of a callus and the emission of roots. The layers should be watered regularly, or at least should be made in a moist soil and cool situation, otherwise the formation of roots will be considerably delayed, or the layers may fail altogether to form roots. Rooted layers may be transplanted towards the close of the following winter, in February or early in March, and with ordinary care do not fail to establish themselves, even if they happen to be but poorly provided with rootlets. Cuttings are made during winter and should be from 20 to 40 c. m. in length, with the terminal bud on the last summer's growth. They should be unbranched, and if there are any side twigs these should be removed with a clean cut. The cuttings are planted in a moist situation, in soil deeply worked, with a top dressing of well-rotted manure, and should be planted deep about three-fourths of their length. They require to be watered carefully in dry weather and during the first summer. With due care about 50 per cent. of the cuttings will root, and the young plants may be allowed to remain for two or three years in the nursery bed to acquire strength, at the same time removing all side shoots to secure a clean straight stem, and then they may be transplanted to their final destination.

The black mulberry being a large tree with far spreading branches should not be planted less than eight metres apart. This distance will encourage the branches to spread, and these lower branches are generally more productive and produce finer fruit than the straight-growing upper branches. Planting is done in winter, preferably early in February, and the young trees being raised from cuttings or layers, and therefore having no tap-root, should be planted deep enough to encourage the formation of more roots at different levels all round the stem, so that the tree may have a firm

hold on the ground. Trees recently planted should be well watered at least during the first two summers. This is practically the only attention required to prevent failures, besides aiding the young trees to establish themselves more quickly. The tree will commence to bear fruit when quite young, from the second or third year after planting, every year increasing the yield until the 25th or 30th when the tree reaches full size. Afterwards the growth becomes slow, but the production is kept up for many years, trees over a hundred years old continuing to yield a normal production of fruits of good quality.

CULTIVATION. Like the fig tree and the common mulberry, the black mulberry is a surface feeder, and therefore when manuring the soil for other crops deep trenching in close proximity to the stem should be avoided, as otherwise many surface roots will have to be cut, and bruises of the main roots are dangerous because they may be followed by an attack of the dreaded root fungus. Where the soil is not cropped regularly, it should be tilled lightly first in autumn and again in mid-winter, and a third time rather deeply towards the close of March, and the ground being then properly levelled may remain untouched until next autumn.

It is advisable to trench the soil lightly and carefully to a depth not exceeding 15 c. m. every fourth or sixth year, towards the close of autumn, at the same time giving a substantial dressing of manure. This attention is particularly required if the foliage of the tree is habitually fed to animals, or if the dropped leaves are made use of as bedding for the stable, as in these cases the tree is deprived of the fertilizing material resulting from the natural decay of the foliage.

Pruning is done in winter, and should be limited to the proper thinning of superfluous twigs and small

branches in order to admit air, without interfering with the natural globular or hemispherical shape of the tree. All dead wood should be removed by a clean cut just within the living tissues. At the same time the pruner will remove any drooping branches which are too close to the ground and are too much shaded by other branches above them. Large wounds are always dangerous, but if unavoidable they should be painted over at once with tar, or with some other protective mixture, giving no time to the spores of fungi to establish themselves on the exposed wood. Pruning will cause a rather copious flow of latex or milk even in winter when the tree is leafless, and it is therefore important to perform the operation when a dry north wind is blowing so that the wounds may dry soon, as a prolonged flow of sap may become exhausting.

When fully established the black mulberry does not require irrigation, but the fruit will be much finer in size, and better in quality, if the tree is watered twice or thrice from May to July, especially in warm and dry situations.

The fruit begins to ripen in May, and may be picked every two or three days. The tree continues to ripen its fruits often well into August, but the late fruit is often small and contains too many seeds, their central stalk or core also becomes tough. The fruit is picked by hand, but our gardeners have an ingenious way of picking the fruit by means of a strong thread or thin cord tightly strung by a small piece of reed or other elastic material, about 30 c. m. long bent in the shape of a bow. With a little practice the use of this bow become more easy than direct hand picking, and besides presenting the great advantage that the fruit is not touched by the hand, it also protects the fruit better from undue squeezing or injury during picking. The pickers of the fruit, even when using

the bow, cannot avoid soiling their hands with the blood-red juice. To remove this they moisten their hands with the juice of the half ripe scarlet fruit, squeezing it between the fingers, and wash at once in clear water. Spots of the juice on clothing are removed readily by moistening lightly with water and exposing them to the fumes of burning sulphur.

The fruit of the black mulberry is eaten chiefly at breakfast, as fresh from the tree as possible, and is both very wholesome and agreeable to the taste. It is supposed to have powerful antiscorbutic qualities, and is used as a depurative of the blood, in the fresh state as well as in the form of jam or syrup.

DISEASES. The tree is liable to the same diseases as the white mulberry. It is rather less subject to root-rot, but attacks of *Phyllosticta morifolia* Pass. are more frequent and often severer on the black mulberry ; however the infection is rarely severe enough to cause defoliation before the ripening of the fruit.

THE POMEGRANATE.

Punica Granatum L.—MYRTACEAE.

Maltese=*Rummiena* or *Rimmiena*. Italian=*Melagranato* or *Melagrano*.

French=*Grenadier*.

The Pomegranate was the national tree of Phoenicia, and the Phoenician architect of Solomon's temple did not forget to place a chest of bronze pomegranates on each of the two bronze pillars at the entrance. This beautiful fruit surmounted by the crown-like calyx, and full of seeds each surrounded by juicy pulp which is often of a delicious flavour, is a fit emblem of Providence. The tree is a native of the East, from Greece to India, but is naturalized in our valleys, in several of which it grows wild or half-wild. The tree is deciduous, but on account of the lively green of its small elliptical foliage and the large scarlet flowers, followed by the large fruit often beautifully coloured, it is an ornamental tree of no mean value, besides its commercial importance as a fruit tree. It is a tree often exceeding 4 metres in height, with a trunk more or less crooked, whose yellowish brown bark flakes off in small pieces with age, but owing to its tendency to throw up suckers from the base of the trunk, at any rate when young, it often acquires a shrub-like character. In the typical wild pomegranate the fruit is sprightly acid, and is uneatable without the addition of sugar, and the plants are therefore budded with one of the cultivated varieties. The juice of the cultivated pomegranates contains much fruit sugar and has marked refreshing qualities without astringency. The leathery peel of the fruit and the placental segments to which the seeds are attached, are very rich in tannic and gallic acids, and are extensively used by dyers. They also

contain pelletierine, a very active anthelmintic principle, which is also found in the bark of the stems, and especially in the roots.

SOIL AND SITUATION. The pomegranate thrives well in all soils and all situations; it is but little affected by stagnant humidity, and delights in cool and moist situations. It is one of the trees more often planted in the yards of country houses, for which purpose it is eminently suitable, chiefly on account of its powerful root-system which effectually dries up all moisture from the foundations of the building, in addition to the fact that the tree is leafless in winter, and its light foliage does not obstruct too much the rays of the sun in summer. It is generally planted along with other fruit trees in the gardens at the head of valleys or in ravines, where it soon establishes itself and requires no further attention beyond hoeing twice or thrice a year, and an occasional pruning. It is also quite at home along the boundary stone-walls of fields, even in exposed situations, and it would make an excellent and remunerative hedge-bush if so desired. Under good cultivation, and on good and moist lands its growth is very rapid, and is very productive. For this reason it is frequently planted along the watercourses on irrigated lands, where its presence is not considered detrimental to the vegetables grown in its neighbourhood.

PROPAGATION. The pomegranate is easily grown from seed, and chance seedlings are met with everywhere in gardens and valleys. Sometimes there is a reversion to the sour type of the wild pomegranate, but usually there are only slight variations from the type as sown. The seed should be sown soon after maturity, or if that is not possible, it should be stratified, and then sown in spring; but the pomegranate is so readily propagated by other methods, that nobody thinks of propagating it by seed.

Propagation by cuttings affords the easiest way of multiplying the pomegranate. Cuttings are taken in winter, from November to February, and may be of any quality, but two-year old wood up to the thickness of a lead-pencil, and about 20 c. m. in length answers best for this purpose. The cuttings are planted in a cool situation, about 20 c. m. apart and deep about $\frac{3}{4}$ of their length. They require no attention beyond keeping the soil clear of weeds, and occasionally watering them in dry weather.

Layers are made in the usual way. The best time for layering is when the tree is putting out the new foliage in March and April, and in about six weeks the layers will be sufficiently rooted to bear removal. Most gardeners adopt a simpler and less troublesome method of layering. The lower branches if of sufficient length, are partly broken, and brought lower down, a trench is opened and the branches are buried at a depth of 10 to 20 c. m. leaving the extremities of the twigs exposed. This operation is usually done in winter or early spring, before the formation of new foliage. By next winter every twig will be found to have rooted, especially if the gardener has been careful to water the layers a few times in summer. They may then be removed and planted at their destination, but of course will become much stronger if allowed to remain for another year. Sometimes a whole tree is thus layered, the stem being brought down by cutting the roots on one side. By this means a large quantity of plants can be raised, with very little trouble.

Suckers thrown up by the tree, around its base, are often found rooted, and afford another ready way of propagation.

Grafting and budding as a method of propagation, are hardly ever resorted to, except when it is desired to change the quality of a tree already in existence, or when it is desired to utilize wild pomegranates of the sour type or seedlings of inferior quality.

The pomegranate flowers towards the close of April and the flowering period is often prolonged till June. The fruit is ripe in October, but keeps well on the tree, or stored, far into the winter, sometimes until spring. The flowers are bisexual, but are not of the same value as fruit-producers. The true fruit-producing flowers have a long, fleshy, well-developed calyx, of a reddish or yellowish green colour, with a plump and well-marked ovary. The other type of flowers as a rule have a weak funnel-shaped calyx of a deep red colour, and a hardly distinguishable ovary. In these flowers the petals are often slightly larger and the stamens are more numerous and better developed than in the others, and it is probable that their function is to fertilize the true fruit-bearing flowers, although they occasionally set fruit, which however always remains small or at least undersized.

A prejudice quite common with our gardeners is that the pomegranate is fertilized by the white flowers of *Ammi majus* L. (in Maltese=*dacra*) or of *Tordylium apulum* L. (in Maltese=*ħaxixet it-trieraħ*), two umbelliferous plants common everywhere in our fields and valleys. Small bunches of flowers of any of these plants are tied to the twigs of the pomegranate in May, and the operation is repeated once or twice during the flowering period. Of course, from a botanical standpoint the practice is absurd and indefensible, but after a series of careful trials I am unable to deny that the operation is generally followed by increased productiveness, and it is difficult to account for this unexpected result, except on the supposition that the white flowers of the umbelliferous plants above mentioned may attract a larger number of pronubal insects, to serve as pollen carriers between the two types of flowers of the pomegranate.

The following are the principal sorts of pomegranates existing in these Islands.

1. The SOUR POMEGRANATE. (M=*Rummien kares.*) The fruit is slightly larger than that of the wild pomegranate, and is greenish yellow, suffused brown, at maturity. The grains or seeds are fairly large, having a deep rose-coloured pulp, with a soft stone, and the juice is sprightly acid, with a sweetish after-taste. The tree is fairly productive. This is considered as an eatable variety, but is fast disappearing from cultivation.

2. The RED-GLOBE POMEGRANATE. (M=*Rummien bullar.*) The tree is very productive. The fruit is very large, nearly spherical, with a thick rind or peel, which is deep yellow, entirely or almost entirely suffused with lively claret red. The grains are large or very large, of a deep claret red, with a stone which is hard in some forms, and soft in others. The juice is acid, but has a delicious vinous and sweetish flavour. As a dessert fruit it is very ornamental and its vinous acidity is liked by many consumers.

3. The FRENCH POMEGRANATE. (M=*Rummiena francisa*). The tree is very productive. The fruit is large or very large, with a greenish yellow peel, often slightly suffused rose, or coppery red or claret. The pips or grains are of good size, rose or deep rose, with a small hard stone, and sweet juice having a grateful acidity. This is the pomegranate more often planted, owing to its fine appearance, productiveness and good commercial qualities.

4. The SANTA ROSA POMEGRANATE. (M=*Rummiena ta Santa Rosa*). The tree is very productive, probably the most productive of all pomegranates. The fruit may be large, but is always inferior in size to that of the French pomegranate, and splits open more often than that of other varieties. The peel is rather thick, of a beautiful deep yellow colour, generally with a large rose, deep rose or red blotch on one side. The grains are rather small, rose or deep rose in colour, with a

small stone which is rather soft, and the juice is sweet, with a very delicate flavour. In certain forms the fruit is small, sometimes very small, but then the tree bears quite an enormous quantity of fruits.

5. The BLOOD-RED POMEGRANATE. (M = *Rummienna demmia*). The tree is productive, with deep green foliage. The fruit is middling, sometimes large. The peel is light green or yellowish green, often suffused brown or coppery red, and more or less dotted with brown. The grains are fairly large or middling, of a deep blood-red colour, with a hard stone, and slightly acid juice, rather sweet, but with a flat flavour. This variety is considered inferior, and is becoming rare in our gardens.

6. The SANTA CATERINA POMEGRANATE. (M = *Rummienna ta Santa Catarina*). The tree is very productive, with deep green foliage. The fruit is generally small, with a green or light green peel, often dotted or tinted brown. The grains are small, ruby red or bright claret, with a very small and very soft stone. The juice is sweet and has a delicious flavour. The fruit keeps well for a long time, and is little liable to split. This is the best pomegranate as a dessert fruit, notwithstanding its small size and the unattractive colour of the peel. A form producing larger fruits with larger grains is also cultivated, but is far less productive.

7. The SAN GIUSEPPE POMEGRANATE or MULE'S TOOTH POMEGRANATE. (M = *Rummienna ta San Giusepp*, or *ta Snien il Baghal*). The tree is little productive. The fruit is very large or enormous, sometimes measuring over 20 c.m. in diameter. The peel is comparatively thin, and the colour is greenish yellow, mottled brown, often suffused light pink or light coppery red on one side. The grains are very large and long, flesh-coloured or light pink, with a long but very soft stone. The juice is very abundant and very sweet, with a fairly good

flavour. This pomegranate comes next to the preceding as a dessert fruit.

The double-flowered pomegranates never bear fruit, the stamens and pistil being transformed into petals, and they are therefore purely ornamental. The flowers continue in bloom for a long time, as the petals are renewed by new productions from the centre of the flowers. There are three forms of the double-flowered pomegranate, viz : (1) the typical double red form, (2) the red-and-white double pomegranate, in which the flowers are very large and double, and the red petals are variegated with white, and (3) the pure white double pomegranate, bearing rather small double white flowers. The double-flowered pomegranates particularly the large red-and-white double, are very ornamental, and are frequently met with in our gardens.

DISEASES OF THE POMEGRANATE.

The fungous diseases attacking the pomegranate are few and unimportant. The thick round woody pileum of *Fomes robustus* Karst. var. *Punicae* Sacc. is sometimes found on old trunks of the pomegranate. As a result of the presence of this fungus the heartwood of the stem rots off, and sooner or later the stem becomes too weak to perform its function, and is replaced by strong suckers thrown up from the base of the tree. *Polyporus hirsutus* Fr. is another rare fungus whose pileum has been found on the stem of an old pomegranate at Boschetto. *Aposphaeria punicina* Sacc. attacks the extremities of the twigs in dry localities, the twig is killed and the fructifications of the fungus appear as minute black dots in vertical lines along the bark of the twig. Clumps of *Armillaria mellea* Vahl. are occasionally formed at the base of old trees in damp situations, but the pomegranate is rarely killed by root-rot caused by this fungus.

Considerable damage both to the tender foliage and to the flowers is frequently caused by a dark green *Aphis*, which usually makes its appearance in April or early in May, and persists during all the time that the tree is in active growth, as well as on the growing fruit. Spraying the tree with lime-wash, twice or thrice in winter at intervals of fifteen days has given very good results against this insect. A species of *Lachnus* is commonly found in countless numbers on the stem and large branches in close localities, but with no ill results. One of the *Acari*, probably a species of *Tetragnathus*, is common on the twigs as well as on the growing fruit. Its attacks are followed by a suberification of the rind which becomes at first glistening whitish green and afterwards brownish, but the quality of the fruit is not affected. The large yellow black-spotted larva of the borer moth, *Zeuzera pyrina*, is found tunnelling in the stem and branches, and is often very troublesome. Small branches break off as a result of this attack, and the fully developed larva, or its chrysalis, is found in the part broken off, awaiting to complete its metamorphosis, before issuing forth as a winged insect. The thick rind of the fruit is a bar to the attacks of the fruit-fly, but whenever the fruits split in autumn, this fly is seen sucking the sweet juices of the pips or kernels, and frequently deposits its eggs in them. The ravages caused by rats are far more important. These rodents gnaw off a round hole on one side of the fruit and eat the juicy kernels, returning night after night until the whole interior is eaten clean. As stated at page 65, under Citrus trees, a pinch of white arsenic thrown into the interior of the damaged fruit will be found useful to keep down these ravages.

ROSACEOUS FRUITS.

It is natural to suppose that fruit trees belonging to the order Rosaceae, should be linked together by definite morphological and anatomical characters, on which the order has been constituted botanically as a distinct entity. However, their close relationship is also clearly demonstrated by other factors of great practical importance which are within the domain of the horticulturist, and force themselves upon the most casual worker in his daily practice in the nursery and in the orchard. The Maltese expression "*frott irkik*" has been often translated into English as "small fruits" which of course is not only incorrect, but misleading. The same expression is still more often translated into the Italian "*frutta sottile*", a strictly literal translation, now sanctioned by frequent use, which happens to unite the two qualities of being amusing and absurd. The local expression "*frott irkik*" is in allusion to the short life or weak vitality (*ruh irkika*) of this class of trees, as compared with Citrus trees and other trees of longer life and more permanent nature, and has no relation to the size of the tree or of the fruit.

Leaving aside the strawberry, the blackberry and the raspberry, which are included in the category of "small fruits", the other rosaceous fruits may be grouped into two classes, viz : the kernel-fruits and the stone-fruits.

The kernel fruits or pip fruits or pome-fruits (It = *frutta a pomo*, F = *fruits á pépins*) include the pear, the apple, the quince, the medlar, the service, the hawthorn and the loquat or Japanese medlar. These fruit trees

(tribe Pomaceae) are united together by close affinity, which is shown not only by their anatomical character, but also by the facility with which they can be budded or grafted upon each other. Thus, the pear can be grafted on pear seedlings, on the quince and on the hawthorn, the apple can be grafted on several species of wild apple, on the quince and on the hawthorn; the quince can be grafted on own seedlings, on the pear, on the wild apples and on the hawthorn; this last can be grafted on hawthorn seedlings, on the pear, the apple, the quince and the loquat, and the loquat can be grafted on the hawthorn as well as on its seedlings, while the medlar can be grafted on its seedlings, on the quince and on the hawthorn. The service tree is more refractory, but can be grafted on its own seedlings or suckers and on *Pirus aucuparia* and other species of *Pirus*. The kernel fruits produce their flowers in umbels or clusters, rarely in panicles. Their fruit or pome is the enlarged receptacle or calyx of the flower, and at the central part or core is divided into five locules each containing one or more soft-coated seeds (pips or kernels). The five segments of the calyx persist in the ripe fruit. They are further linked together by their common liability to certain fungous or insect parasites, and as a rule do not exude gum from wounds or breaks of the bark of the stem or branches.

The stone fruits or drupe fruits (It=*frutta a nocciuolo*, F.=*fruits à noyaux*) include the almond, the peach, the nectarine, the plum, the apricot, and the cherry. These fruits are closely related to each other in the same manner as the kernel fruits. In fact the almond can be grafted or budded on its seedlings, on the peach, on the nectarine, on the plum and on the apricot; the peach and nectarine are grafted on the almond, the plum, the apricot and on their own seedlings; the plum is grafted on the wild plums, on the almond, on the peach and nectarine and on the apricot; the apricot can be

grafted on its own seedlings, on the plum and on the almond. The cherry, like the service tree among the kernel fruits, is less accomodating being grafted only on its seedlings or suckers, and on species of wild cherry. The stone fruits (tribe Amygdaleae) produce their flowers singly, that is each flower is usually in separate buds, or there may be two flowers in one bud, and the fruit consists of the fertilized superior ovary, and contains only one hard-shelled locule, or *stone*, enclosing one or sometimes two seeds. These fruit trees show their relationship also by their common liability to certain diseases, and by the fact that they all exude gum from wounds in the bark of the stem and branches.

A feature common to all rosaceous fruits, including strawberries and other small fruits, is that when they die they all leave a peculiar poison in the soil owing to which any rosaceous tree planted to replace them, cannot thrive well, and generally dies as soon as it has established itself properly, that is as soon as its roots have reached the dead and rotten roots of the former tree. This poison often lasts for a considerable time, sometimes as much as ten years or more, and persists for a longer period when the dead tree has been a large one. The poison seems to be more virulent on lands which are not well drained, but its action in a cool and moist locality is much the same as in a dry and sunny one. Not all rosaceous fruits are affected by this poison to the same extent. Of the kernel fruits, the quince seems to be the most susceptible, and of course the pear grafted on the quince suffers to the same extent. On the other hand, the pear growing on pear stock is the most resistant of all kernel fruits. The almond, particularly the bitter almond, is the most resistant of the stone fruits and perhaps also of all rosaceous fruits, but when the almond is used as stock for the peach it loses much of this power of resistance, and becomes weaker still when

used as stock for the plum. The least resistant is the cultivated plum when grown on own roots, and worse when grafted on the wild plum (*Prunus spinosa*). However the wild plum is itself fairly resistant, and imparts this quality to the plum grafted upon it, if it is allowed to form one or two suckers as close as possible to the grafted stem, provided of course that these suckers are not allowed to grow too much, and exhaust the tree in their turn. The precise nature of this poison is not known, but as in the case of a similar disease of the fig and of the mulberry, clusters of a toadstool (*Armillaria mellea* Vahl.) develop at the base of the decaying trunk or stump of rosaceous trees which have been dead for some time, so that this poison may be only the dormant mycelium of the fungus still lingering on the rotten roots, or it may be a chemical poison secreted by the fungus, which weakens the resistance of the new trees and so causes them to become an easy prey to the dormant mycelium.

As the infection of the soil has a tendency to extend radially from the first tree which has succumbed, it is important to remove the tree as soon as the grower is satisfied that it has become too sickly to hold out hopes of recovery. The larger roots should be dug up and burned, and the hole made for their removal should be allowed to remain open and exposed to the beneficial action of the sun and the air, until the time comes to replace the missing tree. Dead trees should be removed at once, the roots dug up and burned, and the soil carted away from other rosaceous trees, and replaced by fresh soil, so that the roots of the new tree may not be in contact with infected soil. Disinfection of the soil can be carried out, should the cartage of infected soil prove too expensive, and the process consists in mixing it with fresh lime in the proportion of 2 or 3 kilog. per

square metre, and then digging deeply and soaking thoroughly with water. Sulphate of magnesia (Epsom salt) is also known to be an efficient corrective for infected soils, and is distributed either in substance or as a fairly strong solution.

The stone fruits are further linked together by their common liability to exude gum from breaks and wounds in the bark of the stem, branches and twigs. This is of course a diseased condition and may be due to various pathogenic causes. Wounds in the bark caused by pruning in summer or by accidental injuries may cause an exudation of gum in the shape of drops or of irregular worm-like lumps which are usually transparent and colourless or may be tinged yellow or red. A plethora of sap in the course of the summer provoked by a sudden excess of moisture in the soil, brought about by irrigation, is sure to cause breaks in the bark attended by an abundant flow of gum. Independently of these physical causes, an abundant formation of gum in summer or autumn, either as small drops disseminated all over the stem and branches, or as large lumps of dirty, dark, semiliquid gum, is a sure indication of root trouble, particularly if at the same time the tree is in a sickly condition with weak growth and chlorotic foliage, and the tree will probably succumb in the course of the following winter. The unhealthy state of the roots may be due to various causes, such as an excess of humidity with bad drainage, a long and exhausting period of drought followed too suddenly by liberal irrigation, the presence of fermenting organic material, or an excess of nitrogenous manures, but here again the most frequent cause of trouble is the insidious presence of the mycelium of root-rot fungi above referred to.

THE PEAR TREE.

Pirus (Pyrus) Communis Lin.Maltese=*angiasa*. Italian=*pero*. French=*poirier*.

The wild pear (*Pirus communis* L.) and its variety the almond-leaved pear (*P. communis* var. *amygdaliformis* Vill.) are still met with growing in the valleys of Malta, and suckers of seedlings taken from them are used by our gardeners as stock for grafting the cultivated pear ; but the distribution of the wild pear extends to all the countries bordering the Mediterranean, as well as to Central Europe, the Caucasus, Central Asia and Northern China. The wild pear is highly ornamental and its trusses of pure white blossoms are larger and finer than those of the cultivated pear, and bloom four or five weeks earlier, usually in February. All cultivated pears are supposed to derive their origin from *P. communis* var. *Achras* Gaertn. (= *P. Piraster* L.) a variety of the wild pear common all over the continent.

The pear has been cultivated by the ancient Greeks and Romans, but the older varieties have been superseded by more recent sorts, chiefly of French, Belgian and Italian origin, which are less gritty and therefore more palatable. However, the cultivation of the pear as a first class dessert fruit, on an extensive commercial scale, is in most countries a comparatively modern development.

The tree has a pyramidal habit of growth, with a deep tap root when grown on own roots, but in this Island rarely exceeds four metres in height. When on own roots it thrives best in a deep moderately moist soil, preferably of a clayey nature, with considerable admixture of calcareous earth ; but when grown on quince stock it is more productive and produces fruit of better quality if planted in rich porous red soils. Very dry situations are unfavourable to the pear. In sunny and sheltered situations the tree grows with vigour, and the production is regular and of better quality, but in

situations which are too shaded, the growth is invariably slow and weakly, the production is low, and the fruit is generally gritty at the core even in the best varieties. Shelter from high winds is essential to obtain a good production, and as the blossoms of the pear are formed in trusses, and ordinarily bloom at the same time, prolonged wet weather during the flowering period is followed by a poor production, the rain washing off the pollen and preventing fertilization. However, in certain varieties the flowers do not bloom together, the flowering period being sometimes prolonged for more than a month and these sorts are therefore not affected by bad weather to the same extent as the others, although late blossoms are frequently sterile or produce undersized fruit.

The pear tree delights in a moderately moist soil, indeed the tree requires the same attention as regards irrigation as an orange tree, and perhaps more. In fact if about midsummer the interval between one irrigation and another is unduly prolonged, the foliage soon turns yellow and drops off, leaving the tree almost bare, so that with the next watering or with the first rains of autumn the flower buds already formed for next year burst at once into bloom, and as a consequence next year's crop is seriously compromised. The pear tree has naturally a fairly long life, but it is so much persecuted by the destructive wood-borers that it is justly considered as very short-lived. It is owing chiefly to these wood borers that the pear is not grown here more extensively. Isolated specimens of the pear growing out of reach of the borers grow to a great size and produce enormous crops year after year.

PROPAGATION. New varieties are of course raised from seed, and for this purpose the seed is best reserved from fruits produced by specially fertilized or crossed blossoms, or else from selected fruits of superior table varieties. However, propagation by seed is only resorted to for the purpose of raising wild or half wild stock for

grafting or budding. In this case any pear seed will do, many continental nurserymen making use of the pips or kernels of the half-wild small-fruited sorts used only in the manufacture of perry (poiret), a beverage like cider, the kernels of this type of pear being more easily obtainable in quantity for nursery use, than those of other types of pears. Promising seedlings raised from selected table pears can be re-grafted or re-budded on adult trees already in bearing condition, and in this way the quality of their fruit may be ascertained in a short time, as otherwise they will require at least eight years to come to fruit.

The kernels should be stratified at once on removal from the fruit, because if kept too long, they may become excessively dry and fail to germinate. They are best stratified by mixing them with sand or with common garden soil, and are stored in boxes or in shallow earthenware pots, covering the top with a layer of sand or soil about 2 c.m. thick. This system is better than packing the seed or kernels in layers 2 c.m. thick, alternating the layers of kernels with layers of sand or garden soil of the same thickness.

Sowing is done early in March in beds properly prepared with well consumed manure in a cool and shaded part of the nursery, and the pips are distributed evenly, with an average space of 2 c.m. apart, and are covered by a layer of 1 to 2 c.m. of finely sifted soil well mixed with leaf-mould or old manure. The bed should be sprayed frequently with a fine rose and kept well clean of weeds. Germination takes place in two or three weeks, but may be prolonged for one month or more, and with ordinary care the seedlings will be about 10 c.m. high by autumn. In winter they may be shifted to the nursery, but it is better to allow them to remain for another year in the same bed to grow stronger. Transplanting is best done towards the close of winter, in February, the seedlings being taken up with as many

roots as possible, the tap root is cut short to induce the growth of lateral roots, and all side twigs are removed. The seedlings are then planted in lines on the square, or better on the quincuncial system, about 60 c.m. apart, the soil is packed firmly around the roots, and if the weather is dry the operation is completed by a copious watering. The plants meant for stock may be budded in the following March or may be budded in autumn, but then the buds will remain dormant until next spring. All seedling pears of whatever origin, raised for stock, are known by French writers as *poiriers franc*, and pears grafted or budded on them are called *poiriers sur franc*, pears on own roots, to distinguish them from those grafted or budded on the quince, *poiriers sur cotonnier*.

Unfortunately, cuttings or layers of the pear strike root only with the greatest difficulty, and therefore pear trees grown from cuttings or layers are rare. Moreover although the wild pear throws up suckers rather freely, and these suckers if transplanted with due care in winter generally do well, the cultivated pear grown from cuttings or layers very rarely produces any suckers, and the chance of transplanting such suckers with success is a remote one. This is all the more extraordinary when it is considered that cuttings of the pear planted in a moist soil produce an abundant callus, and the majority of them commence to form new leaves at the usual time in spring, and may continue in leaf well into the summer, but ultimately die off without emitting any roots. It is therefore practically impossible to propagate the pear on a considerable scale from cuttings or layers, and this is regrettable because a pear tree growing on its own roots will throw up new stems and start to new life, in the event that the original stem is destroyed by the wood borers.

The pear is propagated on a commercial scale exclusively by grafting or budding on pear-seedlings or

on the quince. Grafting or budding on the wild pear is adopted only in those places where wild pears are abundant. Grafting on the hawthorn gives good results, and accordingly the wild hawthorn (*Crataegus Oxyacantha* L. var. *monogyne* Jacq.), growing in valleys is frequently grafted with the cultivated pear, but as in the case of the wild pear the self-sown hawthorn is grafted where it grows, and is rarely transplanted, although the hawthorn bears transplanting almost as well as the quince. The hawthorn, if desired, is as easily propagated by seeds or kernels as the pear, but the kernels require to be stratified for about a year before sowing, otherwise they take two years to germinate. The hawthorn is also easily propagated by suckers, and cuttings strike root fairly well. The quince is most readily propagated by cuttings and also by suckers which are freely produced around a stem which has been cut down. The common half-wild type of quince is preferable as stock, being more resistant to drought and perhaps more vigorous.

Cuttings of the quince are planted in winter (October-February) and should not be thicker than $1\frac{1}{2}$ c.m. in order that the stock may not be too thick when budded in the following spring or grafted in the following winter. If the quince stock is too thick the graft is more liable to fail. However, quince stock is best raised from quite small cuttings of a year's growth, not thicker than an ordinary lead pencil, with or without a heel of the old wood. These cuttings are planted in beds, and are well watered throughout the summer. In October they will be strong enough to be transferred to the nursery, where they are planted at the proper distance apart, as in the case of pear seedlings, and budded in the following spring or grafted next winter. Those rooted cuttings which when transplanted are found strong enough to bear a graft, may be set apart and then earthed up provisionally in a trench until February, when they

are taken up again, grafted with one scion, and planted apart at proper distances in the nursery to complete their development. Well-rooted suckers if strong enough may be dealt with in the same way. The system of transplanting the pear or the quince, or indeed any other rosaceous deciduous fruit tree, including the apple, the peach, the nectarine, the apricot etc. in October or early in November, has the advantage that the root system starts growing at once and becomes partly established before its activity is definitely stopped by the cold of winter ; but the gardener when transplanting young trees still in leaf should be careful to strip them of their leaves, leaving only the terminal leaf of each branch or twig in order to prevent the buds from pushing out or moving, along with the movement of the roots.

All varieties of pears will do well on "own roots," that is grafted or budded on pear seedlings. Their growth is vigorous, and attain a large size, but they take a long time to come to fruit, and generally when they commence bearing, the first fruits are of inferior quality, although later on when the tree has nearly reached adult size and has lost the original vigour of the first years, the fruit improves in quality, and as a rule enormous crops are produced every year. On stiff clayey soils and on deep red soils which are highly charged with clay and are therefore of a retentive nature, pear trees grown on own roots will do much better than those on quince stock, and will give better results as regards longevity and productiveness, and are also less affected by the wood borers. For shallow and light red soils, resting on an open and porous subsoil in warm localities, the pear grown on quince stock is more suitable, as the pear grown on own roots will disagree with such soils and if it survives at all, is sure to become stunted and unproductive. On these soils the quince stock, also, thrives better and produces stronger and finer trees than on clayey soils.

On the other hand, there are certain varieties of pears which possess little affinity with the quince stock or disagree with it, and therefore require to be grown on pear seedlings. If grafted or budded on quince stock these varieties often do well for the first year or two, but the graft never binds well with the stock and the young tree dies off after a precarious life of a short duration. Where no pear seedlings are available for stock, or where owing to the nature of the soil the quince stock is preferable, the difficulty may be overcome by rebudding or regrafting (*surgreffage*). This operation consists in budding or grafting in the first instance the quince stock with a variety of pear which thrives well on that stock, and then the young pear is rebudded or regrafted with the desired variety at a distance of 10 to 20 c. m. above the original graft on the quince stock. In this manner although the roots of course belong to the quince stock, the pear will be growing in reality on the pear stock consisting of that part of the stem of the tree situated between the first and the second graft.

The operation of budding is best performed in March, when the sap of the stock is already in movement, and the buds of the pear are about to move. In order to secure retarded buds of the pear, the slips may be selected some time before and earthed up in a cool and shaded situation, until the stock to be budded is well in movement. It is preferable to bud the stock close to the ground in order to secure a clean stem which may be trained as desired. The slips should be taken out of the ground where they had been earthed up, gradually as required, so as not to expose them to the risk of drying too much before use. The lower buds of each slip should be discarded, being too weak, and the upper buds being too pronounced and often angular or irregular should also be avoided, well formed buds on the middle portion

of the slip being the best and give the smallest percentage of failures. Ordinary shield budding is the method adopted almost exclusively, and the bud should be inserted preferably not more than 5 c. m. above the ground level. Budding on the quince stock generally results in a more or less voluminous swelling being formed at the junction of the bud with the stock, which would be unsightly if allowed to remain above the ground when the young pear tree is transplanted to its final destination. Pear trees on pear seedlings, meant to be reared at standards may be budded at one metre or more above the ground. In ten days or two weeks the ligature may be removed, and the stock topped, that is shortened to about 15 c. m. above the bud, and the young shoot which pushes out soon after should be secured to the stump or spur to protect it from injury and to compel it to grow straight. If the stock is vigorous, by autumn the young shoot should have grown from 30 to 60 c. m. or more, and it is then time to think about the training of the young tree. Should the bud fail to develop in summer, the stock is grafted in winter or early in spring.

Grafting is performed in winter or very early in spring before the buds begin to swell. For stock exceeding three centimetres in thickness crown-grafting should be preferred, in order not to have to cleave the thick stem too deeply and so cause a wound which would take long to heal. Cleft-grafting, whether simple or double, is the method very generally followed by our gardeners. Simple cleft-grafting, with the insertion of only one scion, is used when the stock is only about $1\frac{1}{2}$ c. m. in diameter; for stock of 2 c. m. in thickness and upwards double cleft-grafting is used and two scions are inserted. The scions are usually selected there and then when the gardener is about to operate, but may be selected some time before and earthed up in a cool corner of the nursery. When

scions are to be sent long distances it is a good plan to enclose them in a tin box hermetically sealed, or in a wide-mouthed glass bottle or glass jar with a cork stopper, and when thus packed without any addition of moss or other substance they will keep in good condition for several weeks. When the box or glass bottle is opened, the slips or scions should be lightly washed in tepid water, dried by a piece of cloth, and used at once. Our gardeners select for scions straight and healthy spurs of medium vigour, not more than 10 c. m. in length, preferring those with about 3 c. m. of old wood of the preceding year's growth to form the wedge of the scion of this old wood. The graft is bound with spunyarn or with rush twine, or raffia bast and the cleft is stopped by covering it over with a bit of the bark taken from the portion of the stock which has been cut off during the operation. No grafting clay or grafting wax are used, but the graft is earthed up with soil leaving exposed only the tips of the scions, and a stick put over it to mark the site. This primitive method generally gives good results, because the scions are usually well cut and well inserted, and as they have several buds as well as the terminal, the grafted plant takes a bushy form, which is afterwards corrected as desired. This bushy type becomes more accentuated when both scions are allowed to grow together. A few gardeners have adopted the more rational method of grafting with scions shortened to two buds, the scions being inserted so as to have the lower bud just above the stock, or at a level with it, and directed outwards. The graft is bound with twine or bast, and the cleft stopped with a bit of bark gummed on by grafting wax, and the graft is neatly besmeared with the same substance so as to cover lightly but thoroughly all exposed or wounded parts of the stock and of the scions, as well as the small wound made on the top of the scion when it was shortened to two buds, taking care not to besmear or soil the buds

with this substance. When the shoots have formed, the most vigorous is retained to become the future stem of the tree and is secured to a pole to protect it from injury and to train it straight, the others are nipped off leaving only the lower rosette of leaves to favour the movement of the sap, and later on in July or August they are cut off clean, as by that time the wound caused by the cleavage of the stock will have healed almost completely. In this manner only one shoot is retained even when both scions have been successful. For grafting standard at a height above the ground the primitive method above referred to is of course not applicable, and the second method with shortened scions and the use of grafting wax is necessarily adopted. Moreover as standards are more exposed to the drying action of wind it is advisable to graft late, at the last moment, when the buds of the scions are about to move.

TRAINING. Most varieties of the pear when grown on a single stem naturally assume the form of a pyramid, and this is the form most suitable for an extensive plantation as well as for the small cultivator, and the pyramidal form is easily maintained without requiring much attention and without taxing the skill of the pruner. Certain varieties are apt to throw up a long and vigorous leader, often attended by an uneven distribution of branches. This tendency may be corrected by topping the leader, with the result that branches are formed at once around it, and the last bud usually forms a second leader which takes the place of the first. Sometimes two or three leaders are formed, and of course the best is retained, the others being topped or bent down to become lateral branches, if they happen to be situated below the one retained, but if they are situated above it, then they must be sacrificed, shortening back the original leader to the level of the bud from which the second leader has sprung.

The operation may be repeated as many times as necessary, should the second leader or its successors again fail to form spontaneously the lateral branches required to keep up the pyramidal form. Trees so trained are called pyramids, and are more productive and produce finer fruits than trees with the bushy habit above mentioned.

The fusiform shape (*fuseau*) is a pyramid with a more pronounced development in height and with a corresponding reduction in the length of the lateral branches. The leader is accordingly never or rarely shortened, but if necessary is induced to form lateral branches by partially notching or ringing the stem below the bud which it is desired to develop into a branch. The lateral branches require to be trimmed carefully to shape, this trimming being also necessary to bring the tree to fruiting condition. This training of the pear is suitable for the gardens of amateurs, where in the small space available it is frequently desired to grow many varieties, and this also without shading the ground unduly for the cultivation of vegetables. The vegetation of the tree so trained is necessarily dense, with consequent detriment to its productiveness and to the quality of the fruit.

The "vase" and the "*contre-espallier*" are two types which are rarely found in our gardens. They require the assistance of a permanent construction of wood or iron to sustain the shape of the tree, and this shape can be obtained only by the exercise of much skill and patience, which however are amply repaid by increased productiveness, and also by the great beauty and perfect quality of the fruit produced by trees so trained.

The vase is produced by stopping the leader to about half a metre above the ground; the uppermost four lateral shoots which are then produced, are retained and trained horizontally in opposite directions to form

a cross, and in their turn are stopped when they reach 40 or 50 c. m. from the leader in the centre: from each of them two shoots are trained and curved upwards and then slightly outwards, so that the vase will have eight principal shoots or branches on which the fruit spurs are encouraged to grow. Vases with only six branches or with ten or twelve branches are formed in the same manner, but for cultural reasons the vase with eight branches is more desirable.

The "*contre-espallier*" is obtained by training the tree to wire supports in a manner so as to form a continuous line or wall. The same trees when trained against a wall are "*espalliers*". It is important that the frame of stretched wire to support the *contre-espallier* be directed from north to south so that the sun may act on both sides of the tree either in the morning or in the afternoon. The *contre-espallier* may have a single or a multiple stem. The single-stemmed type is the cordon, which may be vertical, oblique, and double-oblique or losenge. The horizontal and the convolute or spiral are mere modifications of the same. The vertical cordon is the simplest, the trees being planted only 60 c. m. apart, and trained to one straight vertical stem, two or three metres high, the formation of fruit spurs being encouraged all along the stem to within 30 c. m. from the ground. The oblique cordon is the same form, with a straight stem, but obliquely trained to the supports at an angle of 45° ; trees so trained are supposed to be more productive than vertical cordons.

The double oblique cordon is obtained by stopping the leader in the first year at 25 c. m. from the ground, and two stems or leaders are then retained one on each side, training them obliquely at 90° apart, preferably one stem on each side of the wire, so that stems trained in the same direction may be on the same side of the wire. When properly trained the stems of the

double oblique cordons should make out lozenge-shaped spaces with the greater diameter directed horizontally.

The horizontal cordon may be simple or double. In the first case the leader having reached the desired height is bent at right angles and the fruit spurs are encouraged to form on its whole length, commencing from 30 to 50 c. m. above the ground, removing at once all the vigorous shoots or leaders which may spring up at or about the bend. To obtain the double horizontal cordon the leader is stopped at the desired height, and two vigorous shoots or leaders are afterwards retained at the summit, in opposite directions and are bent down at right angles to form the horizontal branches. Taking the maximum total development of the simple horizontal cordon, or of both branches of the double horizontal cordon at 3 metres and supposing the height of the wire support or fence to be $2\frac{1}{2}$ metres, with four stretches of wire about 66 c. m. apart commencing at half a metre from the ground, it is obvious that the cordons must be planted about 75 c. m. apart, distributing them in a manner so that the tallest stemmed cordons may be at least 3 metres apart, and approximately the same distance is retained for cordons of each height in succession. This method seems to be a complicated one in theory, but will be found to be quite simple in practice.

The convolute or spiral cordon is a vertical cordon made to assume a spiral shape which of course gives a greater fruiting area for the same height of stem. The multiple spiral is a one-sided palmette or fan made to assume a spiral shape.

The multiple-stemmed *contre-espallier*, often called palmette or fan-shape, may have two, three, four, five or more branches, the more complex sorts requiring considerable industry to obtain, and the insertion of buds (budding) is often necessary to induce the production of branches properly situated. The simplest form is

the double-branched or U-shaped *contre-espallier*. This is obtained by stopping the original leader at 25 c. m. from the ground, just above two buds situated in opposite directions, but as nearly as possible at the same level. The two shoots produced by these buds are bent carefully upwards at a distance of 40 to 50 c. m. apart, and then trained straight and parallel to each other. Should one branch show greater vigour than its fellow, it may be shortened once or twice or else tied fast to its support to check its growth, to the advantage of the other, and so secure equal growth. The three-branched form, or *gradirion*, is obtained in the same manner, but above the two lateral buds a third bud is retained on the front side of the stem, and this third bud gives origin to the middle branch, both the lateral branches being bent up at a distance of 40 c. m. from the middle one. The four-branched form of *palmette* is obtained in the same way as the preceding with the difference that the two shoots produced by the two lateral buds are given at first a horizontal direction, and are bent upwards at a distance of about 60 c. m. from the stem. The leader produced by the front bud is stopped at 40 c. m. and the resulting two lateral and nearly opposite branches are trained as in the U-shaped form. By a repetition of the above process the five-branched form is obtained, taking due care to train the lower branches in a manner as to make room for the fifth central branch. More complicated forms such as the single or double *Verrier palmette* should be tried only on the more vigorous varieties, and require more careful tending to bring to perfection.

TRANSPLANTING. The pear tree can be transplanted with perfect safety at any age from a year-old sapling to a fair-sized tree in full bearing, provided that it is budded or grafted on quince stock, because if the stock consists of pear seedlings (*poirier franc*), and the tree has been established in its place for some years, it will resent

interference and failure is more frequent than success. In transplanting, the roots require to be handled with care, and still more so if the tree is at all an old one. As many rootlets as possible should be secured, and those roots which have been much bruised should be cut back to the healthy bark, slanting the cut so that when the tree is replanted the surface of the wound will be directed downwards. The pocket or hole should be large enough to receive all the roots without overcrowding, and these should be disposed in their proper order and natural position. It is a safe precaution to plant the tree a few centimetres deeper than its position in its former place, but this precaution should not be overdone, as too deep planting is commonly associated with failure and unproductiveness. Some well-rotted manure should be mixed sparingly with the soil when filling up the hole or pit, and when the roots are well covered with earth, a more liberal top-dressing of manure may be given.

It is advisable to prepare the hole some time before planting, so that the sun and the air may act upon the lower strata of the soil and improve their condition, physically and chemically, and it is always better to construct the holes larger than necessary, to be afterwards filled up as required during planting. It is preferable to transplant the pear in October or early in November, so that the tree may have time to form new roots and establish itself before winter, and will not then require to be watered early in spring before the normal watering is commenced. If the pear tree is transplanted in winter when the roots are dormant it will be necessary to water it early in spring at the time when the buds are pushing, and as the tree will be then establishing itself watering should be continued at intervals of eight days to two weeks, if the weather is dry.

The size to which a pear tree grows varies a

great deal from one sort to another. The local Angelica pear attains usually a height of 3 to 4 metres, with about the same spread of branches, but other sorts such as Beurré d'Angleterre, Duchesse de Berry, Clapp's Favourite, Alliance Franco-Russe etc. hardly ever exceed $1\frac{1}{2}$ metres in height or in spread. However, except for a few varieties, it will be found that the best distance at which to plant is 2 metres apart in the row, and 3 metres between one row and another. This of course applies to the open orchard where trees are trained as pyramids or as bushes. For the spindle or fusiform shape (*fuseaux*) and for cordons the distance apart should be much smaller, and the distance for the *espallier* or *contre-espallier* must vary according to circumstances. The distance apart for pear trees planted as a border in the vegetable garden should be ample, so that the trees may not reach each other with their branches, and throw on the ground a continuous shade which would interfere with the proper development of the vegetables.

CULTIVATION. As in the case of most fruit trees, the surface roots of the pear are those which are chiefly concerned in the production of fruit, and have a direct influence on the productiveness of the tree as well as on the quality of its fruit. To the deep roots the tree owes its vigour and the formation of wood. This axiom already known to and accepted by the ancients, is still unchallenged and the cultivator cannot ignore it with impunity. Hence deep trenching should be undertaken at long intervals of six or eight years, when the tree has lost much of its vigour owing to excessive production, and it is thought advisable to give it a resting period of one year and the chance to recuperate its vigour and to form new wood. In deep trenching the soil is moved to the depth of 20 to 25 c. m. a liberal supply of well consumed manure being given at the same time, so that the

formation of new roots may proceed rapidly. It is always better to trench and manure all the land uniformly to the same depth, than to trench and manure only a circular trough around the tree. In any case the larger roots should be spared, and due care should be taken not to injure or bruise the first layer of main roots which come out of stem close to the surface, and the operation is best performed in autumn some time after the first rains, but before the leaves are shed. Surface dressings of manure may be given in mid-winter in alternate years, or better every year, at the time of the surface hoeing of mid-winter. Stable manure or manure from the cow-shed, properly fermented, is the best manure for the orchard, but loose soils will be greatly benefited by a spring dressing of phosphatic and potassic manures, given at the time of the spring hoeing.

Surface tillage will be required in October or November, and again in December or January, the object being to keep down weeds and to aerate the soil and favour the absorption of rain. In March or early in April the soil is tilled a third time. The spring tillage should be deeper, reaching a depth of about 15 c.m. The soil is then properly levelled, the use of the garden rake being sufficient to put down the weeds which may follow after the showery weather of April. Green-manuring if associated with phosphatic and potassic fertilizers, will be a good substitute for a dressing of stable manure. It is sufficient to sow broadcast a leguminose crop of vetches just before the autumn hoeing, and to dig in the plants in March when they are in bloom, the mid-winter hoeing being in this case dispensed with.

In deep soils with moist subsoils the pear tree will do without irrigation, but even then the quality of the fruit cannot compare with that obtained from irrigated trees. Irrigation should commence in May or early in June, so that the development of the fruit may not suffer

a check for want of moisture in the soil. The pit or trough around the tree may be shallow, but at least as wide as the outer boundary of the crown of foliage, and watering should be repeated regularly throughout the dry season. It is a grave mistake to stop watering after picking the fruit. Trees dealt with in this way will soon lose their leaves, long before autumn, and then the flower buds will burst into bloom soon after the first rains, which of course means the loss of next year's crop. Watering is best done by irrigation or by flooding, but where possible an occasional spraying in the evening when the sun has declined, will be very beneficial both to the tree and to its fruit.

It is permissible to grow catch crops of certain vegetables in the pear orchard, not only in winter but also in summer, provided that the vegetables are properly watered during the dry season and that they are not too rank growing, such as cauliflowers or cabbages, in order not to interfere with the action of the roots of the trees by drawing too much on the resources of the land. The best crops to grow are those which have a moderate root system and are surface feeders, and also those which require frequent dressings of manure, such as potatoes, salads, onions, beets, turnips, radishes, peas, French beans and marrows.

PRUNING. Besides the pruning and trimming required to train the tree to shape as desired, the pear tree will require the attention of the pruner every year, or at least every two years. All dead or diseased wood should be removed, and any dense growth of branches or twigs should be thinned out, to admit air and light to all parts of the tree, and also to keep up its vigour and to bring the new growth into bearing condition. All suckers within the tree are removed by a clean cut, reserving those which are required to renew a sickly or exhausted branch. The sucker (Fr=*gourmand*) is a fast growing twig produced on the old wood towards the interior of

the tree ; it is usually very slender in proportion to its length and is generally unproductive, no flower buds being formed upon it, except when it happens to replace a diseased branch. The flower bud (*bouton*) may be borne on a long and rather slender twig (*brindille*) or on a short and stout spur (*lambourde*). Very vigorous varieties produce many spurs along the stem and main branches, but these spurs develop leaf buds, and only exceptionally flower buds, becoming then a true lambourde and continuing afterwards as fruit twigs, producing flower buds in alternate years. This alternate production of flower buds is noticeable also in the upper ends or fruiting ends of the branches, as the extremity of the spur which has flowered, or has produced a fruit, becomes swollen into what is called a purse (*bourse*), and on the lower half of the purse, away from the fruit, leaf buds are formed in the same year, which in the following year become flower buds, and so on. A spur with too many leaf buds, may be called a multiple spur, and though it may stand in a likely situation on the stem or branches often fails to produce any flower buds, unless the number of the leaf buds is reduced, either in winter or in June-July, some time after the full development of the foliage. A reduction in the number of spurs or of the leaf buds is generally followed by an intensive formation of flower buds and the tree is thereby placed in a bearing condition. Trees grown as bushes or trained as pyramids generally require a topping or shortening of their leading branches to reduce their vigour and bring them to fruit ; but when the leading branches have been allowed to grow too numerous, the weaker branches may be thinned out, and a few of those retained may be bent down and tied to a lower branch, and this forced position by retarding the flow of the sap soon causes the formation of flower buds for the following year. As soon as the flower buds are formed the branch may be allowed to resume its former position, and next year the same treatment is meted out to the other branches.

In a large plantation it is not always convenient to bend down many branches for the purpose above mentioned, and a very good substitute will be found in the following simple operation. The branches which refuse to form flower buds are taken between the fingers of the hand, placing the thumb and fourth finger on one side of the branch, and the index and middle finger on the other, and a gentle pressure is exercised just enough to bend the branch and break a part of its wood tissues without injuring the bark ; a slight noise is made by this partial breaking of the wood fibres, but the bark will not show any trace of what had occurred. This simple operation is best done in May or June, when the sap is still in active movement. The circulation of the sap is thereby momentarily but seriously interfered with, the growth is stopped, and the branch soon after resumes its vigour, but instead of starting fresh growth, develops flower buds. The branches upon which to operate should not be more than 2 c.m. in thickness, and those only 1 c.m. in thickness give better results. Occasionally a branch snaps between the fingers, particularly if the operation is done when the tree is leafless, and of course will have to be shortened to the next good bud, but the injury thus caused is quite negligible, and with a little practice may be avoided almost entirely.

The operation of ringing is another means to bring a branch to fruit. For this purpose small pincers with double blades are used, which by one fourth of a turn of the hand remove a narrow strip of bark, 1 to 2 m.m. wide, around the branch, and as a result of the disturbed flow of the sap, flower buds are produced that same year.

HARVESTING THE FRUIT. Those varieties of the pear which mature before August may be allowed to ripen on the tree, but it is important to pick them as soon as they are well coloured, otherwise they may become overripe, and rot away at the core (*bletissure*). If picked two or three days before the full development of

the colour, they keep better and are therefore more marketable. All other pears which ripen from the 1st August onwards, should be gathered some days before they begin to show the colour of maturity. If allowed to remain on the tree until the colour begins to form, they may increase in size as well as in weight, but they lose much in flavour and keeping quality, may become coarse and fibrous, and very often rot inside at the core (*blotissure*) before acquiring their full colour, that is when in reality they are still unripe. All these pears require the dark and even temperature of the fruit room to develop their colour, their flavour, and their keeping qualities to the best advantage. If the fruit is picked from the tree a few days earlier than its proper moment, its maturation is greatly delayed, and the rind will show signs of shrinkage, by the formation of wrinkles around the stalk and sometimes lower down on the body of the pear, so that the difficulty is not solved by anticipating the harvest. It is true that the late pears, those ripening in December-April, always show a tendency to shrink around the stalk, and that this slight shrinkage is unavoidable, and is not considered a defect; but in the autumn pears, those ripening from September to November, any shrinkage however small, is really a defect due to anticipated harvesting and is generally associated with hardness of texture and want of sugar and aroma. Moreover the time of maturation of imported varieties of pears is so often either advanced or delayed as compared with that of the place of origin, that a hard and fast rule is not practicable, and the cultivator must rely chiefly on his local experience rather than on that of the foreign grower. The difficulty is further increased by the fact that the same imported variety of pear, not being yet duly acclimatized, sometimes varies its time of maturity from year to year. In Italy it is the custom to pick the summer pears two or three days before maturity, and the autumn pears from ten to fifteen days before the time when they are expected to ripen; but the winter pears

are left on the tree as late as possible, sometimes until there is danger of frost. In the following pages the time of harvesting according to our local experience, shall be given for each variety in the course of its description, along with other cultural information.

Before harvesting the fruit, it is desirable to suspend watering for a few days, so that the fruit may not be too watery and therefore more liable to shrinkage. The fruit is cut if possible in the morning as soon as the dew has evaporated, and before the fruit has become too much heated by the sun. Baskets used for this purpose should have internally a double lining of canvas, so that the fruit may not be exposed to injury by pressure against the sides and bottom of the basket. The fruit should be handled with care; it is taken in the hand, placing a finger under the stalk close to its insertion on the branch, and by slightly turning up the fruit, this will leave its hold at once, if in its proper moment for picking. The fruit is then placed gently on its side in the basket, carefully avoiding injury to the stalk by rough handling or otherwise. When the basket is full it is taken at once into the fruit room and emptied with care, disposing the fruit on the shelves to ripen. The room should not be exposed to extremes of heat or cold, and should be well ventilated, but should be kept constantly dark, except of course when handling or inspecting the fruit. The shelves may be of wood, well smoothed, and covered loosely with sheets of paper. They may be in tiers, 20 c.m. apart and not more broad than is compatible with easy inspection and handling. Shelves made of trellis work, or wire netting, or other similar material will afford better ventilation, but the fruit is bound to suffer by pressure against the angles or inequalities of the structure, although partly protected by the paper. Shelves made of smooth stone scantlings are good, but they take too much space, and cannot be moved easily as required. The fruit is disposed on

the shelves preferably with the stalk up, as close as possible to economise space, but without touching each other. One or two days before taking in the fruit, the room should be thoroughly disinfected by the fumes of sulphur or by spraying with a watery solution of formalin (1 per 100). The fruit should be inspected every one or two days, and those showing signs of injury are taken out at once. Summer and autumn pears should be taken out and disposed of as soon as they are ripe, but late autumn and winter pears may be kept much longer, if better prices are expected.

The classic land for the pear is France and Belgium. In fact not only have these countries produced a considerable proportion of the best pears, but the cultivation of the pear is understood there probably better than anywhere else. English and Italian cultivators have contributed their fair share to the general stock of desirable varieties of this delicious fruit, but the leading place for the pear is held by France and Belgium, perhaps more decidedly than is the case of England's leadership for the cultivation of the apple. Unfortunately many of the best French and Belgian pears do not acclimatise themselves readily in our southern climate. In full sunshine they often become dwarfed and unproductive, and though they thrive better in very shaded situations, their fruit has a tendency to become gritty at the core particularly in late ripening varieties. Certain Italian sorts do well with us, and the few English pears hitherto introduced seem to do almost as well as the Italian varieties.

Pears may be classed into three groups. The first includes the small-sized pears often grown on the continent for the production of perry (*poiret*) a beverage like cider ; with this group of pears we have nothing to do, as they are not grown in these Islands. The second group includes the kitchen pears (*poires a cuire*) and comprises a section of preserve pears (*poires a compôte*).

The third group includes the table pears or dessert pears (*poires a couteau*). Trees of the first group are usually grown as standards, and make noble avenues in France and Belgium. The other two groups are grown in specialized orchards or as borders in vegetable gardens.

It is stated that there are nearly 3000 varieties of pears under cultivation, many of which are either worthless or have been superseded by better sorts. However the cultivator should not attempt to grow more than six varieties, and three or four would be quite enough for an orchard of limited extent. In this way a greater uniformity of produce is secured which is an important condition of success for market purposes. The selection should be limited to those sorts which are found on experience to thrive best in that district ; but as the pear like most fruit trees is liable to become sterile under self-pollination, it is advisable to grow at least two varieties and to plant them in alternate rows, so that a regular production may be secured by cross pollination. The amateur cultivator will require a more extensive assortment of varieties to make sure of a continuous supply of pears for his table throughout the year, but even in his case a selection of 12 to 24 sorts will be quite sufficient for the most fastidious taste.

The following is a descriptive list of pears grown in these Islands :

EARLY SUMMER PEARS.

The fruit attains maturity in June or July, and is allowed to ripen on the tree, being sent directly from the orchard to the market. These pears on account of their earliness are not liable to the attacks of the fruit fly, and they also resist to the attacks of the tree borers better than other varieties

I. MALTA JUNE PEAR. (M=*mascarella ta Malta*). The tree is very vigorous with thick ashy-grey twigs, and grows quickly to a large size. It is very productive,

the fruits being produced in large clusters of 3 to 10. The fruit is small, pear-shaped, lemon yellow with a red or crimson flush. The flesh is crisp, sweet and aromatic. Keeps well and travels well. This is a valuable market pear of attractive appearance.

2. SMALL MALTA JUNE PEAR. M=*mascarella irkika, bambinella*). The tree has the same general appearance as that of the preceding but is dwarfer. The fruit is produced in large clusters, is small, rounded or slightly pear-shaped. Colour and other qualities as in the preceding, the flesh being more tender and sweeter, but with a weak aroma.

3. MADAM. (M=*dama, damigella*). Fr. *Jansemine, Jeanette, mouille-bouche de Bordeaux*. The tree is middling in vigour, but takes naturally an erect pyramidal form. It is very productive in alternate years, the fruits being produced in clusters of 3 to 5 or more. The fruit is small, round, with a long thin stalk, and becomes light yellowish green at maturity. The flesh is melting, sweet and delicately flavoured. Does not keep long when ripe, being subject to rot at the core. It is a good market pear, and is in favour with amateurs as a very early and exquisite dessert pear.

4. GAMBA DI DONNA. (F=*Blanquette de Charente?*). This is a good pear maturing early in July and long known to our gardeners. The tree is middling in vigour and size, and is well productive. The fruit produced in clusters of 3 or more, is rather small, top-shaped and becomes pale yellow or wax-white at maturity. The flesh is white, melting and sweet. This pear is not much grown now, but is a good market pear to succeed the Malta June pear.

5. LAWSON. The tree is vigorous but dwarf, and generally well productive. The fruit is small or middling, pear-shaped, yellow, well coloured with red. Matures late in July, and is of good quality.

6. CLAPP'S FAVOURITE. (M=*Favorita*). The tree is vigorous having thick red twigs always well provided with flower buds, and is rather dwarf in habit. The fruit is produced singly or sometimes in pairs, is large and has a perfect pear shape, a smooth rind, and a short thick stalk loosely fixed to the twig. The colour is greenish yellow with a large red flush towards the sun. The flesh is melting, sweet, and aromatic, with an exquisite vinous flavour. This is a first class fruit for the amateur as well as for the market, but does not keep well. Matures late in July, and its flavour is richer when the fruit is picked a few days before use. Does best in full sunshine.

SUMMER PEARS.

The fruit attains maturity in August-September, and is picked from the tree as soon as the first fruits begin to show colour, maturity being completed in the fruit room.

7. EPARGNE (other French names are: *Beau présent*, *Chopine*, *Courge*, *Cueillette*, *Gross Cuisse Dame*, *Jargonelle*; M=*settembrina*). The tree is vigorous and productive but middling in size. It is very resistant to drought and thrives well in all situations. The fruit is long, pear-shaped, tapering and irregular towards the stalk end. The stalk is long, slender and curved. The colour is lemon yellow, dotted lightly with rust spots, and sometimes flushed light pink. The flesh is half-melting, sugary, and perfumed. This is a fine pear for the market and for the amateur, ripening in August, and is a good keeper.

8. CITRON DES CARMES or GROS ST. JEAN, or MADELEINE. The tree is middling in vigour and dwarf, but fairly productive. The fruit is small, round, long-stalked, light green or streaked light yellow, dotted with grey, and has a rich flavour. Matures early in August and keeps fairly well. May be allowed to mature on the tree.

9. COSCIA. This is an Italian pear with good market qualities. The tree is fairly large and vigorous, and fairly productive. The fruit is top-shaped and elongated, lemon-yellow, flushed with pink. Should be picked in the first days of August, and ripens soon after, but keeps fairly well. The flesh is white, half-melting, with a fine flavour. Is more productive in full sunshine, but thrives well in the shade.

10. ALLORA. This is another good Italian sort, ripening at the same time as Coscia, or immediately after it. The tree is fairly productive and vigorous, but remains dwarf and spreading. The fruit is top-shaped, slightly larger than coscia, and its colour is golden yellow with a fine red flush. Keeps well, provided that it is picked from the tree before the colour begins to show. The tree requires the full sunshine. The flesh is melting, sweet and aromatic.

11. DE L'ASSOMPTION. (M=*Santa Maria*). The tree is vigorous and resistant to the tree borers, but remains dwarf, with thick branches and small black buds. The production is irregular. The fruit is large, sometimes very large or enormous, pear-shaped, often nearly cylindrical, with a thick short depressed stalk. The rind is rough, white or yellowish white, thickly dotted or blotched fawn. The flesh is rather firm and meaty but very juicy, sometimes slightly pink coloured, sweet, perfumed, with a delicate acidulous flavour. Maturity is irregular, takes place generally about mid-August, but sometimes early in August or towards the close of September, and therefore the fruit is better put in bags as a protection against the fruit fly. This is a pear for amateurs, who will overlook its ugly appearance on account of its delicious flavour.

12. FONDANTE DES BOIS. (M.=*Fiur ta Auissu*). The tree is large, broadly pyramidal, and is vigorous and productive. The fruit, usually produced in pairs or triplets, is large or very large, beautifully pear-shaped,

smooth, with a long stalk, light yellow sometimes dotted with rust, and almost always with a large red or crimson flush. The flesh is buttery, sweet and highly perfumed. Should be picked in the first week of August and matures in August or early in September. Requires the full sunshine. This is a charming fruit of excellent quality both for the market and for amateurs.

13. BEURRE' SUPERFIN. The tree is middling or dwarf, but very productive, and well resistant to the wood borers. The fruit is middling or small, round and smooth, with a thick and short stalk. The colour is lemon yellow, flushed red, and dotted with rust. The flesh is white, soft, nearly melting, sweet, and delicately perfumed. The fruit keeps well; should be cut in the third week of August and ripens towards the close of that month or in September.

14. BEURRE' GIFFARD. The tree is rather weak and dwarf, with tortuous, slender, purple red twigs and branches. The fruit is middling in size, pear-shaped, smooth, pale yellow dotted grey, and blotched fawn near the stalk. The flesh is white, melting, perfumed and agreeably acidulous. Matures towards the close of July, and requires to be planted in a rather shaded situation.

15. WILLIAMS or WILLIAMS BON CRETIEN. The tree is vigorous and forms a thick bushy growth. It is well productive. The fruit is large, oblong, rather top-shaped, often uneven and bumpy, golden yellow dotted with rust, and marbled rust near the stalk. The quality is good, being sweet, highly perfumed, with a musky flavour. Should be cut by the end of August and matures in September.

16. DIRECTEUR HARDY. The tree is fairly vigorous, and very productive. The fruits are produced singly; are rather large, pear-shaped, with a smooth peel, yellowish white, lightly blotched all over with tan. Flesh yellowish white, melting, sugary, with a very agreeable perfume and

flavour. Should be cut in the first week of September, and ripens within that month. It is a good fruit for amateurs. The tree thrives best in shaded situations.

17. DOCTEUR JULES GUYOT. The tree is vigorous, and is an abundant bearer. The fruit is produced singly, sometimes in pairs, is large or very large, oblong, with a short thick stalk, inserted obliquely; becomes lemon yellow at maturity, with a rose flush on the side exposed to the sun. Should be cut in the first or second week of August, and matures after mid-August. The flesh is melting and sweet with a pleasant aroma. This is a good pear for the market as well as for the amateur, and prefers a half-shaded situation.

18. CARLISLE or DOYENNE BLANC or CITRON DE SEPTEMBRE. (M.=*butira tal Vitoria*). The tree is middling or dwarf, but well productive. The fruit is small or middling, top-shaped, with a short and depressed stalk. The colour is lemon yellow, dotted brown or rust, often with a beautiful pink flush towards the sun. Should be cut in the third week of August and matures in September. The flesh is white, melting sugary, with a mild flavour and fine fragrance. Keeps very well. This is a fine fruit for the market and for the amateur.

19. LOUISE BONNE D'AVRANCHES or BONNE LOUISE. The tree is middling in size and vigour, with reddish branches, and is fairly productive, but thrives better on pear stock. The fruit is middling or large, perfectly pear-shaped, smooth, light green at maturity, rosy yellow on the side exposed to the sun. The flesh is white, of fine flavour and agreeably perfumed. The fruit should be cut in the first week of September, and matures in September, but keeps well into October. This is a good sort for the market and for the amateur.

20. MADAME CHAUDY. The tree is weak on quince stock, but is vigorous and regularly productive on pear

stock, the tree assuming then a fine pyramidal form. The fruit is large or very large, obtusely top-shaped, smooth and plump, greenish yellow or light green at maturity. The flesh is white, watery, and very sugary, but the flavour is poor for lack of aroma. The fruit is gathered about mid-August, and ripens soon after. Maturation is often anticipated, and as frequently postponed.

21. BEURRE' D'AMANLIS. The tree is vigorous, with long straggling branches of a greyish red colour, with dark green foliage. It is fairly productive, and thrives best in full sunshine. The fruits are produced singly or in clusters of two or three. They are large, pear-shaped with a short thick and depressed stalk, the colour is light green, dotted grey, with a dark red flush. The flesh is yellowish white, melting, and juicy, and faintly perfumed. Should be cut in the last week of August, and matures in September.

22. BEURRE' DIEL or B. ROYAL. The tree is vigorous and grows to a fine size, and is very productive. The fruit is broadly top-shaped, with a thick stalk, slightly depressed. The colour is golden yellow, dotted rust. The flesh is white, sugary, acidulous, of middling quality. The fruit is cut in the last week of August or early in September, and matures in September. Keeps well. This is a good pear for the market.

23. BEURRE' GRIS or BEURRE' DORE'. The tree is middling or large, fairly vigorous and productive. The fruit is top-shaped, obtuse, but pointed close to the stalk, which is short and slender. It is plump and smooth, light greenish yellow at maturity, dotted grey and heavily blotched with shining fawn or bronze. The flesh is white, creamy, juicy, with a delicate acidulous flavour. The fruit is cut towards the end of August or early in September, and matures in September, but keeps fairly well to October. Is suitable for the market grower and for the amateur.

24. BEURRE' HARDY. The tree is rather delicate, and dislikes the full sunshine as well as too much shade. The fruit is middling, top-shaped, with a short depressed stalk, and has a rough but thin rind easily bruised; becomes light yellow at maturity, heavily blotched fawn and dotted brown. The flesh is white, melting, of excellent quality, and has a delicate aroma. The fruit is cut in the first or second week of September and matures in September-October.

25. MARGUERITE MARILLAT. The tree is fairly vigorous, with thick light red twigs, and is fairly productive. Requires the full sunshine and prefers the pear stock. The fruit is large or very large, beautifully pear-shaped with a short oblique stalk. The colour is light yellow, dotted fawn or rust. The flesh is yellowish white, melting, juicy, well perfumed and weakly acidulous. It is cut in the second week of September and matures in September-October. Keeps fairly well. It is a fine fruit for the amateur.

26. SAINT MICHEL ARCHANGE. (M. = *San Michiel*). The tree is vigorous, but rather dwarf, with greenish twigs. It is very productive and thrives well in full sunshine as well as in the shade. The fruit is middling, top-shaped, with a thick stalk; the colour is greenish yellow, dotted fawn or rust, slightly flushed with reddish orange. The flesh is straw-coloured, buttery and melting, very sweet and has a very agreeable aromatic flavour. It is cut in the first or second week of September and ripens in September-October. Does not keep long. It is an excellent fruit for the amateur, and is also a good market pear.

27. SOLDAT LABOUREUR. The tree is large and vigorous, and when full grown is very productive. Requires the full sunshine. The fruit is middling or large, pear-shaped with a short, thick, rather depressed stalk. The colour is light yellow, heavily dotted or marbled fawn or rust. The flesh is yellowish white, melting, juicy, with a

sweet and very pleasant flavour. It is a fruit for amateurs, but is also good for the market. It is cut in the first week of September and matures in September-October.

28. BELLE GUERANDAISE. The tree is vigorous, with a marked pyramidal habit, prefers the sunshine, but away from hot walls. It is very productive. The fruit is large or very large, obtusely oval, with a thick and depressed stalk. The colour is yellowish, intensely dotted fawn. The flesh is white, very juicy and sugary, and deliciously perfumed. Should be cut in the second week of September and matures in September-October. This is a first class fruit for amateurs, and is also a good market sort, hardly ever producing any malformed fruit.

29. SUMMER DUCHESSE DE BERRY. (M.=*butirata Anuissu*). The tree is fairly vigorous and well productive, comes fast to bearing condition, and the production is well sustained. Resists well to the tree borers, and does well in full sunshine. The fruit is small or middling, rather variable in shape, but usually rounded, with a short thick stalk slightly depressed. The skin is smooth, lemon yellow, often dotted fawn, with a large and fine deep rose flush. The flesh is white, melting, of exquisite quality. The fruit should be cut towards the third week of August, and matures in August or in September. Keeps well. This is a good market pear, and is also a desirable pear for the amateur.

AUTUMN PEARS.

The fruit ripens in October or November. As these pears are not picked from the tree before September, they must be put in bags by mid-August as a measure of protection against the fruit fly. If put in bags earlier the natural red flush of the fruit produced by the action of the sun, will not form or will disappear if already formed; but this is a minor disadvantage as compared with the risk which would be incurred by leaving the fruit exposed to the ravages of the fly.

30. ANGELICA OF MALTA. This is an ancient local pear, and is extensively grown for the market. The tree is very vigorous and attains a large size in a few years, and when full grown its fertility is astonishing, large trees being known to produce 200 kilog. of fruit or more. It thrives in all situations, but prefers the full sunshine and a deep soil moderately moist. Unfortunately it is very liable to the attack of the tree borers, which seem to prefer this tree to many others, and quickly kill it. The fruit is produced singly or in clusters of 2 to 6 or more. It is middling or large, irregularly top-shaped, often rough, with bumps and depressions; the "eye" or calyx is depressed, the stalk is long and slender, but fleshy at its insertion on the fruit. The colour is golden yellow, often with a large deep red flush towards the sun, with many dots of a deeper red. The flesh is yellowish, thick, but half-melting, very sugary and well perfumed. The fruit is cut in the 2nd or 3rd week of September, and sometimes towards the close of that month, and matures in October and November. Keeps long in good condition. This is an ideal fruit for the market as well as for the amateur, and is deservedly popular. A form producing larger fruits of the same shape, and maturing later, is known as *Angelica jebba* or *A. imuahħħra*, the hard Angelica or late Angelica, is sometimes grown but is not much esteemed.

31. ANGELICA OF ROME. The tree is middling or dwarf, but reaches a fine size when grown on pear-stock. It thrives well in the sun, but better in the shade. The fruit is middling, sometimes large, top-shaped, smooth, light yellow, almost entirely shaded or blotched fawn or bronze. The flesh is white, creamy, melting, sweet, deliciously acid and highly fragrant. Should be cut in the third week of September and matures in October or November. Keeps fairly well. It is an excellent fruit for the amateur.

32. ANGELICA OF PADOVA. The tree is delicate, rather short-lived, and little productive. The fruit

resembles that of the Angelica of Rome in size and appearance, but is more plump, and the flesh is yellowish white, floury, sweet, and faintly acidulous and perfumed. Should be cut at the close of September and matures in October. Keeps badly.

33. BARILLET DESCHAMPS. The tree is rather dwarf, but well productive, and resistant to the tree borers. The fruit is borne singly or in clusters of two or three. It is large or very large, perfectly pear-shaped, smooth, with a thick and slightly depressed stalk. The colour is greenish yellow, streaked rose, and flush pink towards the sun. The flesh is white, half-melting, juicy, sweet, with a pleasant vinous and aromatic flavour. Should be gathered in the third or fourth week of September, and matures in October, but keeps well into November or December. It is a fine fruit for the amateur, and grows best in cordons, but not in full sunshine.

34. OTTOBRINA or DUCHESSA TA MALTA. This is probably an ancient local pear, similar to the old Calabasse, but distinct from it. The tree is vigorous and attains a fine size. It is well productive, in weight if not in numbers. The fruit is very large or enormous, commonly weighing $\frac{1}{2}$ kilog. and over, and is shaped like a Duchesse d'Angouleme, with an irregular and rough skin. The colour is light green or green, dotted brown, and heavily blotched or marbled dark fawn or rust. The flesh is white or greenish white, very juicy, often somewhat fibrous, but sweet and well perfumed. This pear is still grown occasionally for the market, for which it is singularly unsuitable on account of its bulk and unattractive appearance.

35. DUCHESSE D'ANGOULEME. The tree is middling in size, but vigorous and productive in shaded situations or along a northern wall. In full sunshine it is dwarfed, and becomes unproductive. The fruit is large or very large, bell-shaped, with a short and thick stalk, nearly

always depressed. The rind is rough and thick, yellowish green, dotted or marbled with rust. The flesh is white, melting, juicy, sugary and fragrant. It is a fine fruit for the amateur and is also a good market sort, but the tree is rather capricious, while some trees in the same row thrive very well, others refuse to respond even to the best treatment. The fruit is cut in the first or second week of September and matures in October.

36. **BARONNE DE MELLO** The tree is fairly vigorous and is usually very productive, but requires a shaded situation, along a north wall. The fruit is produced singly or in pairs ; it is top-shaped, middling in size or small, with a smooth rind, light yellow heavily splashed and marbled with rust. The flesh is white or shaded green, melting, juicy, sugary with fine acidulous and musky flavour. It is a good pear for the amateur, and very reliable as to production. It is cut in the second and third week of September, and matures in October, but keeps well to November.

37. **BERGAMOTTE CRASSANE.** The tree is vigorous and requires the shade. The fruit is flat or depressed, with a long thick and fleshy stalk, slightly depressed. The colour is light green, dotted or marbled fawn. The flesh is creamy white, juicy, sweet, well perfumed, with an agreeable acidity. The tree is capricious in its growth, and the production is irregular. The fruit is cut in the last week of September and matures in October or November.

38. **BEURRE' BACHELIER, or BACHELIER, or CHEVALIER.** The tree is vigorous and fairly productive. Grows well in all situations. The fruit is large or very large, oblong and plump, with a short depressed stalk, and an uneven rind. The colour is greenish yellow, dotted grey, and sometimes slightly marbled with fawn, with a faint rose flush. The flesh is white, melting, sweet and acidulous, with a faint perfume. The fruit is cut in the first or second week of October and matures in October

or November. It is a pear for the amateur, but is hardly a market variety.

39. BEURRE' CLAIRGEAU. The tree is vigorous and grows to a fair size. Does best in full sunshine, and is very productive. The fruit is large or very large, irregularly pear-shaped and elongated, with a very short and thick depressed stalk, inserted sideways. The colour is yellow, dotted grey and marbled rust, with a large reddish-orange flush on the side exposed to the sun. The flesh is white, rather firm but tender, sugary and perfumed, but somewhat astringent. It is fairly good as a dessert fruit, but will be more valued in the kitchen. The fruit is cut towards the close of September and matures in October or November.

40. BEURRE' D'APREMONT or BEURRE' BOSC. The tree is very vigorous, grows to a fine size, but is slow to come to fruit. It is resistant to the tree borers. The fruit is perfectly pear-shaped, middling or large, with a long curved stalk. The colour is yellow or chrome-yellow, sometimes mottled with rust. The flesh is white, melting, juicy and sugary, with a pleasant aroma. The fruit is cut in the last week of September and matures in October-November. Keeps very well. The tree thrives well in full sunshine, but prefers the shade. Would be a fine market fruit, but the production is irregular.

41. BEURRE' D'HARDENPONT or B. D'ARENBERG. The tree is middling in size and fairly vigorous. The fruit is large or very large, pear-shaped, with a short stalk and smooth rind, light yellow dotted grey, heavily marbled fawn near the stalk. The flesh is white, half melting or buttery, sugary, and well flavoured. The tree prefers the shade, but its production is irregular. The fruit is cut toward the close of October and matures in November or December.

42. COLMAR D'ARENBERG. The tree is fairly vigorous and regularly productive, with thick light

reddish twigs and large pointed buds, and requires the full sunshine. The fruit is large or very large, is produced singly or in pairs, perfectly pear-shaped, narrow towards the stalk, which is long and thick. The colour is yellow or chrome yellow, with a large red flush, shaded flesh towards the stalk, heavily marbled fawn near the stalk and at the base. The flesh is creamy white, juicy, melting, with a very agreeable vinous and aromatic flavour. The fruit is cut in the second week of September and matures towards the close of September or in October. Keeps fairly well. It is a first class pear for the amateur and is also a desirable sort for the market.

43. BEURRE' STERKMANS, or DOYENNE' STERKMANS, or BELLE ALLIANCE. The tree is vigorous and forms nice pyramids. It is very productive. The fruit is borne usually in pairs or triplets; it is large or very large, irregularly pear-shaped, with a straight thick stalk. The colour is pale yellow, rarely marbled fawn near the stalk, with a very smooth skin, but irregular and bumpy. The flesh is buttery, light yellow or cream, very sweet, with a delicate vinous and aromatic flavour. The fruit is cut in the third or fourth week of September and matures in October and November. Keeps fairly well. It is an excellent and reliable pear for the amateur, and is also recommendable for the market.

44. ALLIANCE FRANCO-RUSSE. The tree is middling or small, but well productive. The fruits are always borne singly, are large, of uniform size, oval, with a long slender depressed stalk. The colour is yellow or greenish yellow, usually without any flush or markings. The flesh is white, melting, sugary, well perfumed, of excellent quality. The tree thrives best in a sunny situation, away from walls. The fruit is cut in the second week of September and matures in October. It is a good autumn pear for the amateur, and is also a fine fruit for the market.

45. GENERAL TOTLEBEN. The tree is vigorous, with slender spreading and often contorted branches, and is well productive. Thrives well in all situations. The fruit is large or very large, pear-shaped with a very long and curved stalk. The colour is greenish yellow or dirty yellow, dotted or marbled with grey and rust. The flesh is melting, buttery, very sweet with a very aromatic and pleasant flavour. The fruit is cut in the second or third week of September, and matures in October. It is an excellent pear for the amateur, but keeps too badly to be suitable for the market.

46. CONSEILLER DE LA COUR or MARECHAL DE LA COUR. The tree is very vigorous, with a spreading pyramidal habit, and grows to a large size. Thrives well in all situations and is very productive. The fruit is produced singly or in pairs, is pear-shaped, with stalk slightly depressed, and has a thick and rough skin. The colour is yellowish green, dotted grey and often splashed fawn. The flesh is white, juicy, but rather firm, sugary but often strongly acid. The fruit is cut towards the close of September and matures in October and keeps well, but is not a fruit of quality.

47. CURE' or POIRE DE FRANCE, or BELLE DE BERRY, or DEL CURATO. This pear is probably of Italian origin, renamed in France. The tree is very vigorous, with a spreading pyramidal habit, and dark dull green, leathery, rounded leaves. Thrives well and is well productive in all situations. The fruit is produced singly or in pairs, it is pear-shaped, very long, bumpy or gibbose towards the stalk, and generally with a well marked furrow along its side. The stalk is short, but thick and inserted obliquely. The colour is lemon yellow, rarely flushed light rose towards the sun. The flesh is white, half-melting, sweet, with a grateful vinous flavour and fine fragrance. The fruit is cut in the first or second week of October and matures in October or November, but keeps very well and improves in

quality. This is a very desirable pear both for the amateur and for the market. It is an excellent dessert pear, and is also perhaps the best pear for cooking.

48. *DOYENNE' DU COMICE*. The tree is weak and dwarf. The fruit is large, obtusely pear-shaped; the colour is pale greenish yellow, mottled with rust with a large pale pink flush. The flesh is creamy and very juicy, with a very delicate flavour. It is cut in the first week of October and matures in October-November. Unfortunately this good pear is rarely in fruit except on adult trees, and even then its production is unreliable.

49. *FONDANTE DU PANISEL*. The tree is middling in size, with slender tortuous branches, and is not productive. The fruit is an irregular ovoid, with a thick short stalk, inserted sideways on a protuberance of the fruit. The colour is yellowish; the flesh is white, melting, with a sweet delicious flavour. The fruit is cut in the second week of October and matures in October or November, but keeps well into December. Would be an excellent pear for amateurs if it were more productive.

50. *FONDANTE THIRRIOT*. The tree is very vigorous with numerous thick greyish branches. Dislikes the shade as well as the full sunshine and is well productive. The fruit is large, top-shaped, with a long curved stalk slightly depressed. The colour is deep yellow, dotted grey, with a large rose flush with red dots towards the sun. The flesh is white, melting and juicy, with a pleasant acidulous flavour. The fruit is cut in the second week of September and matures in September-October. It is an excellent pear for the amateur, but does not keep well enough for the market, notwithstanding its rough and thick rind.

51. *SUCREE DE MONTLUÇON*. The tree is very vigorous but rather dwarf, and is very productive. Thrives better in sunny situations. The fruit is top-shaped or round, and plump, with a long, slender and curved

stalk slightly depressed. The colour is greenish yellow, with a large crimson flush. The flesh is white, half-melting, very sugary and aromatic. The fruit is cut in the second or third week of September and matures in October. Keeps very well. This is a good pear for the amateur, but is also one of the best foreign pears for the market.

52. TRIOMPHE DE JODOIGNE. The tree is very vigorous, and grows to a fine size, but is rather unproductive. The fruit is large, pear-shaped, swelling towards the middle, with a short thick stalk. The colour is light green or greenish yellow, with a dark red flush. The flesh is white, melting, sugary and vinous. The fruit is cut in the first week of October and matures in October or early in November. Does not keep well, being liable to rot off rapidly at the core.

53. PASSATUTTI. The tree is very vigorous and assumes naturally a fine pyramidal form, with dark green shining foliage. The fruit is pear-shaped, large or very large, produced singly or in pairs, with a thick short stalk. The colour is lemon dotted grey. The flesh is white, rather firm, sugary, with a pleasant acidity. The fruit should be gathered in the third week of October and matures in November or in December, and keeps well. The tree is very subject to the wood-borers and thrives best in the shade.

54. CONFERENCE. The tree is middling in size, but is fairly vigorous and productive. The fruit is produced singly and has an elongated pear-shape resembling that of Curé, but is more plump in the lower third. The colour is yellow or chrome yellow flushed rose towards the sun. The flesh is white, melting, with a pleasant flavour. It is cut in the third week of September and matures in October or November. Keeps fairly well. It is a good pear for amateurs, and has an attractive appearance for the market.

55. BELLE POITEVINE. The tree is very vigorous and very productive. The fruit is large, is finely pear-shaped with a long stalk, the colour is chrome yellow or deep yellow, beautifully flushed crimson, often dotted or marbled grey and brown. The flesh is yellowish, melting, sugary, with a delicious vinous flavour, but also more or less astringent, even when fully ripe. But for this defect, this pear would be an ideal fruit for all purposes. The fruit is cut in the second or third week of September and matures in October and November.

56. ROOSEVELT. The tree is rather weak, and dwarf when in full sunshine, but grows better in the shade. It is fairly productive. The fruit is large or very large, always produced singly, nearly spherical or slightly oval, with a long thick depressed stalk. The colour is light yellow, heavily mottled or marbled fawn. The flesh is white, melting, juicy, sugary and aromatic. The fruit is gathered in the third week of September and matures in October. Keeps fairly well.

57. LE LECTIER. The tree is vigorous with a pyramidal habit and prefers the full sunshine. It is well productive. The fruit is large, pear-shaped, elongated, irregular and bumpy. The colour is yellow rarely shaded rose towards the sun. The flesh is white, of fine texture and half-melting, sweet, fragrant, with a deliciously faintly acid flavour. The fruit is cut in the second week of October and matures towards the close of November, but keeps well into December. This is a very desirable pear for amateurs, and is also a good market variety.

58. EVA BALTET. The tree is very vigorous and an abundant bearer. The fruit is middling or large, pear-shaped, irregular and bumpy. The colour is lemon yellow or deep yellow, sometimes with a clear red flush on the sunny side. The flesh is white, half-melting, sugary and highly aromatic. It is cut at the close

of September and matures in October. Keeps well. It is a fairly good pear for the amateur, and a good autumn pear for the market.

WINTER PEARS.

Mature in December-January.

59. OLIVIER DE SERRES. The tree is very vigorous with bronze coloured twigs, and grows to a fine size, with a broad crown and spreading branches. In the first years it is almost sterile, but afterwards becomes very productive, yielding fine crops with great regularity. The fruit is middling or large, produced singly or in pairs, rather flat or spheroidal, irregular, with a rough skin, and a stout bronzed coloured stalk, slightly depressed. The colour is yellow or light yellow, heavily dotted and splashed bronze. The flesh is straw-coloured, melting, juicy, sweet, fragrant, with a very pleasant acid flavour. Grows anywhere, but prefers the shade. The fruit is cut in the first week of November and matures in December or January. It is a first class winter pear for the amateur, and is also recommendable for the market.

60. TRIOMPHE DE TOURAINE. The tree is vigorous, with a compact pyramidal habit. It is very productive, and prefers a deep soil in a dry and warm situation. The fruit is large or very large, usually produced in pairs or triplets, perfectly pear-shaped with a smooth skin and long stalk slightly depressed. The colour is yellow, sometimes suffused rose towards the sun. The flesh is white, melting, moderately sweet, acidulous and aromatic, without any grittiness. The fruit is cut in the first or second week of November and matures in December or January, but keeps well until February. It is a good pear for the amateur and for the market.

61. ROBITAILLE' PERE. The tree is fairly vigorous, but little productive. Prefers the shade. The fruit is large, broadly top-shaped, with a long slender stalk

slightly depressed. The colour is yellow, dotted green and fawn. The flesh is half-melting, sugary, juicy, and well-flavoured. Is cut in the first week of November and matures in December-January. It is an excellent fruit for the amateur.

62. COMTESSE DE PARIS. The tree is not vigorous, but fairly productive. The fruit is always in pairs or triplets. It is pear-shaped, rather elongated, smooth, light green or yellowish green, dotted all over with brown or black. The flesh is white, half-melting, sugary, and acidulous. The fruit is cut towards the end of October and ripens in December.

63. MADAME BALLET. The tree is very vigorous and well productive, prefers the full sunshine with copious waterings. The fruit is large, ovoid, with uneven skin. The colour is golden yellow. The flesh is half-melting, juicy, of good quality. It is cut in the last week of October or early in November, matures in December, but keeps well for a long time. It is a fine pear for the market.

64. VIRGINIE BALTET. The tree is fairly large, and is very vigorous and well productive, prefers a deep moist soil in full sunshine. The fruit is large, broadly pear-shaped, with uneven rind, and is generally produced in couplets. The colour is light yellow. The flesh is white, or shaded pink, very melting and sugary, of exquisite quality. The fruit is cut in the second week of November, and matures late in November or in December. It is an excellent late autumn or winter pear for amateurs, but keeps too badly to be a good fruit for the market.

65. LA FRANCE. The tree is vigorous, with long upright branches and small roundish foliage, and has a dense habit of growth. It is very productive. The fruit is produced generally in clusters of two to four, and has an irregular round shape, rather flat, or spheroidal,

with a long depressed stalk. The colour is light greenish yellow or pale yellow, without any flush. The flesh is white, of very fine texture, melting, sweet with a delicious flavour. The fruit is gathered in the first week of November and matures in December, but keeps well to January. This is a first class pear for the amateur, but unfortunately its appearance is not attractive for the market.

66. WINTER BON CRETIEU. The tree is very vigorous and productive. The fruit is generally produced in pairs, and is large or very large, pear-shaped, of a beautiful yellow colour, without any flush. The flesh is cream-coloured, rather firm, sugary, with a delicate acidity and fine aroma. The fruit should be cut late in October and matures in November-December, but keeps in good condition until January or February. It is good as a dessert pear, but is more suitable for cooking.

67. BEURRE' HENRI COURCELLES. The tree is fairly vigorous, with long branches and small pointed foliage. It is well productive. The fruit is generally produced in clusters of two or more; it is top-shaped, with a thick stalk rather depressed. The skin is often uneven. The colour is yellowish green or light yellow. The flesh is white, of fine texture, half-melting, sweet, with a very pleasant and peculiar flavour. The fruit is gathered in the second or third week of November and matures in January, but keeps well until March. It is a desirable fruit for the market as well as for the amateur.

68. MARTIN SEC or ROUSSELET D'HIVER or CANNELLINO DEI VENETI. The tree is fairly vigorous when grown on deep soils but prefers the pear stock. The fruits are small or middling, pear-shaped, with a long stalk. The colour is yellow entirely covered with shining bronze. The flesh is yellowish, half-melting, sweet and highly aromatic. The fruit is cut in the first week of November and matures in December-January.

It is fairly good for the table, but is one of the best pears for cooking.

LATE WINTER PEARS.

Mature sometimes in January, but more often in February or March.

69. **BERGAMOTTE ESPEREN.** The tree is very vigorous, with a spreading pyramidal habit, and thrives best in full sunshire, in the open. It is well productive. The fruit is often produced in clusters of two or three, it is large, or very large, top-shaped, plump, with a strong stalk slightly depressed. The colour is light green or yellowish green, dotted with brown and fawn. The flesh is white, melting, of very fine texture, juicy, sweet, with a delicate aroma. It is cut in the third week of November, or later, and matures in February or March. Keeps very well. It is one of the very best late winter pears.

70. **BERGAMOTTE HERTRICH.** The tree is vigorous, but rather capricious as to productiveness. The fruit is of the same size and appearance as Bergamotte Esperen, and matures at the same time. It is often marbled or streaked with rust. The flesh is of the same rich quality, with a more decidedly vinous flavour. It is a superior pear for amateurs.

71. **BERGAMOTTE RENEE.** The tree is vigorous and well productive. Requires the full sunshine. The fruit is large or very large, obtusely top-shaped, light yellow, often marbled and dotted fawn and brown, with a reddish flush towards the sun. The flesh is white, melting, of the same quality as B. Esperen. Should be gathered late as that variety, and matures in February but keeps well till March or later.

72. **PASSE CRASSANE.** The tree is fairly vigorous and thrives best in the shade. It is fairly productive when it reaches adult size. The fruit is large or very large, rounded, with slightly depressed stalk and is of a yellowish green colour. The flesh is white, half-melting,

sweet, with a fine flavour. The quality is variable, but is generally an excellent late winter pear. It is gathered in the third week of November and matures in January or February.

73. DOYENNE' D'HIVER or BERGAMOTTE DE PENTECÔTE. The tree is fairly vigorous, and fruits best in full sunshine along a southern wall. Resists well to the wood-borers. The fruits are produced singly or in pairs, sometimes in triplets. They are large or very large, oval, with a short depressed stalk. The skin is smooth, yellowish green. The flesh is cream-coloured, half-melting, sweet, acidulous, fragrant, but often gritty at the core, especially if grown in the shade. The fruit is gathered after the middle of November, as late as possible, and matures in January or February, and keeps well until April.

74. DOYENNE' D'ALENÇON. The tree is small or middling, and thrives in all situations. It is well productive. The fruit is of the same shape as the preceding, but is smaller. The skin is rough and thick, light green, passing to pale yellow or lemon yellow at full maturity, dotted or marbled brown. The flesh is cream-coloured, without grittiness, melting, sweet, with a pleasant flavour. The fruit is cut in the second or third week of November and matures in January or February. Keeps well.

75. NOTAIR LEPIN. The tree is very vigorous and requires the full sunshine and a dry situation along a southern wall. The fruit is large or very large, bell-shaped or irregularly pear-shaped, with a long depressed stalk. The colour is yellow dotted with rust and marbled fawn. The flesh is white, gritty at the core, firm, but juicy and sweet, with a good flavour. Should be gathered late in November, and matures in January, but keeps well until April.

76. REALE DI TORINO. The tree is very vigorous, grows to a fine size, with a marked pyramidal habit,

and is very productive. Thrives well anywhere, but prefers the shade. The fruit is bell-shaped or bluntly top-shaped, produced mostly in clusters of two or three. The colour is yellow or greenish yellow, often dotted with rust. The flesh is cream-coloured, of fine texture, fairly juicy, half-melting, sweet, with a rich flavour. Should be cut towards the end of October or early in November, and matures in December-January, but keeps well till February or later. It is a fine pear for the market as well as for the amateur.

77. PRESIDENT DROUARD. The tree is vigorous but rather dwarf, and is well productive. The fruit is pear-shaped, with a short depressed stalk, inserted obliquely. The colour is yellow, dotted fawn, sometimes with a rose flush towards the sun. The flesh is white, of fine texture, half-melting, sweet and juicy, of good fragrance and flavour. The fruit is cut in the second week of November and matures in January, but often keeps well till March.

78. DOYENNE' GEORGES BOUCHER. The tree is fairly vigorous and productive. Thrives well anywhere, but prefers a warm and sunny situation. The fruit is broadly bell-shaped, large or very large, with a short stalk slightly depressed. The skin is smooth, but very thick, deep yellow, dotted or marbled fawn and rust, with a reddish flush. The flesh is straw-coloured, sugary and juicy, faintly aromatic. The fruit, like that of *Triomphe de Touraine*, takes its yellow colour when still quite young on the tree. It is gathered after the middle of November and matures in February or March. It is fairly good as a dessert pear, but delicious when cooked.

79. ST. GERMAIN D'HIVER. The tree is vigorous and tall, and very productive. Thrives well in all situations. The fruit is produced singly, and has an elongated oval shape, with a slender stalk, slightly depressed. The colour is greenish yellow dotted fawn and

brown. The flesh is gritty towards the core, pale-yellow or cream, half-melting, juicy, sweet and markedly acidulous. It is rather poor in flavour. The fruit is cut late in November and matures in January or February, but keeps until April, and is best eaten cooked.

80. BERGAMOTTE DE PARTHENAY. The tree is very vigorous, and attains a large size with a pyramidal habit, and large roundish, thick foliage. It is little productive. The fruit is very large or enormous, shaped like Bergamotte Esperen, with a rather rough, yellowish green rind. The flesh is rather coarse and gritty, but juicy sweet and fragrant. The fruit is cut late in November and matures in February or March. This is a kitchen pear of fairly good quality.

81. CATILLAC OR CADILLAC OR CHARTREUSE OR GROS MONARQUE. The tree is vigorous and tall, with spreading branches. Prefers the shade and is very productive. The fruit is large or very large, obtusely top-shaped with a depressed stalk. The skin is rough and thick, yellow, deeper yellow towards the sun, with a dark red flush, and dotted and marbled fawn. The flesh is white, often gritty, firm, sugary and faintly perfumed. The fruit is cut late in November and matures in December-April. This is a cooking pear of good keeping quality.

Besides the above sorts of pears, many others have been introduced in these Islands during the last years, but so far they are very little grown, and it is not possible as yet to express an opinion as to their qualities under local cultivation. They are: De la Forestrie, Bergamotte Arsene Sannier, Lincoln d'hiver, Bergamotte d'été, Premices de Maria Laseur, Lucrative or Seigneur Espere, Graslin, Idaho, Parrot, Wilder, Buerré Supreme, Doyenné d'automne, Roi Charles de Wurtemberg, Buerré gris d'Amboise or Buerré doré, Belle de Lesquin, Belle Angevine, Suzette de Bavay, Kieffer's Seedling, Bel Present d'Artois, Compte de Lambertye, Prevost,

Professeur Opoix, Besi de Chamontel, Bonne de Malines or Winter Nelis, Charles Ernest, Beurré Le Brun, Docteur Joubert, Souvenir de Jules Guindon, Fortunée and Fertility.

Amateurs desiring to have a small collection for private use may plant the following 12 varieties: Madama, Clapp's Favourite, Fondante des Bois, Duchesse de Berry d'été, Epargne, Angelica of Malta, Duchesse d'Angouleme, St. Michel Archange, Curé, Le Lectier, Olivier de Serres, Bergamotte Esperen. A larger collection may include the following: Allora, De l'Assomption, Colmar d'Arenberg, Soldat laboureur, Directeur Hardy, General Totleben, Sucrée de Montluçon, Angelica of Rome, Marguerite Marillat, Baronne de Mello, La France and Passe Crassane.

The grower for the market will do well to limit his attention to the following: I. (1) Malta June Pear, or (2) Madame. II. (3) Fondante des Bois or (4) Epargne or (5) Allora or (6) Coscia. III. (7) Angelica of Malta or (8) Sucrée de Montluçon. IV. (9) Duchesse d'Angouleme or (10) Soldat laboureur or (11) Beurré Sterkmans or (12) Madame Ballet. If he were to limit himself to only three sorts, he may select Malta June Pear, Epargne and Angelica of Malta. The cultivation of winter or late winter pears although alluring, and desirable for the amateur, will be found little profitable by the market grower, as at that time the market will be glutted with the best oranges. However, the pear grows and fruits in these Islands better than the apple, and but for the presence of the fruit fly and of the wood-borers there would be no tree so remunerative or so kindly responsive to the attentions bestowed upon it.

DISEASES.

FUNGI. The pear tree is liable to many fungous diseases, but of these only two are really troublesome. The first makes its appearance on the twigs and branches,

in the shape of grey vesicles as large as a pin's head, or larger blisters formed by the coalescence of several vesicles, which eventually break open exposing the tissues of the bark and wood, which are found to be in a diseased condition, with black and hard concretions, resolving themselves into a black powder. The disease (Italian = *rogna*) is due to a fungus *Fusicladium dendriticum* Fuck. The diseased twigs and branches succumb sooner or later, and a bad attack may result in the death of the tree. The same fungus attacks also the leaves, causing numerous small irregular, black spots on both sides of the leaf. The diseased leaves soon turn yellow and drop off leaving a bare twig which may also become a prey to the disease, although the vesicles above mentioned usually develop on the base of the twig or on wood more than a year old. *Fusicladium dendriticum* is generally considered as the conidial form of *Venturia chlorospora* Ces., the perithecia of which develop on the leaves in autumn. This last is therefore the maturer form of the fungus, but so far has escaped detection in local orchards.

Another fungus, *Fusicladium pirinum* Fuck. attacks the leaves and the fruit. On the leaves it produces irregular broad black spots on both sides of the leaf, and generally attacks the foliage when quite young, causing it to drop off soon after. The same black spots varying in size from a pin's head to 1 or 2 c.m. in diameter are formed also on the green fruit (Italian = *brusone* or *ticchiatura*. French = *tavelure*. Maltese = *tebgha*). The diseased fruit remains on the tree and eventually ripens, the diseased spots retaining their black colour, surrounded by a whitish margin of hardened tissues. In some cases the spots if too small disappear at maturity, but their site is always recognisable in the ripe fruit by a hardening of the tissues, which usually acquire a bitter taste. On trees growing in the shade or in cool situations the fruit attacked by this disease becomes deeply fissured, particularly when the disease takes the shape of minute small

dots with coalescing whitish margins. *Fusicladium pirinum* is considered by Aderhold as the conidial form of *Venturia pirina* Cooke, whose perithecia are formed in autumn on the diseased leaves and also on the twigs. A bad attack of this fungus in moist summers may result in the destruction of 50 per cent. of the crop, certain pears like Angelica of Malta growing in shaded situations being very liable to it, while others such as Duchesse de Berry d'été and Beurré superfin being liable to the minutely dotted form above alluded to. As a remedy against these diseases it is recommended to collect and burn all diseased twigs, leaves and fruits, and to spray the trees repeatedly with a 1 per cent. solution of Bordeaux mixture.

On the leaves of the pear during the autumn months are sometimes developed small whitish round spots surrounded by a brown or reddish margin. These spots are due to the presence of the fungus *Sphaerella sentina* Fckl; other spots discoidal in shape, with or without a brown margin, are produced by *Phyllosticta piricola* Sacc. *Ph. pirina* Sacc. is an allied species also common on our pear trees, and hardly distinguishable from the first except by the use of the microscope. Large irregular brown spots on the upper surface of the leaf made up of black lines crossing each other in all directions are due to *Asteroma geographicum* Desm.; and large brown spots, also on the upper surface, with a radiating black margin, are due to *Vermicularia trichella* Tr. Another fungus *Stigmatea Mespili* Sor, which also attacks the quince and the medlar, causes small spots which penetrate the tissues of the leaf and are visible on both surfaces. At first these spots are reddish and then become brown with a small round crust in the centre. The leaves affected by this fungus soon become brown and drop off.

Gleosporium pirinum Pegl. is another fungus frequently attacking the leaves of the pear in our orchards.

The disease develops as small yellow dots early in autumn, which increase in size and become reddish and then brown, and in the centre become ashy grey and develop many minute black points. The same disease attacks the leaf-stalks in the shape of black points surrounded by a reddish border, which coalesce and envelop the leaf-stalk causing it first to thicken and then to become fissured transversely. Brown spots rather large but irregular in shape are sometimes formed on the upper surface of the leaf by *Ascochyta pirina* Pegl., the central part of these spots soon becoming ashy grey, and afterwards become crowded with minute black dots. The same disease has been noted in rare instances also on the green fruit.

The pear-mildew (*male bianco*) is a rare disease on our pear trees, and is caused by *Phyllactinia suffulta* Sacc. The young twigs and foliage affected by this disease assume a powdery aspect, with microscopic black spots or nodules.

Gymnosporangium Sabinae Wtr. attacks the leaves and sometimes also the fruit of the pear tree in France and Italy, but this disease has not been detected in these Islands. It may be remarked that the mature form of this fungus, *Roestelia cancellata* Rebent, lives on junipers, which with the exception of rare individuals of *Juniperus virginiana*, do not exist here. Another fungus, *Diplodia Pseudodiplodia* Fuck. lives on dead twigs of the pear, but its nature seems to be entirely saprophytic.

Polyporus ignarius Fr., *P. squamosus* Fr. *P. sulphurens* Fr. and *P. cinnamomeus* Trag. have been found growing on the stem of the pear in France and Italy. Of these only the last, *P. cinnamomeus*, has been found growing on the old stems of the pear in the Boschetto. Should it become frequent the same treatment may be adopted as suggested against *Polyporus obliquus* of Citrus trees.

ANIMALS. The rootlets of the pear-tree growing in stiff soils, insufficiently drained, sometimes develop small irregular nodules or galls within which is found the eel-worm (*Heterodera radicicola* Mull). The injury caused to the roots by these eel-worms, particularly where the land besides being too moist, has been also heavily manured for the cultivation of vegetables, results in a state of general malnutrition with sickly twigs which easily die off during the winter. In such cases the soil should be dug deeply and allowed to dry, or sown with crops which do not require watering. Pear trees grafted on the wild pear or on pear-seedlings develop nodules on the roots, usually as large as a walnut, but occasionally much larger. These nodules are due to an abnormal or uneven process of nutrition and are probably not due to any parasitic action.

The stem and the roots of young pears, at a depth of 10 to 15 c.m. below the surface of the ground, are sometimes gnawed off and deeply injured by the grub of *Geotrupes laevigatus* F. This grub, about 5 c.m. in length, is grey-coloured, fat, and is always found curved upon itself like a horse-shoe. It lives on the sap of the young trees and in spring comes out of the ground as a large black beetle. Its Maltese name is *bukauuar* and the havoc caused by the grub as well as by the beetle itself in its early life, to rose plants etc. is well known, but it attacks also the pear, the apple, the quince, the almond, the plum and other fruit trees. The young tree attacked by it of course dies, if the stem has been completely gnawed off, but is always so deeply injured even when the damage is only partial, that it is better to replace the young tree.

There are two Acari or mites affecting the pear tree. The one more frequently met with is *Phytoptus Piri* Sor., which produces small protuberances or papillae on both sides of the leaf (Italian=*vaiuolo*). These papillae at first are yellowish or reddish, and then turn

black. The other mite, *Phytoptus Mali* Am., is less frequent on the pear but common enough on the apple. It produces hairy spots of silvery white colour on the undersurface of the leaf. These hairy white spots are situated in a depression of the surface, which corresponds to a blistered condition of the upper surface, and gradually increase in size until they coalesce, often extending to the whole undersurface of the leaf (*eriosis*). These spots later on become reddish brown or brown. The diseased leaves should be picked and burned.

There are three species of *Aphis* known to attack the pear tree. The most frequent is *Aphis Mali* Fab. of which the wingless insect is light green, with a reddish head, and the winged insect is black, with a green abdomen. This *Aphis* is very common on the apple and often jeopardizes the crop very seriously. It is less common on the pear, but still it is the species more frequently met with on this tree, although the infestation is never so general or so severe as in the case of the apple. The next in importance is *Aphis Piri* Koch. of which the wingless insects are light reddish brown, covered with a mealy powder, the winged insects being greenish yellow spotted black. This *Aphis* is much more dangerous to the pear than the preceding species, curling up and destroying the foliage with great virulence, and unless properly treated repeats the same havoc year after year on the same tree. However, it is fortunately rather rare, and it does not seem to extend rapidly from tree to tree. The third species is *Aphis piraria* Pass. of which the wingless insect is black, and the winged insect is greenish brown with a black head and thorax. This *Aphis* has not been noticed as yet on our pear trees. As a remedy against the *Aphis* it is recommended to spray the tree when in leaf with a solution of tobacco juice or with a 1 per cent solution of lysol, or dusting repeatedly with precipitated sulphur containing nicotine (Schloesing's

sulphur). The best results are obtained by the winter treatment, when the tree can be thoroughly whitewashed with lime, twice or thrice between December and February.

The pear is infested by various scale insects, but here it is only necessary to mention those which are found on the pear in these Islands. *Chrysomphalus dictyospermi* Maskell is often troublesome and is perhaps the worst. *Mytilaspis pomorum* Beké is frequent on pear trees growing in sheltered and shaded situations. It is similar to *Mytilaspis citricola*, but smaller. *Lecanium Oleae* L., the black scale, is often found on the pear growing near Citrus trees. *Lecanium Piri* Schrk. is nearly spherical with brown markings and finely dotted black. *Ceroplastes Rusci* is rather rare on the pear, but *Icerya Purchasi* Mask. is more frequent. *Aspidiotus Hederae* is perhaps the most common of scale insects affecting the pear, and is almost sure to be present on trees growing in shaded situations, but does not appear to be half so virulent as *Chrysomphalus*. *Dactylopius Citri* Sigr. is common on the fruit, usually inhabiting the depression at the calyx, or the depression around the stalk, or the sides of the fruits which are in contact in the same cluster. Against the scales the sulphur-lime lotion applied in a strong solution (6 to 8 per cent) in winter gives very good results. The mealy bug, *Dactylopius Citri*, should be brushed off the fruit before taking it into the fruit-room, otherwise it will multiply there and besides disfiguring the fruit will exhaust it by sucking its juices, and also soil it by the honey-dew which it secretes abundantly.

The Diptera include two species which are injurious to our pear trees. *Cecidomyia Piri* Beké is a minute gnat-like dark-coloured insect, not longer than $1\frac{1}{2}$ to 2 m.m., with iridescent wings provided with dark hairs, with a black thorax, and light red sides and abdomen. The headless and footless larva of this insect inhabits the

gall-like folds of the margin of the leaf. A pear tree may have many leaves affected by this disease, but the injury is generally hardly noticeable. The other species is the execrable fruit fly (*Halterophora* or *Ceratitis capitata*) for which see under Citrus trees. Contrary to what happens in Italy, this fly attacks here all pears which are still on the tree after mid-August, so that in badly infested localities, in the first or second week of September, it is not possible to find a single pear which has not been punctured by the fly, and the crop becomes a total loss as the maggots which develop in a few days soon make short work with the grower's hopes. As soon as they are hatched the maggots penetrate deeply into the substance of the pear, establishing themselves around the core, and the fruit soon rots and drops off the tree, or if in the meantime it has been harvested and taken into the fruit room, rots there all the same. The winter pears although still quite green and hard in September, are not spared, but are punctured in the same manner, and the maggots develop in the same way without waiting for the fruit to mature or to approach maturity. The only known remedy against the fruit fly is the use of small bags made of paper or better of any cheap cloth. The fruit is put into the bags as early as possible after mid-August, so that by the end of that month no fruit is allowed to remain without this protection, and the bags are removed only at the time when the fruit is cut and taken into the fruit room. The best bags are those made of muslin or other light cloth with open mesh, but the cloth should not touch the fruit; as otherwise the fly is sure to reach through the cloth by its powerful ovipositor. The fruit-room should be kept dark not only on account of the fruit, but also to keep away the fly which otherwise may find its way into the room and proceed to puncture the fruit as if it were still hanging on the tree.

Among the Lepidoptera there are three species of moths which sometimes cause considerable havoc in our

pear orchards. The first is *Cheimatobia brumata* L. which is a small moth, the larva of which has ten feet and is about 2 c.m. in length. Its colour is light green with three longitudinal white lines along its sides. The male winged insect is about $1\frac{1}{2}$ c.m. in length, with greyish red wings, the posterior wings having a curved black line towards its middle. The female is much smaller, about 5 m.m. in length, with wings shorter than the body, the anterior wings with two black transverse lines, and the posterior wings with only one black transverse line. The female is unable to fly, and therefore has to crawl up the stem and twigs to deposit the eggs. The larva eats into the flower buds, and destroys the young leaves. It is also carried along with unripe fruit into the fruit room where it lives in the depression of the calyx of the ripening fruit, and partly eats into the flesh of the pear and causes it to rot. This moth is fortunately rather rare with us, and the loss incurred on its account is insignificant, but has been noted also on the apple, the quince and the stone-fruits. Should it threaten to become dangerous, it will be necessary to cover the stem with a thick ring of tar or other sticky substance, just below the first branches, so that when the female moth attempts to crawl up the stem it is held by those sticky substances and dies there before it has a chance to lay its eggs.

Grapholitha pomonella H.S. or *Carpocapsa pomonella* Tr. the codling moth, attacks the fruit of the apple and of the pear all over Europe. Here it is frequently found on the apple but is much more common on the pear, occasionally destroying as much as 75 per cent. of the produce of a tree. It is a small moth hardly reaching 1 c.m. in length. The anterior wings are grey with dark grey lines or blotches. This moth deposits an egg in the flower when still in bloom, or in the calyx close to the pistil soon after the petals are shed, and the young grub penetrates into the interior of

the receptacle or young fruit, and feeds upon the kernels, tunnelling around the core. As a rule only one egg is laid in each flower. The fruit goes on with its normal course of development, but when it has nearly reached full size begins to drop off, often however remaining on the tree until full maturity. In the meantime the larva of the codling moth will have made a tunnel through the substance of the fruit with an opening close to the calyx of the fruit or at the sides in the case of fruits touching each other in the same cluster. When it has reached full size, the larva comes out of this opening and drops to the ground or crawls down to the trunk of the tree, and hides in the fissures of the bark where it undergoes its metamorphosis. Not all pears are equally liable to the ravages of the codling moth. Some sorts maturing in early summer such as Malta June Pear are often badly attacked, while other sorts maturing at the same time and growing side by side with that variety hardly show traces of disease. Fondante des Bois and Beurré Superfin are also frequently visited by the moth, but Clapp's Favourite, De l'Assomption and other pears of the same period generally escape. So also the Malta Angelica is often severely affected, while Duchesse d'Angouleme, Belle Guerandaise, St. Michel Archange etc. never suffer. The winter pears are sometimes visited by the moth, but of these only Olivier de Serres is liable to attacks of some severity, the others are rarely visited, and in their case the parasite seems to exhaust itself, and the pear heals and matures in due course, although the kernels had been eaten away and there is a small mouldy cavity at the core with just a suspicion of an obliterated tunnel to the calyx, showing the way taken by the tiny grub when it penetrated into the fruit. The remedial measures may be directed against the chrysalis when it is hibernating in its tiny cocoon in the crevices of the bark, or against the winged insect when in the process of depositing the eggs in the calyx.

Against the hibernating chrysalis it is recommended to scrape off the loose or dead portions of the bark and to whitewash the stem with fresh lime or to apply a strong solution of sulphate of iron (green vitriol) $\frac{1}{2}$ kilo to 25 litres of water. Against the winged insect, or rather against its eggs, it is recommended to spray the trees when in bloom or soon after with arsenic mixture, made by dissolving Swift's Arseniate of lead, $\frac{1}{2}$ to $1\frac{1}{2}$ kilos in 50 gallons of water. The drops of this mixture which fall on the blossom effectually kill the egg or the larva as soon as it is hatched before it has time to penetrate within the fruit. A measure directed against the moth on the wing, consists in placing among the pear trees a barrel open at both ends, with the inside besmeared with grease or turpentine or some other cheap sticky substance. The barrel is placed on its side, and in the evening a lantern is lighted within. The moths are attracted by the light and remain sticking to the sides of the barrel.

The third moth is *Zeuzera Aesculi* Latr. (*Zeuzera pirina* L.) which is a well-known wood borer attacking the living wood of the pear, the apple, the quince, the hawthorn, the service, the loquat, the pomegranate, the walnut and occasionally the orange tree, besides many ornamental trees. The moth is $2\frac{1}{2}$ to $3\frac{1}{2}$ c.m. in length. Its colour is ivory white with the thorax and wings dotted with many small steel-blue spots. The male insect has large bipinnate antennae. The larva is 3 to 5 c.m. long, yellow with black dots in lines across the body, its head being of a shining black colour. The moth visits the pear trees at dusk and deposits the eggs. These are laid singly on the stem and branches, in any small irregularity of the bark. The larva tunnels its way upwards into the wood and at times comes down to enlarge the opening in the bark, through which the excremental matter is cast out in the shape of small reddish glomerules as large as a pin's head. The

larva is easily reached through the opening by means of a bit of wire hooked at the end, and thrust upwards until it meets the soft body of the grub at the end of the tunnel.

Other lepidoptera are not infrequently found on the pear in these Islands, but the injury caused by them is so slight that it generally passes unnoticed. Thus, the larva of *Nephopteryx spissicella* Fb. folds up the leaf along the midrib and lives on the tissues forming the tube where it undergoes its metamorphosis. The larva of *Acrobasis obtusella* Hb. lives on the tissues of the leaf which it folds irregularly. The growing twigs are sometimes corroded or eaten, some way below the growing end, by the reddish grey black-headed larva of *Grapholitha ocellana* Schiff. The greyish blue larva of *Hibernia defoliaria* Cl. with red spots on its back and a yellow line on each side eat the young leaves as well as the blossoms.

Besides these a legion of small moths work havoc in the pear and apple orchards of Europe and North America, but so far have not been seen yet on our trees. The grub of *Cossus ligniperda* Fb. tunnels into the wood of the pear, the apple and other fruit trees. When young the larva is of a dirty pink colour, covered with long hairs; when fully grown it is about 9 c.m. in length yellowish pink, dark almost black on the back, and bites and ejects from its mouth a caustic liquid. Its tunnels run irregularly, but usually along the length of the stem, having a round opening on the bark, through which the excrements and wood dust are thrown out. The winged insect is $3\frac{1}{2}$ to 4 c.m. in length; the anterior wings are ash-coloured shaded or spotted brown, the body is grey with broad whitish lines along the segments; the antennae are jointed, the joints being flat up to the apex, and the posterior tibiae have two pairs of spines. This is a dangerous insect and the infested tree often succumbs when there are two or more larvae living in the same stem.

Considerable injury is caused to the foliage of the pear in Italy by the larvae of *Hyponomeuta padella* L., *Smerinthus Tiliae* L. and *S. ocellata* L., and also of *Calymnia pyralina* View., *Brotolonia meticulosa* L., *Ocneria dispar* Hb., *Lasiocampa quercifolia* L., *Porthesia chrysorrhoea* L., *P. auriflua* Fb., *Bombyx Populi* L., *B. lanestris* L., and *B. neustria* L. The leaves of the pear in France, Germany and Italy, are also preyed upon by the larvae of the following butterflies: *Papilio Podalirius* L., *Aporia Crataegi* L., and *Vanessa polychloros* L.

There are two beetles which are particularly injurious to our pear trees. By far the most common of these is *Cerambyx Miles* L. (M. = *kirda tal langias*, *kirda mukrana*). The beetle is 3 to 5 c.m. long, of a shining black colour, sometimes shaded off to brown or rust along the outer margin of the elytrae. Both male and female insects have very long, jointed antennae like a pair of horns. The male insect is often smaller than the female, but has longer antennae. This beetle comes out of its tunnel in the base of the trunk, in spring from March to June, and is able to fly away for long distances, but generally crawls up the stem, where it copulates. The female insect soon comes down again to the base of the trunk, of the same tree or of those in the neighbourhood, and proceeds to lay its eggs in the fissures of the bark. One female may lay from 50 to 100 eggs, and as a rule visits one tree after another, and lays a few eggs in each. The eggs are white, 2 to 3 m.m. long, pointed at both ends. They hatch in a few days, and the small white grub at once penetrates into the living bark, and then into the cambium or zone between the bark and the wood. There it remains for several months until it reaches the length of 1 to $1\frac{1}{2}$ c.m. Up to this stage the bark of the trunk hardly presents any sign of the presence of this formidable enemy. The larva then proceeds to tunnel deeply into the wood, and increases in size rapidly. The tunnel is often tortuous, and always

directed downwards into the underground portion of the base of the trunk and into the main roots, and its section is elliptical with a longer diameter of 2 to $2\frac{1}{2}$ c.m. An opening is made at the base of the trunk, through which the excrements and wood dust are thrust up, the opening being always kept well closed against possible enemies. The larva continues its active life for about two years, and then becomes a pupa, at first white, and when the metamorphosis is complete the insect assumes its black colour, but remains cosily esconched in its tunnel waiting for the advent of spring. There are often as many as twelve larvae in separate tunnels within the same trunk, and when the insect visits the same tree one year after another, in a few years the tree dies or is blown down by the wind.

The other borer is *Capnodis tenebrionis* L. of which the female insect is about 3 c.m. long, but the male is never longer than $2\frac{1}{2}$ c.m. Both have the same shape and colour. The shape is peculiar, being obtusely round-headed with very short antennae, the body tapering behind abruptly almost to a point. The colour is dull black or dirty black, but the head is white, with splashes of white continuing over the thorax. The life history is the same as that of *Cerambyx miles*, and the larva directs its tunnels always downwards, but the insect is much less frequent than *Cerambyx* so that for every 20 adult *Cerambyx* caught in the same orchard it is not always possible to find one *Capnodium*. The ravages caused by these tree borers is incredible. The depletion of our pear and apple orchards is due to them, and but for them the cultivation of these kernel fruits would be much more popular. Long before the introduction of the fruit fly in these Islands the older gardeners used to say that "he who plants a pear-orchard will be planting a bagful of sorrow", no doubt alluding to the short-lived character of the plantation owing to the activities of these insects. These borers can be kept in check only

by a persevering attention on the part of the cultivator, and the treatment can be carried on the following lines :

a). Collect and destroy the mature beetles before they have the chance to lay eggs. These insects do not fly readily, except towards midday, and usually attempt to hide themselves by crawling round the stem on the approach of a visitor ; but they are easily detected from a distance on account of their black colour. They may be picked by hand and crushed against the stem, or may be picked up by a secateur and cut in two. They commence to come out of their burrows towards the close of March and are most common in April, but are still found here and there until June or later. The best time to look for them is early in the morning or just before sunset, and should be hunted for every day.

b). Paint the stem with tar or with arsenical mixture commencing from about 10 c.m. below the surface of the ground to the first or second tier of branches. The tar or the mixture should be applied thickly so as to fill up all crevices of the bark. The arsenical mixture is prepared by mixing 25 parts of fresh lime (by weight) with 25 parts of wood ashes, and adding 1 part of arseniate of copper (Vienna green or Scheele's green) adding enough water to obtain the consistence of a thick wash. This treatment should be done in March.

c). By means of a bit of copper wire hooked at the end try to reach the larva at the bottom of its tunnel. If the tunnel is too tortuous and the insect cannot be reached, pour down into the tunnel a tea-spoonful of lysol, or hypnol, or solutol or other powerful insecticide, or if there is no such preparation at hand make use of petroleum.

Rhynchites betuleti Fb. is a small beetle which rolls up the foliage in the form of a cigar, hence called *sigarajo* by the Italian growers, and *Phyllopertha horticola* Kby., is also accused of eating the foliage of the pear and apple as well as of the cabbage tribe. *Oxythyrea*

stictica Muls. and *Epicometis hirtella* Burm. are two beetles which feed on the flowers of the pear and of other rosaceous trees. In their stead we have *Epicometis squalida* and *Leucocelis funesta* (Maltese=*busuf*) of evil fame with the cultivators of roses, but they also frequently destroy the blossoms of the pear and other fruit trees. The same remark applies to *Labidostomus taxicornis* Labill. a small beetle with a large metallic blue green head and orange yellow elytrae, which eats the foliage as well as the blossoms. *Potosia floricola* var. *cuprina* sometimes eats the flowers of the pear and of other rosaceous trees, and also destroys many a ripening pear and apple in order to enjoy the sugary juice.

Otiorrhynchus raucus Germ., *Peritelus griseus* Germ., *Phyllobius argentatus* Schh., *Ph. oblongus* Schh., *Ph. Piri* Schh., *Polydrosus sericeus* Schall., *Magdalis Pruni* Germ., *Anthonomus pomorum* Germ., *A. Piri* Koll., *Apion Pomonae* Hbst., *Rhynchites Bacchus* Hbst., *Rh. equatus* Hbst., *Rh. conicus* Ill., *Rh. pauxillus* Germ., *Rh. auratus* Scop., *Scolytus Pruni* Ratz., *Bostrichus dispar* Fb., *Luperus flavipes* Geoffr., and *L. rufipes* Geoffr., prey upon the pear tree in France and Italy, and no doubt some of them, or species nearly allied, exist also in these Islands, although the injury caused by them has never been serious enough to attract attention.

The Hymenoptera include a few species which are injurious to the pear tree. The larvae of the small bee-like insect *Eriocampa adumbrata* Klg. about $\frac{1}{2}$ c.m. long, with a shining black body, yellow anterior feet, and brown wings, eat the substance of the leaf, leaving only the nerves; *Lyda Piri* Schrk. and *Nematus abbreviatus* Hart. prey upon the leaves of the pear in Italy and other continental countries.

THE APPLE TREE.

Pirus (Pyrus) Malus Lin. ROSACEÆ-POMEÆ.

Maltese=*tuffieha*. Italian=*pomo*. French=*pommier*.

The Wild Apple (Crab or Crab Apple) grows all over Europe and the Caucasus, but is not indigenous in Malta. It grows much further north than the pear and stands the cold better than this tree, although its large blossoms are easily affected by frost. The apple does not thrive well in tropical or subtropical regions except at a considerable elevation above the sea level. Therefore the tree prefers a temperate or cold climate, but a fairly hot summer is always necessary for the proper development of the fruit.

The apple tree was cultivated by the ancient Greeks and Romans, these last having in Pliny's time 22 varieties under cultivation, but it was not known to the ancient Phoenicians, or at least was considered by them as a foreign tree. The Maltese name *tuffieha* is a generic term for any roundish fruit of some size, and is not peculiar to the apple. The ancient name was probably *app* or *epp*, and the term still survives in the local name of the medlar (*omm il-epp* or *omm il-app*), the medlar being supposed by old gardeners to be the mother plant of the apple.

At present the cultivation of the apple has spread to all temperate and cold regions of the world, and there are now under cultivation close upon 3,000 varieties of dessert, kitchen and cider apples, and new sorts are raised almost every year. The English apples have long held and still hold very deservedly the first place for quality, and there are also excellent Canadian, American and Australian sorts, as well as many really valuable sorts raised in Continental Europe. Of course many ancient varieties are next to worthless, and are now entirely replaced by more recent creations, but the number of varieties which are extensively cultivated is a

large one, and is probably larger than that of any other cultivated tree. However, it happens frequently that an apple which does very well in one district and is there a first class fruit, is found to give poor results and to produce comparatively inferior fruit in another, and this fact is not always accounted for by any great difference of soil or climate, or by different methods of cultivation. Unfortunately, most of the best English and continental apples cannot be grown with success in our subtropical climate. Many celebrated apples have been introduced in these Islands during the last two decades, and their cultivation was attempted experimentally either by budding or grafting on the doucin or on the paradise stock, or by growing them on own roots, propagating them directly by cuttings or layers. Accordingly, only a few of them have thrived well enough, or have produced fruit of sufficiently good quality to be recommendable for general cultivation. Notwithstanding these difficulties the cultivation of the apple in Malta has extended considerably in the last 50 years, so that at present we have many more apple trees than pear trees and the surplus production of fruit is often exported.

The apple budded or grafted on own seedlings or grown on own roots from cuttings or layers, thrives in all soils, provided that they are deep and moderately moist, with a porous and well-drained subsoil. Thrives better in half-shaded situations than in full sunshine and tolerates the shade better than the pear. Lands exposed to the east or north-east, but out of the reach of sea spray are eminently favourable for the apple. On deep rather stiff and clayey soils, and in sheltered situations the apple grows vigorously and in a few years may reach a height of 4 to 5 metres. When grafted or budded on the doucin and still more on paradise stock, the apple becomes dwarfed and fit only for cultivation as cordons or as low bush. For an open orchard, at any rate in our climate, the tree should be grown on own roots or grafted

on own seedlings. In very moist and shaded situations the fruit grows to a large size, but is not so well coloured and its quality is not so good and does not keep so well as when grown in drier and more sunny situations.

PROPAGATION. The apple may be propagated (1) by seed, (2) by budding or grafting, (3) by layers, cuttings and suckers taken from the mother plant.

Propagation by seed is commonly undertaken only for the purpose of raising stock for budding or grafting, and for this object any apple seed will do. However, unlike the pear tree, the apple raised from seed will fruit when quite young, and it is worth while to sow kernels of good sorts of apples, or of fruits which have been fertilized expressly for this purpose, as in a batch of seedling apples one or more may turn out of superior quality and deserving propagation as a new variety. Kernels of the paradise crab (*P. Malus* Lin. var. *acerba* D.C., forma *paradisiaca* L. or *praecox* Bluff et Fing.), and of the cherry crab or *doucin* stock (*P. Malus* L. var. *dasyphylla* Bluff et Fing. forma *mitis* Wallr. and forma *eriphylla* Moris), are sown by continental nurserymen for raising stock, and also propagated on a large scale by cuttings and suckers. Apples grafted on paradise stock are dwarfed more than those grafted on doucin stock, and though they are more productive are only fit for training into cordons and other small forms. However even the doucin stock does not produce plants of sufficient vigour for our climate, although it is largely used on the continent as stock for extensive orchards. The kernels are dealt with in the same manner as those of the pear, and the seedlings require also the same treatment.

Budding is performed at any time from April to September, and grafting is done in winter the best time being towards the close of February. Seedling apples or wildings, as well as the paradise crab and the doucin stocks take budding or grafting most kindly, so that with proper attention failures will be rare. Certain varieties

of the apple are more suitable for small or low forms and therefore in their case the paradise should be preferred as stock. The apple is frequently grafted on the hawthorn (*Crataegus Oxyacantha* L. var. *monogyna* Jacq.) which abounds in our valleys and seems to thrive well on this stock. It is also grafted on the Azarole (*Crataegus Azarolus* L.), and occasionally on the quince ; but on this last the apple though it is fairly productive, rarely thrives well and is short-lived. The best grafting stock for the apple is the seedling apple raised by sowing the kernels of the cultivated sorts. Suckers from these seedlings, as well as the suckers which are produced abundantly by the paradise stock and the doucin stock, are frequently removed in winter and used as grafting stock in the same manner as seedlings.

However, most gardeners as a rule prefer to grow their apples by direct propagation from cuttings or layers or from suckers thrown up by apple trees grown on own roots. It is owing to this method of propagation that the cultivation of the apple has spread and is spreading so well, in spite of the wood borers which infest our kernel fruits. In fact when the stem of an apple tree is too much damaged by the larvae of these insects, a sucker is allowed to grow by its side, and as it makes very quick growth in two or three years it will be quite strong and in bearing condition, so that when the old stem is removed the sucker is already a productive unity.

Cuttings are made during winter from December to February, yearling spurs, 10 to 15 c.m. long, taken with a heel of the older wood, make excellent cuttings, but many gardeners make their cuttings of older wood, two to four years old, the cuttings being 15 to 30 c.m. long, with or without a terminal bud on new wood. The bed is prepared in a cool situation along a northern wall, and the soil is digged deeply and mixed with some old manure. The cuttings are planted deeply,

the shorter ones are stuck straight and the long ones in a slanting position, leaving only about 5 c.m. of the cutting above the ground. The soil is pressed down firmly around them, and is kept clean of weeds and well moist by watering frequently in dry weather. The cuttings are allowed to remain for two years in the bed, and are then transplanted to their final destination.

Layers are made at all seasons, but they are best made in March when the buds are swelling. They are made in two ways, either by interring deeply only a small part of the branch, leaving the upper part above ground, or by interring the whole branch about 10 c.m. below the surface, leaving only the tips of the twigs with their terminal buds above the ground. In the first case the interred part of the branch is bruised or notched with a knife, to induce the emission of roots, and the layer is then left to take care of itself, but if watered during the summer the formation of roots is better assured. In the second method watering has to be continued regularly, otherwise the layered twigs being too close to the surface will not emit roots in a dry soil. By the first method fine layers are obtained from the first year, which will bear transplanting at once to their final destination, whereas the second method is used merely as an alternative to propagation by cuttings when it is required to raise large quantities of plants, as most of the interred twigs will root. However the plants obtained by this method will be too weak to be planted out in the following winter, so that a selection is made and the few strong ones are planted out in the orchard, and the rest are transplanted into nursery beds where they are allowed to acquire strength for a year or two before use.

Suckers afford a most easy way of propagation, and this method is therefore particularly in favour with our gardeners. The apple tree has a natural tendency to throw up suckers around the base of the stem or

from the rootstock. These suckers if too close to the surface of the ground, or above it, are earthed up in spring, and they fail not to emit roots. They are allowed to grow for two or three years, so that when transplanted they make nice strong plants for immediate use in the orchard. Suckers are produced more profusely on the moist clayey soils in which the apple delights, and are sometimes thrown up from the roots at some distance from the stem. Indeed a ready method to obtain suckers consists in severing a few roots, 1 to 2 c.m. in diameter, and turning up the severed end of each root just above the ground, and it never fails to form adventitious buds and to throw up one or two strong suckers in the course of spring or summer. The suckers are removed from the mother tree or transplanted in winter, and if strong enough they are immediately transferred to their final destination, but if too small or weak they should be planted out in the nursery, where they are well tended for a year or two, and then if not required in the orchard, may be sold out as young trees.

One of the advantages of growing apples on their own roots is that the suckers thrown up around the tree, of course reproduce the variety to which the mother plant belongs, and at least in this Island, apple trees reproduced by suckers are as vigorous and as productive as budded or grafted trees. If it is well provided with rootlets the sucker will establish itself at once in its new home, but those suckers which happen to have only one or two thread-like roots, or which are lifted with only a bit of a large root, will not fail to establish themselves if they are properly watered in the first year following their removal.

The apple may be planted at any time from October to February or early in March, but is best planted in October or November when the soil has been well moistened by the rains of autumn. The

tree can be transplanted with or without a ball of earth, but if the operation is performed so early in autumn it is preferable to transplant with a ball of earth. All the leaves should be removed, leaving only the last one or two leaves on each twig. This defoliation is necessary in order that the tree being newly transplanted and therefore still weak, may not become too exhausted, and the terminal leaf is allowed to remain, so that the circulation of the sap may continue and this will prevent the formation of new foliage so late in the season. Trees transplanted in autumn will establish themselves before winter, but those planted in winter of course cannot form new roots before spring. This means not only a gain of time, but also less risk of failures, as the trees which are yet in the process of establishing themselves when they put out the new foliage in spring, will require to be watered oftener and earlier in the season. Apple trees raised from cuttings, layers or suckers should be planted rather deeply, the object being to encourage the formation of new roots from the stem which will aid the tree to establish itself the sooner, and will give it a better hold on the ground.

The distance at which apple trees should be planted apart, of course must vary according to the situation, the soil, the variety planted, and the particular form in which the tree is trained. In a close or sheltered situation and on good deep soil where the apple tree is expected to reach full size, the distance apart should not be less than 4 metres in the row, and 5 metres between one row and another. In poorer soils and more open situations the distance may be $2\frac{1}{2}$ to 3 metres in the row, and $3\frac{1}{2}$ to 4 meters from one row to another. Cordons may be planted 50 c.m. to 1 metre apart, but pyramids or standards planted along the walks or the sides of a vegetable garden should have a distance of at least

3 metres apart, so that the land may not be too much shaded for other cultivations. The land is tilled deeply and well manured beforehand, and it is a good practice when planting in deep, stiff or clayey soils, to construct for each row of trees a trench 1 metre deep and $1\frac{1}{2}$ to 2 metres broad, filling the bottom of the trench for about 30 c.m. with rubbish or loose material, and then filling up with the soil which had been taken out, mixing it with stable manure or with road sweepings.

CULTIVATION. The apple tree grown in the vegetable garden or on irrigated lands requires no further cultivation beyond that regularly bestowed on the crops of vegetables. It is not then in need of either special tillage, manuring or irrigation, the only attention required consisting in regular pruning and trimming to shape in winter, and in the various treatments against insects and fungous parasites, if necessary. The fertilizing material which sinks into the ground out of the reach of the roots of vegetables will be utilised by the apple trees, and the root system of these is never such as to interfere appreciably with the cultivation of vegetables or to appropriate the fertilizers meant for them.

The apple orchard should be tilled at least three times a year, in the same manner as the pear orchard; the same attention is also required as regards manuring. The land may be cropped during winter and early spring, but of course the heavier crops should be avoided, preference being given to leguminose crops such as peas, vetches, and French beans or haricots. Beans may be grown if sown sparingly between the rows of trees. When the land is cropped regularly, trenching and manuring should be done every fourth year, but care should be taken not to trench deeply in order not to cause injury to the upper roots of the trees. On land newly trenched, if the soil is suitable, two crops of potatoes may be obtained, one in spring and the other in autumn, or a crop of melons, water-

melons or vegetable marrow may be raised, to be followed by a crop of peas or French beans or of winter vegetables. Beans may be sown afterwards, and in the fourth year a crop of green forages may be obtained, after which the land should be trenched again. Trenching is best done late in autumn, when the trees are shedding their leaves, but in the third and fourth year after trenching, it will not be possible to allow any crop to vegetate in apple orchards in spring or summer without causing serious injury to the trees and to the crop of fruit. An abundance of potash in the soil is necessary to improve the colour and the flavour of the fruit and therefore frequent dressings with wood ashes or with potash manures will be found beneficial for light soils.

On moist clayey soils, or in shaded valleys the apple tree grows well and yields abundant crops without any irrigation, provided that the natural moisture of the soil has been preserved by fairly deep tillage in April, the surface soil being reduced to a fine tilth, and properly levelled. Apple trees growing on light soils or in open situations require to be watered in the dry season from June to September otherwise there will be a check in the progress of vegetation, and the fruit will remain undersized or will drop off the tree too early to be put to any use. The circular trough made around the tree to receive the water need not be deep, but should be broad enough to extend approximately to the outer boundary of the crown of foliage. Irrigation should be regulated every fortnight, and should be continued until the first rains. However, even on the best lands the apple tree is always greatly benefited by irrigation, unless the land is watered in connection with the cultivation of summer vegetables, when of course the trees are indirectly watered along with the vegetables. Brackish water is more frequently injurious to the apple tree than to Citrus trees, and

where brackish water is used the land should be drained thoroughly, to avoid the accumulation of chlorine in the soil which will soon cause the trees to develop chlorosis, with disastrous results. If water of better quality is not available it is advisable to commence irrigation as late as possible and to discontinue it after the first good shower of rain, and in the meantime to till the soil carefully as above mentioned, for dry land fruit-culture.

TRAINING. The apple tree can be trained into the same forms as the pear, and perhaps with greater facility. Certain varieties of English and French origin which refuse to stand the ordinary orchard treatment will give good results if trained as espalliers or contre-espalliers along a shaded wall or close to it; but as a rule it is better to grow them either as cordons budded on paradise stock or grown on own roots from cuttings or layers and trained as bushes or small pyramids. These same sorts of apples which will die off if planted in the red soils in open situations, will do very well and fruit abundantly if grown in large pots, and trained either as cordons or palmettes, or more simply as bushes or small pyramids, but of course this system appeals only to the amateur. The most convenient form to give to the apple tree for the open orchard is that of a pyramid or of a vase-shaped bush, and for exposed situation even the pyramidal form is not always desirable. The bush form when kept well open within is more productive and yields finer fruit, as the several branches rising from the ground or close to it behave as so many cordons or palmettes. The vase-shape is roughly but readily obtained in the nursery by cutting down the young sucker or the young plant to within 20 c.m. from the ground, and of the side branches which develop 3 to 5 are selected late in spring or in summer and trained round a hoop of willow or other cheap material, which

keeps them well open and at regular distances from each other, until the young wood has hardened, and the shape is afterwards kept up by careful pruning in winter and trimming in spring. Grown-up bushes may be trained into the vase-shape, roughly but quite effectively, by the removal of the inner branches in winter, at the same time trimming back the sides to shape. This operation may result in the loss for the first year of a few flower buds along with the wood, but it will be found that the total production of that year is hardly affected and the fruit will be of better quality. Moreover, the beneficial results will be permanent if the grower is careful to keep up the shape of the tree by proper attention in winter.

PRUNING AND TRIMMING. The operation of pruning is done in winter from November to February, and should be attended to every year or at least every two years, and the occasion may be availed of for the treatment of parasitic diseases if necessary. In a well kept orchard which is pruned regularly, there will be little to do in the way of pruning, beyond cutting back any drooping branches, and the branches which form within the tree, which if allowed to grow will draw upon the strength and resources of the tree, and will obstruct the full action of light and air. The twigs should be thinned out rather severely, as a dense growth of foliage is more injurious to the fruit of the apple than to that of the pear; at the same time vase-shaped trees should be trimmed to shape by removing any side growths which may have formed during the course of summer. The removal of large branches should be avoided, but if indispensable should be done cleanly and carefully according to the general rules of pruning. Suckers may be removed at any time of the year, and the sooner the better, but if required for propagation may be removed in winter and are first separated by a clean cut from the mother

plant, and then lifted up gently along with their rootlets. The operation of trimming is best performed in May, and is easily done by rubbing off with the fingers any weakly side shoots, and those which are pushing out of place or within the tree, which if allowed to remain will consume uselessly the vigour of the tree, only to be removed in the following winter.

Root pruning is necessary, particularly on irrigated lands which are also devoted to the cultivation of vegetables, as the frequent irrigation provokes an excessive formation of superficial roots. However, as a thorough root pruning is an almost unavoidable consequence of trenching, which on such lands is usually performed at regular intervals of four years, and as some root pruning is always done by the hoe every time the land is tilled, the work need not be undertaken as a special operation. Even on unirrigated lands the trenching done every fourth or sixth year, and the deep hoeing or digging is quite sufficient to put down any undue formation of superficial roots. In this connexion it is well to remember that the upper roots along with the superficial rootlets emitted by them, are those which contribute most to the formation of fruits and to their quality, and cannot be interfered with recklessly without influencing adversely the prospects of the crop in the summer following the operation.

HARVESTING. Windfalls, if the fruit is already of suitable size, are sent to market for sale as cooking apples. The fruit which is too small for this use is fed to animals. As in the case of the pear, the fruit of the apple should be harvested some days before it reaches full maturity. The apple is often attacked by the fruit fly but as a rule the eggs do not develop into maggots, and the punctures heal. Fully developed maggots of the fly have been detected in the apple only on rare occasions, so that the apple may be said to be practically immune from this insect, and the tedious and costly operation of

putting the fruit in bags, as in the case of the pear, is dispensed with, and the sun is allowed to act on the fruit and to develop its beautiful colours unhindered.

The summer and autumn apples if allowed to attain full maturity on the tree become floury and almost tasteless and keep very badly, and therefore they should be picked and forwarded to market or put into the fruit room as soon as they begin to turn mellow, or in the case of the red and green apples as soon as the colour becomes brighter. When the fruit has reached this stage it is also easily blown down by the first lively breeze, and this is another reason why harvesting should be anticipated by a few days. It is noteworthy, however, that unlike the pear, the fruits of the apple usually mature irregularly, so that when the first fruits are picked the last fruits may have to remain on the tree sometimes for three or four weeks. This peculiarity far from being a drawback is of great advantage to the grower who has time to dispose of his fruit gradually to meet the requirements of the market without causing a glut. The winter apples should be allowed to remain on the tree until the end of October, and then they may be picked and stored on the shelves of the fruit room, disposing them as close together as possible without touching each other, and on no account should they be deprived of their natural bloom. The custom of cleaning or rubbing the apples to show their beautiful lustre to the best advantage, though always reprehensible, should be left to the fruit-seller in his stall, who is anxious to make his fruit attractive to the purchaser and to sell at once, without minding much whether the keeping quality of the fruit has been impaired by this attention.

Perhaps there is no fruit which lends itself so easily for cold storage as the apple, and this practice is now resorted to very extensively in the large apple growing countries, particularly in North America. There are

ample cold stores in the Island, and with slight modifications the storage of fruits such as apples, pears and oranges would be possible, and should prove very remunerative, the fruit duly selected and sized, being packed in properly ventilated cases of convenient dimensions for easy handling.

Apples, like pears, are classified into (a) dessert or table apples, (b) kitchen or cooking apples, (c) cider apples. These last are unknown in Malta, and the cultivation of kitchen apples is still in its infancy, being a very recent introduction. Even the cultivation of dessert apples on a large scale is limited to a few sorts, but numerous continental and English varieties, also of recent introduction, are cultivated sporadically in the gardens of amateurs, although several of them which seem to agree well with our climate are finding their way to the orchard of the market grower.

The following is a descriptive list of the apples now grown in these Islands.

1. THE SMALL RED APPLE (M=*tuffieha ta Billudia* or *Buludia*=literally "the fruit of the country of the heathens or barbarians"!). The tree is vigorous and very productive. The fruit is small, round and well coloured. The flesh is firm, crisp and acid. This variety probably represents the original apple grown in Malta, and is little grown at present. The name *tuffieh ta Billudia* is often applied indiscriminately to most other varieties of apples.

2. THE LARGE APPLE (M=*tuffieh ohxon* or *tuffieh ta Gian Matten* said to be introduced by a person bearing that name). The tree is always well productive. The fruit is a truncated cone, large or very large, sometimes enormous. The rind is very smooth, but little lustrous, very fragrant, yellow or greenish yellow at maturity, flushed light pink towards the sun, with longitudinal stripes of red or deep rose. The flesh is yellow or

pale yellow, often floury and sometimes rather spongy, but always half-melting, sweet, with a delicate acidity and fine aroma. The tree is very vigorous and in sheltered situations grows to a large size. The bulk of our apple orchards consists now of this variety. The fruit keeps well and ships well. Maturation commences towards the close of July and is prolonged well into September.

3. THE LARGE WHITE APPLE (M=*tuffieh abjad ohxon*.) The fruit is large or very large, cream-coloured or light yellow at maturity, often slightly flushed, very light pink towards the sun. The shape is nearly round but often slightly oval, broader towards the base, and generally with a long and slender, but strong stalk. The flesh is floury, but juicy, sweet and well perfumed. The tree is very vigorous and productive. This apple is much grown in our orchards, being next to the preceding in importance. The fruit keeps fairly well; the first fruits ripen in July, and the crop is harvested entirely by the end of August.

4. THE SMALL WHITE APPLE (M=*pumicell*: the term is often applied indistinctly to small-sized apples and to winter or late-ripening sorts). The tree is vigorous, but never attains a large size, and has a marked tendency to throw up suckers. It is very productive, the fruit being borne in clusters of two to five. The fruit is small or middling, shaped like a truncated cone, the rind is greenish or yellowish white. The flesh is white, rather firm, but tender and juicy, fragrant and very sweet, with a pleasant acidity. The fruit ripens late in August or in September, and keeps well to October. The tree must have a cool situation, being little productive in full sunshine. It is a good fruit but it is commercially inferior to the preceding two sorts.

5. RED ASTRAKAN, TRANSPARENTE ROUGE DE RUSSIE. (M=*tuffieh ašmar*). The original tree was imported from Italy with the name of *Astrakan rosso*.

The tree is very vigorous and well productive; thrives best in full sunshine. The fruit is middling or large, rather flat and broader at the base. The rind is very smooth and shining, yellow or greenish yellow, entirely covered with crimson. The flesh is white, very tender, half-melting, sweet, with a pleasant acidity. Matures in June-August. This apple strikes well from cuttings, and on account of its charming colour, good size and shape, and its earliness, it has met the favour of growers, but as yet is not grown on an extensive scale.

6. ANURCA (M=*pumicella ta Napli*). The tree is middling, but well productive and requires the shade. The fruit is small or middling, round or ovoid, with a smooth yellow rind, flushed light pink. The flesh is white firm, well-perfumed and acidulous. Matures in November-January. This is one of the best winter apples for the market.

7. LIMONCELLA (M=*pumicella ta Messina* or *pumicella ta Reggio*). The tree is middling or dwarf, and fairly productive. Requires a shaded and cool situation. The fruit is conical or ovoid, yellowish white. The flesh is white, crisp, but tender, fragrant, very sweet and acidulous. Matures in January-March.

8. API ROSE. The tree is vigorous, but is always dwarf. It is very productive. The fruit is small or very small, in clusters of three to six or more, and requires much thinning to reach commercial size. It is flat but smooth, yellow, and almost entirely flushed deep shining rose or red. The flesh is yellowish, fine-grained, half-melting, very sweet and mild flavoured. Matures in November-December. Keeps very well.

9. API NOIR. The tree is fairly vigorous and very productive, but it is always a dwarf. The fruit is like that of api rose, but the colour is plum or dark plum. The flesh is also similar but firmer. Matures in November-January.

10. **HOOVER.** The tree is middling or dwarf, with large, long, dark green foliage of peculiar aspect, and is very productive. The fruit is middling, but often large when properly thinned, depressed, entirely coloured deep red. The flesh is yellow, firm, but fine-grained and tender, sweet and aromatic. Matures in October-November. Requires the shade, and should make a good market apple when better known.

11. **PEASGOOD'S NONSUCH.** The tree is very vigorous and productive and grows to a fine size. Thrives as well in full sunshine as in the shade. The fruit is large or very large, depressed, of very uniform shape and smooth. The rind is ivory white or yellowish white, sometimes with an indistinct pinkish flush. The flesh is firm, very finely grained, cream-coloured or yellowish, sweet and pleasantly acidulous. This is beyond comparison the best cooking apple for local consumption, the flesh acquiring on the fire a deliquescent creamy consistence and an exquisite flavour. Matures in October-November, but keeps well sometimes until January. It is fit for the kitchen as early as September, and is also a fairly good dessert apple when well ripe.

12. **DE JAUNE or REINETTE DE MANS.** The tree is weak and dwarf, but is fairly productive. The fruit is large, slightly depressed, smooth, with a yellow rind dotted grey or rust. The flesh is yellow, firm, savoury and sweet. Matures in November-December. This is another cooking apple of good quality, but the tree is always too weak.

13. **JEANNE HARDY.** The tree is fairly vigorous and productive. The fruit is large or very large, round or slightly depressed, and smooth. The colour is deep yellow, shaded carmine red towards the sun. The flesh is yellowish, firm, but juicy and sugary. Matures in November-December. This is a kitchen apple of middling quality.

14. **SCHOOLMASTER.** The tree is vigorous and very productive; thrives better in full sunshine. The fruit is large or very large, slightly depressed; the colour is deep yellow, spotted grey, with a large pink flush and red streaks towards the sun. The flesh is creamy white, rather firm, juicy, sugary and acidulous, of fairly good quality. Matures in September-October and keeps well. This is a good apple for the market.

15. **TEINT FRAIS.** The tree is very vigorous and fairly productive. The fruit is large or very large, well shaped, smooth, light shining yellow with a large shining pink flush. The flesh is white, rather firm, but tender sweet acidulous and fragrant. Matures in October-November. The tree thrives well in full sunshine but prefers the shade. This is a fairly good table apple, as is very good when cooked.

16. **COX'S ORANGE PIPPIN.** The tree is fairly vigorous with long slender branches and rather small foliage. It is well productive. The fruit is middling or large, round, slightly depressed, with a light yellow rind, flushed light pink towards the sun. The flesh is white or creamy white, crisp and tender, juicy, sugary with a pleasant acidulous flavour. Matures in September-October but keeps till November or later. This celebrated apple is too well-known to English readers to require comment. In Malta it thrives fairly well in the shade, and does best when grown in pots, but the fruit never acquires those qualities for which it is so justly esteemed in England.

17. **BLENHEIM ORANGE OR BLENHEIM PIPPIN.** The tree is vigorous and productive. The fruit is large or very large, round, with a very short stalk. The rind is smooth, yellow flushed pink towards the sun. The flesh is yellowish, crisp and juicy, sweet, with a fine acidity. Thrives in the shade better than in full sunshine. This good English apple thrives here better than Cox's Orange Pippin. Matures in October-November and keeps well.

18. CALVILLE BLANC. The tree is fairly vigorous in the shade, but is little productive. The fruit is large, irregular in shape, broad and often ribbed, with a long and slender stalk. The rind is smooth, pale yellow, flushed very light rose, often spotted with dull red. The flesh is yellowish white, crisp, very juicy and sugary, with a delicate flavour. Matures in December.

19. CALVILLE BLANC LESANS. The tree is vigorous and thrives well in the shade and also in full sunshine. The fruit is middling or large, round or slightly depressed, well shaped. The rind is deep yellow, often shaded rose. The flesh is yellowish, tender, juicy, of very good flavour. Matures in November-December. This is an excellent apple for the amateur, and should do well for the market.

20. CALVILLE GRAND DUC. The tree is vigorous but little productive. Requires the shade. The fruit is large, often slightly ribbed, greenish white, flushed light pink. The flesh is white and firm, but tender. Matures in October-November. It is a good cooking apple.

21. CALVILLE DU ROI or LONDON PIPPIN. The tree is vigorous and reaches a fine size, does best in the shade, but bears well the sun. It is little productive. The fruit is middling, round, light yellow sometimes shaded pink. The flesh is yellowish, crisp, of good quality. Matures in December-January.

22. CALVILLE ROUGE D'HIVER. The tree is rather weak, with slender branches, and its production is poor. Thrives best in the open. The fruit is large and conical; the rind is yellow, almost entirely covered red, and deeper red towards the sun. The flesh is white, sometimes shaded rose, tender and crisp, very sugary, with a fine acid flavour. Matures in November-December. This is a fine apple for the amateur; and does well in pots, but is too weak for the market grower.

23. **TRANSPARENTE DE CRONCELS.** The tree is fairly vigorous and thrives well in the sun. It is fairly productive. The fruit is middling or large, round, very smooth with a wax-like shining rind. The flesh is white, shaded rose, tender, sweet, with an excellent flavour. Matures in August-September. This apple seems to do well with us, and is a good dessert pear both for the amateur and for the market grower.

24. **SUZANNE FIESER.** The tree is rather weak, but does well in fairly shaded localities. It is productive. The fruit is large, sometimes very large, nearly round. The rind is smooth, yellow, almost entirely covered with carmine red. The flesh is yellowish, of excellent quality for the table. Matures in November-December and keeps well. It is a good fruit for the amateur.

25. **TOMPKINS' KING.** The tree is vigorous and well productive. Thrives well in the open where it is fully exposed to the sun. The fruit is large, round, smooth, yellow, flushed or striped red. The flesh is white, tender and sweet, with a delicate vinous flavour. Matures in November-December and keeps well. It is a good dessert apple, recommendable for the market.

26. **REINETTE DE CHENEE.** The tree is fairly vigorous, but little productive. The fruit is large, depressed and smooth. The colour is yellow, well-covered with lively red. The flesh is yellow and firm, but tender and juicy with a good flavour. Matures in December-January.

27. **REINETTE BAUMANN.** The tree is weak and requires the shade. It is fairly productive. The fruit is middling or large, nearly round, smooth, almost entirely covered cherry red. The flesh is yellowish, firm, but juicy and well-perfumed. Matures in November-December and keeps well. It is an apple for amateurs, and is specially suitable for cultivation in pots.

28. **REINETTE ANANAS.** The tree is rather weak, but very productive, and grows to a fair size in half-

shaded situations. The fruit is conical, middling or small, if not properly thinned. The rind is smooth, yellow flushed rose towards the sun. The flesh is yellowish, firm, but tender and sugary, well-perfumed, and with good flavour. Matures in November-December and keeps well.

29. REINETTE DE CAUX. The tree thrives well in the sun, and is rather weak, but is fairly productive in a deep and moist soil. The fruit is large, round, very smooth, deep yellow flushed pink or pale red. The flesh is yellowish white, firm, tender with a delicate flavour. Matures in January or later. It is a desirable market apple, and would be recommendable to the market grower if it were more vigorous.

30. REINETTE DESCARDRE. The tree is weak, and suitable only for cordons or for cultivation in pots. It is well productive. The fruit is large or very large, nearly round, but often depressed and irregular. The rind is yellow, sometimes flushed rose or streaked pale red, with rusty spots. The flesh is yellowish, tender, sugary and juicy, with a very agreeable flavour. Matures in December-January. It is an excellent apple for amateurs.

31. GOLDEN REINETTE. The tree is weak but thrives well in the sun and is well productive. The fruit is middling, round, very smooth, with a fine golden colour flushed rose towards the sun. The flesh is yellowish white and firm, sweet and fragrant. Matures in November-December, and keeps well for a long time.

32. REINETTE DU CANADA. The tree is vigorous on deep and moist soils, and requires a cool situation. It is fairly productive. The fruit is very large and broad, sometimes uneven or slightly ribbed, greenish yellow, often marbled fawn and flushed dull red. The flesh is creamy white, tender, sugary, with an excellent flavour. Matures in December-January and keeps long. This apple is a good dessert fruit and is an excellent kitchen apple, but requires a colder climate to bear regularly.

33. WHITE ASTRAKAN, TRANSPARENTE D'ASTRAKAN, or POMME D'ASTRAKAN BLANC. This is a very recent introduction and is the white counterpart of Red Astrakan. The fruit is of a shining white colour. The flesh is similar to that of Red Astrakan, and the fruit matures at the same time. These two excellent table apples will be largely cultivated when they are better known, as contrary to what one would expect they seem to agree well with our soil and climate.

34. PEPIN D'OR DE BOVELINGEN. The tree is productive and fairly vigorous. The fruit is large, conical, smooth ; the colour is shining lemon yellow. The flesh is white, very tender and sugary with an agreeable flavour. Matures in October-November. It is a good dessert fruit for the amateur, and is also recommendable for the market.

35. BEAUTY OF KENT. The tree is vigorous and thrives in all situations, but grows best in full sunshine. It is fairly productive. The fruit is large, broadly conical, smooth, pale yellow, flushed or streaked red towards the sun. The flesh is rather firm, but juicy and sugary with a fine flavour. Matures in October and keeps long in good condition. It is an excellent kitchen apple.

36. KING OF THE PIPPINS (Reine des Reinettes). The tree is very vigorous with erect branches and dense vegetation, and thrives in all situations. The fruit is large, nearly round, smooth, of a shining yellow colour flushed orange red and streaked blood red towards the sun. The flesh is white, quite firm, sugary and fragrant, of middling quality. Matures in October-November, and keeps long. This apple would be a valuable market fruit if it were more productive.

37. REINETTE GRIS. The tree is rather weak and thrives best in a shaded situation. The fruit is middling, of good form and nearly round, with a long and slender stalk. The rind is yellowish green blotched all over

with fawn. The flesh is white and soft, sugary, juicy, with an agreeable and delicate fragrance. Matures in December-January. This is an excellent dessert apple, but is not productive.

38. ECKLENVILLE SEEDLING. The tree is fairly vigorous with a dense growth, and is well productive. The fruit is large and smooth, rather depressed, yellow, flushed rose on the side of the sun. The flesh is white, rather firm, sweet and acidulous. Matures in November-December. It is rather a cooking apple.

39. STUMP. The tree is fairly vigorous and productive. The fruit is large, well-shaped, yellow, almost entirely covered red or heavily streaked crimson. The flesh is yellowish, firm, of fairly good quality. Matures in November-December. Should be grown in full sunshine on moist lands. It is fairly good as a dessert apple, but quite good for the kitchen.

40. LEVEN ALMA. The tree is rather weak, with erect branches, and is little productive. The fruit is very large, very depressed, green dotted grey and fawn. The flesh is creamy white, firm and acidulous. Matures in winter. It is a kitchen apple.

41. WOLF RIVER'S. The tree is fairly vigorous and productive. The fruit is large or very large, greenish yellow streaked pink. The flesh is white, tender and sweet, with a good vinous flavour. Matures in November-December.

42. ONTARIO. The tree is rather weak but very productive. The fruit is large or very large, slightly depressed, smooth, yellow or golden yellow well flushed with crimson. The flesh is yellowish, firm, sugary, acidulous and fragrant. Matures in December-January, and keeps long and well. This is a beautiful fruit of good quality recommendable for the market, and should be grown along a wall with an eastern aspect.

DISEASES.

One of the worst parasites is *Nectria ditissima* Tul. which is a frequent cause of canker in this as well in other fruit trees in continental orchards. Here it is still unknown and its early detection and treatment, should it find its way to our orchards, are therefore important as a preventive measure. The fungus makes its home on the stem or on the branches, preferably at the point of insertion of a side-branch or twig, which is killed immediately. The infected spots assume a dark cankerous appearance, the wood is laid bare and becomes dark brown or black surrounded by the thickened and rotten edges of the bark, upon which early in autumn are produced the fructifications of the fungus in the shape of small red protuberances. The diseased branch should be cut back down to the healthy wood and burned. If the fungus attacks the stem and it is not desired to lose the tree, the canker should be scooped out until the healthy wood is reached, and the wound is washed with a strong solution of sulphate of copper, and when dry painted over with tar.

Fusicladium dendriticum Fckl. and *F. Pirinum* Fckl. attack the twigs and branches, the leaves and the fruit in the same way as the pear, but the leaves and the fruit of the apple are here much less liable to these diseases than the leaves and fruit of the pear. The characteristic ash-grey blisters often appear on the young twigs when yet in leaf, and the black powdery mass of tissues under the blisters of the bark is more evident in the apple than in the pear. These diseased twigs should be carefully collected and burned. When an apple tree is badly attacked by these fungi it is a sign that the tree does not agree with the soil or with the situation.

Sphaerella sentina Fckl. produces on the leaves white spots edged with brown. *Leptosphaeria pomona* Sacc. produces in upper Italy spots of a similar appearance but of a grey colour, and *Sphaerella Pomi* Sacc.

produces larger spots or blotches of a brown colour, not surrounded by a particular edging. *Asteroma geographicum* Desm., *Vermicularia trichella* Fr., and *Stigmatea Mespili* Sor. attack the leaves of the apple in the same way as those of the pear. *Gymnosporangium clavariaeforme* Jacq., attacks the leaves and the fruit of the apple, and *G. juniperinum* Fr. attacks the leaves of the apple as well as those of the quince, but these two fungi have not been detected in our orchards, nor are they likely to make their appearance in these Islands owing to the absence of the Juniper, their intermediate host.

Three species of *Phyllosticta* attack the leaves of the apple. *Ph. Briardi* Sacc. forms small irregular spots of a brown or chocolate colour, which penetrate the substance of the leaf and are visible on both surfaces. *Ph. prunicola* Sacc. produces larger dry spots or blotches often surrounded by a darker edge, on the upper surface of the leaf, and later on the blotches develop minute black dots, which are the fructifications of the fungus. *Ph. Mali* Prill. et Delacr. produces small brown spots which afterwards become grey, with a thickened dark border, on the upper surface of the leaf.

Hendersonia Mali Thün. is met with along the Adriatic, and produces large round grey blotches surrounded by a violet margin. A rare continental fungus is *Pistillaria maculicola* Fuck. and the lesions produced by it consist in large dry blotches which gradually invade the whole leaf. On the undersurface are developed the fructifications in the form of minute club-shaped receptacles borne on white pedicels. As a preventive measure collect and burn all diseased leaves as soon as possible, giving no time to the fungi to spread or to form hibernating centres.

Capnodium salicinum Mtge. is a sooty fungus rather frequent on apple trees suffering from an attack of Aphis or of scale.

A common fungus on our apple trees is *Sphaerotheca Castagnei* Lev. which attacks the growing twigs as a floury or mouldy production covering the leaves, the leaf-stalks and the twigs (*apple-mildew*), and deforms the foliage, weakens the twig, and prevents or interferes with the formation of flower-buds. A good remedy against this disease when prevalent is to apply one or two dustings with flowers of sulphur on a dewy morning.

Four species of *Polyporus*, viz : *P. spumeus* Fr., *P. cinnamomeus* Trog., *P. ignarius* Fr., and *P. hispidus* Fr., and also *Hydnum Schiedermayri* Henfl. have been noted on the apple tree in continental orchards. Of these only *P. hispidus* has been observed on rare occasions on our apple trees.

Rhizoctonia Vuli D.C. is sometimes troublesome on the roots of apple trees growing in moist situations, and if the mycelium extends to the main roots the tree will probably succumb. The mycelium is at first white and becomes brown or violet-brown with age, and after killing the tissues of the minor roots extends upwards to the larger roots. The tree shows signs of the disease by a weak and chlorotic appearance, the leaves commencing to dry off at the tips early in summer and are shed long before autumn. The dead or dying roots should be carefully dug up and burned, and those showing signs of infection should be cut back to the healthy tissue and the wound protected from re-infection by painting over with tar. However, this disease is more frequent on the loquat than on the apple.

The mistletoe (*Viscum album* L) is a frequent parasite of the apple all over the continent as well as in England but does not exist in these Islands, and it is questionable whether it can thrive here at all, as repeated attempts to inoculate apple-trees with the seeds of the parasite for the sake of ornament always gave negative results.

Two species of Acari are frequent on the leaves of the apple, viz : *Phytoptus Mali* Am. which produces an erinosis on the undersurface of the leaf, and *Typhlodromus Mali* Am. which also attacks the young leaves causing the formation of large blisters which afterwards turn deep red and then brown. Another species, *Phyllocoptes Schlechtendali* Nal. is far less common and causes a part of the leaf or the whole of it to become discoloured and then to turn brown and dry.

Among the Coccideae there are several scales which are injurious to the apple tree. The most important is *Mytilaspis pomorum* Bche, the mussel scale of the apple, which is frequent on the apple in sheltered nooks and close situations. *Lecanium Oleae* L. and *L. Mali* Schrk. a closely allied species, but larger and more elliptical in shape and of a whitish brown colour, are sometimes found on the apple. *Ceroplastes Rusci* Targ., the fig-tree scale, is rather frequent on the apple but never dangerous. *Dactylopius Citri* is also frequent in certain years, and attacks the apple in the same way as the pear.

Three species of Aphis are found on the apple. *Aphis Mali* Fab. of which the wingless insect is light green with a reddish head, the winged insect being black with green abdomen. This species is common on the apple, and particularly on the young suckers around the base of the stem. It is often very troublesome, considerably weakening the tree, and when an attack commences early in the season, prevents the fruit from setting or causes it to be shed off as soon as it sets. *Aphis Piri* Koch. and *A. Sorbi* Kalt. are rarer. The first has wingless insects of a chocolate colour with darker thorax or back, and winged insects yellowish green, spotted black. The wingless insect of the second species is yellowish green or brown yellow, powdered bluish grey, and the winged insect is dark brown or black. An attack of any of these species of Aphis

results in much deformation of the leaf which rolls up or curls irregularly and develops protuberances or blisters of a reddish brown colour. Dusting with precipitated sulphur containing nicotine is a good remedy against these insects when the tree is in leaf, and whitewashing heavily with lime the whole tree, particularly the tips of the branches, in winter, is also a cheap remedy of great efficacy.

The woolly Aphis, *Schizoneura lanigera* Hausm., is now a frequent cause of trouble in our apple orchards, but our local apples seem to be much less liable to its attacks than most of the sorts newly introduced. The insect attacks the twigs, the branches, the stem and also the roots just below the surface of the ground. The wingless insect is about $1\frac{1}{2}$ m.m. long, disposed in rows or lines, chiefly along the undersurface of the twig. Its colour is yellowish or reddish, sometimes reddish brown; the antennae are very short and of a pale yellow colour. The winged insect is of a shining black colour, with a chocolate brown abdomen covered with white woolly formations. Squeezed between the fingers the insect leaves a blood red spot. The wingless insects are covered with long white woolly tufts made of a waxy exudation, which are prolonged downwards like a frieze of wool. The bark where the insect attaches itself becomes hypertrophied, and large protuberances are formed, which ultimately become cankerous and the woody tissues are destroyed for considerable distances along the stem and branches. The branches badly attacked should be pruned back and burned, and the stem and main branches should be well scraped of all diseased formations, and thoroughly painted over with some powerful insecticide such as the concentrated sulphur-lime mixture, or a strong emulsion of soap and petroleum to which some crude carbolic acid has been added, or an emulsion of pittelein 1 per cent., or a mixture made of glue and creosote

or tar. Nessler's tincture often recommended against this parasite, consists of 30 gr. soft soap, 2 gr. sulphide of potash (liver of sulphur) and 32 gr. of fusel oil (amylic alcohol) dissolved in 1 litre of water.

Three species of *Psylla* (plant-fleas) are found on the apple, viz: *Psylla Mali* Schmid., *P. melanoneura* Forst., and *P. pirisuga* Forst.; of these only the first is occasionally met with in our orchards *P. Mali* is yellowish green, the female insect having a red thorax with brown lines, the antennae are yellow with a long and pointed frontal process. The wings are almost transparent with yellowish nerves. This insect attacks the young foliage and the growing twigs, but is easily controlled by spraying with a 1 per cent solution of borax, or by whitewashing with lime in winter.

Typhlocyba Rosae (L) Germ. is sometimes found on the apple tree sucking the sap of the leaves and of the blossoms. It is 4 m.m. in length, of a pale yellow colour, with transparent elytra, and white wings with a bluish shine. It is never so numerous as to become dangerous. The larva of a small fly, *Agromyza minuta* Meig. (Diptera), excavate long tunnels close to the extremity of the leaf, but this insect has not been detected so far in local orchards. The fruit-fly (*Halterophora* or *Ceratitis capitata*), very often punctures the fruit of the apple, depositing a small cluster of eggs in each puncture; but these eggs rarely develop, and the puncture as a rule soon heals, leaving a hardened dark spot in the rind and in the flesh of the apple. The fruit as a result of this puncture is disfigured and its keeping qualities are impaired, but the development of the larva of the fly in the apple has been noted only in rare instances.

The Lepidoptera include a host of species which are injurious, and sometimes dangerous, to the apple in continental orchards. Irregular tunnels in the shape of small spots are produced on the upper surface

of the leaf by the larvae of *Ornix petiolella* Frey., *Cemiosoma scitella* Zell., *Nepticula pulverosella* Stt., and *Lithocolletis corylifoliella* Hw. Tortuous tunnels are produced on the upper surface of the leaf by the larvae of the following: *Nepticula aëneella* Hb., *N. desperatella* Frey., *N. Pomella* Vaugh., *N. oxyacanthella* Stt., and *N. malella* Stt. Deep tunnels visible on both surfaces of the leaf are produced by the grub of *Lyonetia Clerkella* L. On the lower surface of the leaf tunnels are made by the tiny grubs of the following species: *Lithocolletis pomifoliella* Zell., *L. apparella* H.S., and *Incurvaria pectinea* Hw.

In large web-like structures which cover whole branches are found the following larvae which eat both the leaves and the blossoms in continental orchards: the dark grey larva of *Porthesia chrysorrhæa* L., having two red lines along its back and two white lines at the sides; the ashy-grey hairy larva of *Aporia Crataegi* L. black above, with two orange yellow lines along the back, and a reddish line on each side just above the feet; the greyish brown larva of *Vanessa polychloros* L., having a yellowish line on each side of the back; the black blue larva of *Bombyx lanestrus* L., having two lines of orange yellow protuberances on the back, and three white dots on each segment of the body. The larvae of *Hyponomeuta malinella* Zell. live together in large colonies on the branches, surrounded by a large veiling of web, eating and destroying the foliage. These larvae are yellowish grey, with a black head, and two series of black spots on the back, and three such lines of black dots on each side. The larger dirty grey larvae of *H. padella* L. behave in the same manner. There is no remedy against these larvae except picking by hand, and crushing them or throwing them in an insecticide solution; but more than by human agency these grubs are kept in check by being preyed upon by insectivorous birds.

The green larva of *Cheimatobia brumata* L. having three longitudinal white lines on each side, when young destroy the leaf buds and flower buds, and later on feed on the foliage, thus causing considerable havoc. The female moth is unable to fly and crawls up the stem to deposit its eggs on the buds at the tips of the twigs, and consequently the best remedy hitherto recommended consists in tying tightly a piece of cloth or paper besmeared with liquid tar mixed with turpentine or other sticky substance which takes hold of the moth and kills it. This is done towards the close of October, at the same time it is advisable to dig deeply the soil beneath the tree. Small stems are whitewashed thickly with lime.

Whitewashing the stem with lime is also recommended against the following species, whose larvae like those of the preceding species hide themselves among the contorted and crumpled foliage of the twigs: *Grapholitha variegana* Hb. the larva of which is dark green covered with white hairs, and *G. ocellana* Schiff. whose larva is reddish grey, covered with lustrous hairs. The larvae of these two species also destroy the buds during winter. The same treatment is also recommended against the following species which destroy the foliage in the same manner, viz: *Teras contaminana* Hb., *T. rosana* L., *T. heparana* Schiff., *T. diversana* Hb., *T. lipsiana* Schiff., *T. Holmiana* L., *Recurvaria leucatella* L., and *R. nana* Hb.

The brownish grub of *Nephoteryx spissicella* Fb. lives in a leaf folded upwards along the midrib, feeding on the tissues of the same leaf; and the greenish yellow grub of *Teras variegana* Schiff. lives between two leaves which have been joined together by filaments exuded by the insect. The yellowish grubs of *Simaethis pariana* L. and *Swammerdamia pirella* Vill. live on the upper surface of the leaf which they cover with a fine web, the second species being in the habit of

tilting up the extremity of the leaf by means of the same web. In the folded margin of the leaf live the minute grubs of *Ornix guttea* Hw. and of *Gelechia rhombella* Hb.; and the tiny grubs of the following species live in small bag-shaped webs on the leaf: *Coleophora palliatella* Zk., *C. paripennella* Zell., *C. nigricella* Steph. and *C. hemerobiella* Scop.

The large larvae of *Smerinthus Tiliae* L., *S. ocellata* L., *Miselia Oxyacanthae* L., *Diloba coerulescens* L., *Lycaena Crataegi* L., *Orgyia antiqua* L., *Ocneria dispar* L., *Bombyx Crataegi* L., *B. Populi* L., *Lasiocampa quercifolia* L., *Acronicta tridens* Schiff. and *A. Psi* L. feed on the foliage of the apple in Italy, France and other continental countries. The same injury is caused in the countries above mentioned by the larvae of *Bombyx neustria* L., and *Brotolomia meticulosa* L. which are occasionally also met with in our orchards. The only remedy suggested against these larvae is hand-picking in spring or early summer. The small lively grubs of *Cerostoma scabrella* L. and *C. asperella* L. corrode the leaves in Italy and Germany and at the least interference drop down suspended from the leaf by a filament like a spider.

The larvae of *Hibernia defoliaria* L. and *Biston pomonarius* Hb. are often troublesome in Italy and Germany, eating the foliage and denuding whole branches, and are kept in check by the same treatment suggested for *Cheimatobia brumata*. Finally, the grubs of the following species are also reported to feed on the foliage of the apple in Italy, viz : *Rumia crataegata* L., *Phigalia pedaria* Fb., *Boarmia gemmaria* Brahm, and *Selenia lunaria* Schiff. *Cidaria siterata* Hufn., *Cossus ligniperda* Fb., and *Sesia myopaeformis* Bkk. are wood borers frequent in other parts of Europe, replaced here by *Zeuzera Aesculi* L. whose large yellow grub with black dots is too frequently found boring into the stems and branches of our apple tree, making long tunnels, always in an upward direction.

The grubs of two small moths, *Argyresthia ephippella* Fb. and *A. cornella* Fb. destroy the flower buds and the leaf buds in autumn and winter in upper Italy and Germany, where also the grub of *Laverna Hellerella* Dup. tunnels within the young shoot and destroys it.

The grub of *Grapholitha pomonella* L. (*Carpocapsa pomonella* Tr.), the well-known codling moth, produces tunnels within the fruit of the apple in the same manner as in the fruit of the pear, and although it is here much more common on the pear, the havoc which it causes to the apple orchard is often very serious.

Fortunately few of the above species of Lepidoptera have so far been detected in these Islands and with the exception of the havoc caused by *Zeuzera Aesculi* L. and *Grapholitha pomonella* L., the injury resulting from the presence of other species is generally limited to the corrosion of a few leaves here and there without any appreciable influence on the general health of the tree or of its cropping capacity.

The apple tree has also numerous enemies among the Coleoptera or beetles, but as in the case of the pear only two, the large wood borers, are really dangerous. The small larva of *Rynchites pauxillus* Germ. makes tunnels within the substance of the young leaf. The following beetles also feed on the foliage of the apple all over Europe : *Melolontha vulgaris* L. the May-bug, which is a serious pest in most European countries, *Rhizotrogus solstitialis* L., *Rhynchites auratus* Scop., *Phyllopertha horticola* L., *Luperus rufipes* L., *Polydrosus sericeus* Schall., this last in its larval stage also destroys the buds in winter, a feat frequently shared by *Otiorrhynchus picipes* Fb., *Phyllobius oblongus* L., *Ph. argentatus* L. and *Ph. Piri* L., while the small grubs of *Anthonomus pomorum* L. and of *A. Piri* Koll. the pear weevil, lives within the buds of the apple tree as well as of the pear tree, *A. pomorum* usually preferring the flower buds.

Three species of small weevils belonging to the genus *Rhynchites* puncture the base of the new shoots, which soon die or are easily broken off by the wind. These weevils are *Rhynchites conicus* Ill. which is dark blue covered with dark hairs, *Rh. betuleti* Fb. which is metallic blue or green, and *Rh. Bacchus* L. which is metallic red, and thickly covered with hairs. These three species are common in Italy, France and Germany, where also the three wood borers *Magdalis Pruni* L., *M. barbicornis* Latr., and *Pogonochaeros hispidus* Fb. are found tunnelling under the bark of old stems and branches, and lower down the trunk are replaced by *Scolytus Pruni* Ratz., *S. rugulosus* Kock. and *Liopus nebulosus* L., but none of them can compare in destructiveness with our wood borers, *Cerambyx miles* Bon. and *Capnodis tenebrionis* L. which attack the base of the trunk of the apple, and of all other pome fruits with the exception of the loquat, and sooner or later kill the tree unless it throws up new suckers to replace the old stem.

THE QUINCE TREE.

Pirus (*Pyrus*) *Cydonia* Lin. = *Cydonia vulgaris* Pers.

Maltese=*sfargel*. Italian=*cotogno*. French=*coing*, *cognassier*.

The Quince is native of Western Asia and the Caucasus, and is found growing half-wild in valleys and old gardens in these Islands. It is a shrub or a shrub-like tree, which here may reach a height of 3 or 4 metres, and has an erect habit of growth, with dark brown or greyish-black bark, long slender twigs, and oval, acuminate, entire leaves. The flowers are produced singly or in small clusters, and come out along with the foliage. The fruit is a pome, of variable size and shape, of a yellow colour, thickly covered with down or short hairs, which are easily removed with the finger, leaving a smooth rind.

The quince grows in all soils and in all situations. On stiff or clayey soils it has a tendency to throw up a large number of suckers around the base of the stem, owing to which it assumes a more spreading habit. Stands well the drought of summer, but on watered lands its growth is very rapid and produces fruit of larger size. It offers a marked resistance to the poison left in the soil by other rosaceous trees, but when budded or grafted, that is when used as stock, much of this resistance is lost.

The fruit of the quince is too astringent to be of use for the dessert but is frequently used for jams and in confectionery. Certain sorts of quince are more useful for this purpose than the common types, the fruits of which are often excessively astringent and rather devoid of aroma, particularly when grown on stiff soils in cold situations. The fruit of the Chinese quince (*Pirus sinensis* or *Cydonia sinensis*) attains an enormous size, but is hardly worth growing except for ornament.

The quince is propagated so readily by cuttings or by suckers, that its propagation by seed, or layers, or by budding or grafting is hardly ever attempted.

Cuttings are made at any time from October to March, and if well cared for in the first two or three months after they have started growing in spring, not one of them will fail. They are selected of any size from slender twigs of one year's growth, to branches 2 or 3 c.m. thick, and are planted 10 c.m. deep, and straight to procure a straight stem for use as stock or for subsequent cultivation as a quince tree.

Suckers are transplanted also from October to March, and with ordinary care are sure to strike root.

All sorts of quince are suitable for use as stock for the pear, but the common half-wild type of quince is that usually used by our gardeners as well as by continental nurserymen. Quince-stock should be grafted with the pear when not more than 2 or 3 c.m. in thickness, as the union between the stock and the scion is then more easy and thorough, and failures are proportionately less frequent. There are two types of the common quince, and both are used indiscriminately as stock by nurserymen. The first is the so-called female quince bearing rather elongated or pear-shaped fruits (*Cydonia piriformis* Medic.), and the other is called the male quince and produces fruits which are round or apple-shaped (*Cydonia maliformis* Mill.). The quince is more productive, and perhaps produces finer fruits, when grafted on the hawthorn.

Besides the two types of the common quince above mentioned, both of which are fairly common in our gardens, the following sorts are also cultivated occasionally.

1. QUINCE CHAMPION. The fruit is broadly top-shaped, smooth, that is without irregularities or protuberances, very fragrant, yellow, and deep yellow towards

the sun. It is larger or much larger than that of the common quince, with a stout stalk inserted obliquely in a depression. The flesh is yellow, tender and juicy, and makes excellent jams. The fruit matures in October-November, somewhat later than that of other sorts, and is liable to the attacks of the fruit fly. The tree is vigorous and highly productive.

2. QUINCE OF PORTUGAL. The fruit is very fragrant and very large, pear-shaped, ventricose towards the middle, and thrown into deep folds at the upper end around the calyx. The stalk is very short and thick, inserted obliquely. The colour is deep yellow, matures in October, at the same time as the common quince. The tree grows less quickly, but attains a larger size than that of Champion and of the common quince, and is also less productive.

3. QUINCE OF VRANJA or SERBIAN QUINCE. The fruit is enormous, often weighing over one kilo, and is irregular with many protuberances around the stalk and the calyx. It has a greenish yellow or pale yellow colour, and a fine fragrance. The tree is fairly vigorous but little productive.

4. CHINESE QUINCE. (*Pirus sinensis*). The tree is rather dwarf with thick and leathery foliage, finely crenated, of a deep green metallic colour, which becomes red or yellowish red in autumn. The fruit is oval, enormous in size, with a penetrating fragrance, and a smooth deep yellow rind. The flesh is firm and coarse. The tree is little productive, and the fruit is more ornamental than useful.

DISEASES.

The quince is liable to many diseases in common with the pear and apple. Its fruit, particularly that of the large-fruited varieties, is liable to be punctured and destroyed by the fruit fly, which attacks it towards the close of September or in October, when it is turning

yellow. The branches are often tunnelled by the large grub of the leopard moth, *Zeuzera Aesculi* L. or *Z. pirina* L., the tunnel being directed upwards as usual; and the base of the stem is undermined and tunnelled in all directions, but chiefly downwards by the large white grubs of the two beetles *Cerambyx miles* Bon. and *Capnodis tenebrionis* Latr. The quince is more liable than either the pear or the apple to the attacks of the scale insects *Lecanium Oleae* and *Ceroplastes Rusci*. It is also visited by *Lecanium hesperidum* and *Icerya Purchasi* Mask. The fruit is sometimes tunnelled to the core by the larva of the codling moth, *Grapholitha pomonella* L.

The quince mildew, caused by *Podosphaera tri-dactyla* DBy. sometimes checks the growth of the young twigs, late in summer, covering the foliage with its characteristic white powdery formation, and is kept in check by dusting repeatedly with flowers of sulphur. *Septoria Cydoniae* Fckl. and *S. cydonicola* Thüm. produce irregular greyish spots on the leaf, surrounded by a darker margin, which spots later on develop minute black dots which are the fructifications of the fungus. *Gleosporium Cydoniae* Mtge. produces irregular brown spots, on the foliage, on which are developed minute grey dots; and *G. minutulum* Br. and Cav. produces similar spots, but the grey dots are developed preferably along the nerves of the leaf. *Phyllosticta Cydoniae* Sacc. produces dark brown spots with minute black dots. *Gymnosporangium juniperinum* Fr., *G. confusum* Plow., *Aecidium Cydoniae* Lenorm., and *Ramularia necans* Pass. have been observed on the quince in France, Italy and Central Europe.

THE MEDLAR.

Mespilus germanica Lin. ROSACEAE (POMACEAE)

Maltese=*Omm il-epp* (*Fomm il-lipp*). Italian=*nespolo*. French=*neftier*.

The medlar is native of the Mediterranean region, Central Europe and Asia Minor, and is still occasionally met with in a wild state in our valleys.

The name *omm il-epp* is connected with the popular belief still held by old gardeners that the medlar is the progenitor of the apple; *Fomm il-lipp* is a modern corruption which conveys no meaning whatever.

The medlar is sometimes cultivated more as a curiosity than as a fruit tree. It is a deciduous shrub or small tree, 2 to 3 metres high, with oblong-ovate leaves of leathery texture, with an irregular upper surface deeply furrowed along the midrib and nerves. The flowers are large, borne singly or in small clusters of two or three at the extremity of the twigs. The fruits are spheroidal, depressed at both poles, with a broad scar at the top, surrounded by the residues of the five divergent sepals of the calix. The fruit is gathered late in October or in November and is eaten when it becomes overripe and quite soft. To promote and regulate its maturity it is rolled up in a piece of cloth or put up in layers in a jar or box along with husks or thick bran.

The medlar thrives well in all soils and all situations, but prefers a rather stiff soil and a cool situation looking north, where it grows tall and may reach a height of over three metres. It may be propagated by seed which takes about two years to germinate, or by cuttings, layers or suckers. It is also grafted or budded on the hawthorn the pear and the quince.

Propagation by cuttings and layers, and especially by suckers is easy, and may be done as suggested for the apple. If grafted on the hawthorn or on the pear the medlar grows quickly and attains a good size, but it is

rather slow to come to fruit. On the quince stock it becomes dwarfed, but commences to bear fruit sometimes when only a year old.

Besides the common wild form of the medlar, there are now in local gardens the following sorts, cultivated in solitary specimens for their ornamental effect

1. THE MEDLAR OF HOLLAND, whose fruit is larger than that of the wild form and of a more lively bronze colour, and has finer foliage. It has a more picturesque habit of growth, with angular or contorted branches.

2. THE MONSTROUS MEDLAR, whose fruit is twice or three times as large as that of the wild type, with a variable shape, but proportionately more depressed.

3. THE SEEDLESS or STONELESS MEDLAR, whose fruit is also larger than that of the common form, and contains few and abortive seeds. However, the wild form is more productive than any of these three sorts.

DISEASES.

The Medlar is subject to many of the fungi and insects affecting the apple and the pear.

Stigmatea Mespili Sor. produces small brown spots on the leaf, which gradually coalesce and destroy the whole leaf. *Phyllosticta Mespili* Sacc. and *Septoria Mespili* Sacc. produce larger spots of a brownish colour with a darker margin. *Asteroma Mespili* Rob. et Desm., *Ascochyta Mespili* Pass., *Ramularia necans* Pass., *Gleosporium minutulum* Br. et Cav. *Hirudinaria Mespili* Ces., and *Aecidium Mespili* D. C. are other fungi which are found on the medlar in France and Italy. All these fungi are kept in check by spraying with Bordeaux mixture, at 1 per cent. The hawthorn mildew, *Podosphaera Oxycanthae* D. By., attacks the medlar in the shape of a white powder on the twigs and young leaves, and can be kept in check by spraying with Bordeaux mixture or by dusting with flowers of sulphur.

The fruit fly sometimes punctures the fruit of the medlar and destroys it, whenever it is unable to find more suitable fruits wherein to lay its eggs. *Zeuzera Aesculi* Latr. attacks the stem and branches, and the two pernicious beetles *Cerambyx miles* Bon. and *Capnodis tenebrionis* L. attack the base of the stem with the same determination which they display on the pear and on other kernel fruits. Several small moths attack also the medlar in the larval stage of their life, but the injury caused by them is unimportant.

THE AZAROLE THORN OR NEAPOLITAN MEDLAR.

Crataegus Azarolus Lin. ROSACEAE (POMACEAE).

Maltese=*anzalori*. Italian=*azzeruolo*, *lazarolo*. French=*azérolier*.

The Azarole is a native of Europe, and one of its many forms, *Crataegus Azarolus* L. var. *ruscinonensis* Gren. et Blanc., grows wild in our valleys, although it is much less common than the haw-thorn (*Crataegus Oxyacantha* Lin. var. *monogyna* Jacq.). It is a tree often exceeding 3 metres in height, and thrives well in all soils and all situations. The tree can be transplanted in winter with perfect safety, even when it is nearly full grown.

The Azarole can be propagated by seeds or kernels which should be sown or stratified in autumn or winter. The kernels take about two years to germinate, but a few will spring up in the course of the following summer if duly watered, and the remainder will germinate in the following spring. However, the azarole is easily propagated by rooted suckers or by grafting on the common hawthorn. It is sometimes propagated also by cuttings or layers. Rooted suckers are transplanted in winter and with proper care rarely fail to establish them-

selves. They are produced rather sparingly, particularly when the tree is growing on dry red soils, but it is always easy to induce the tree to throw up suckers by cutting a few roots, from 1 to 2 c.m. in thickness late in winter, and twisting up the farther end towards the surface of the soil, where it forms adventitious buds and throws up shoots in the following spring. These suckers, of course, will reproduce the sort to which the stock belongs, and therefore grafted trees cannot be reproduced in this way.

Cuttings are taken in winter and should be planted in a cool situation, and kept well moist in spring and summer until they are properly rooted. They are selected of old wood, two or three years old, with a terminal twig of new wood, this terminal twig being the part of the cutting which is allowed to remain above the ground. Layers can be made all the year, the best time being towards the close of winter, before the buds begin to swell, and if notched or bruised and kept moist will form the roots the more easily.

The Azarole is now little grown as a fruit tree, but the fruit of the larger sorts is quite eatable, besides being an ornament for the table, particularly when it is picked along with the foliage. The fruit matures in September, but keeps well for a long time, until it is preyed upon and destroyed by birds. The tree is little exacting in its cultivation, and pruning is limited to keeping the tree in shape and to the removal of dead wood.

Besides the native form of *C. Azarolus* L. var. *ruscinonensis* Gren. et Blanc., the following sorts of the Azarole are met with occasionally in local gardens.

I. CARRIERI, with hoary lanceolate leaves, entire or trifid at the extremity, long stout dark brown thorns, and large fruits which are first yellow and then turn deep red.

2. CAPITATA, as the wild form, but with larger blossoms.

3. FRANÇOIS RIGAUD. The tree is very floriferous and its fruits are yellow, but rather small.

The Azarole is liable to many diseases in common with other pome fruits. It is subject to the wood-borers to the same extent as the hawthorn, but less so than either the pear, the apple or the quince. The fruit is rarely visited by the fruit fly.

THE SERVICE TREE.

PIRUS (PYRUS) DOMESTICA Ehrh.—*Sorbus domestica* Lin.
Pyrus Sorbus Gaertn.

Maltese=*zorba*. Italian=*sorbo*. French=*cormier*.

The Service tree is native of the Mediterranean region and Asia Minor, but the half wild trees found growing in valleys and old gardens in these Islands are probably the suckers thrown up by the roots of old trees which have ceased to exist. The tree is from three to four or five metres high, with alternate imparipinnate leaves having 6 to 8 pairs of leaflets, which are shed in autumn. The flowers are small, white, produced in panicles at the extremity of the twigs and come out along with the foliage. The tree has naturally a straight erect stem, and at first grows freely but afterwards its growth is very slow. It thrives in the shade as well as in full sunshine, but prefers a deep and moist soil and a sheltered situation. The tree takes a long time to bear fruit, generally from 15 to 20 years, but when in bearing condition the production is regular and usually very abundant, every year the tree being thickly covered with clusters of fruit. The fruit is a pome which matures late in September or in October, but is then too astringent to be palatable, and is cut in October and hung

up in bunches in the fruit room. It is consumed when it becomes overripe and soft, as then it loses much of its astringency and takes a mellow, pasty, fruit taste, not unlike that of the medlar. The wood is close grained and very hard, and is used for the manufacture of screws, pulleys, and other articles in which great resistance is required; it is also in request by cabinet makers.

The service tree can be propagated by sowing the kernels of the fruit in February or March, but this method takes a long time to produce trees of bearing capacity. Propagation by cuttings or layers is difficult and generally gives negative results. However, the tree throws up suckers very freely, sometimes at considerable distance from the stem, and these afford a most easy way of propagation. Indeed the roots of the service tree are remarkable for the persistence with which they continue to throw up suckers, year after year, a long time after the removal or destruction of the original tree. The suckers are transplanted in winter, and seldom fail to establish themselves in their new home, even if they happen to be provided with only a few rootlets; and this is all the more remarkable when it is remembered that cuttings and layers strike root with great difficulty, and generally fail altogether.

The tree is also propagated by budding or grafting on its own seedlings or suckers, and on seedlings or suckers of the hawthorn (*Crataegus Oxyacantha* L.) of the mountain-ash or rowan-tree (*Pirus Aucuparia* Ehrh.) of the white beam-tree (*Pirus Aria* Ehrh.), and of the wild service (*Pirus torminalis* Ehrh.). Budding is done in March, making use of dormant buds of last year's growth; or may be done from May to September, with buds taken from the new twigs which have just ripened. The bud is best inserted as close to the ground as possible. Grafting is performed late in winter, or some time before the buds begin to swell in spring, on stock which is 2 to 3 c. m. in thickness, and may be done either close to the

ground, or at a height of one or two metres, so that a tall tree with a good crown of foliage may be had in a short time, which will settle to fruit in a few years.

The service tree may be planted four metres apart, and it is the custom to plant it very deep, under the impression that it will live longer and that it will produce fruit more quickly, but there is nothing to show that this practice is really well founded. When established, the tree requires no particular care in the matter of cultivation. Pruning should be limited to the removal of dead or diseased wood, and to the clearing of the suckers if too numerous; but should the tree be too slow to bear fruit, the branches may be ringed or twisted slightly to provoke an early formation of flower buds.

There are two forms of the common service tree. That usually met with in our gardens has a tall erect stem and a spreading crown of branches, and produces apple-shaped or round fruits (var: *pomifera* Goir.); the other form is rather rare being probably a recent introduction, and has stiff and erect branches and thick and vigorous twigs, and leaves slightly larger than those of the former, and produces oval or pear shaped fruits (var: *pirifera* Goir.). One or two forms producing larger fruits of the round or apple-shaped type have been introduced from Sicily and Italy; and a new French variety, *le Poitevin*, producing large fruits of the pear-shaped type, has been introduced in 1910.

DISEASES.

The fruit of the service tree is attacked by the fruit fly almost as frequently as the pear, and although the eggs deposited by the fly often fail to develop into maggots, yet the puncture causes the fruit to rot or drop off the tree, and it is therefore advisable to protect the fruit by the use of cloth bags, one bag for each cluster, as recommended for the fruit of the pear. The larva of the moth *Zeuzera Aesculi* L. forms tunnels in the

branches of the service tree, and the injury caused to the base of the stem by the larvae of *Cerambyx miles* Bon. and *Capnodis tenebrionis* L., results in the destruction of the tree as surely as in the case of the pear and the apple. *Aphis Sorbi* Kalt. attacks the foliage, which is also frequently disfigured by the corrosions produced by the small grubs of several moths, and by the spots caused by the presence of a fungus, *Cladosporium condylonema* Pass.

THE LOQUAT OR JAPANESE MEDLAR.

Eriobotrya japonica Lindl.—*Mespilus japonica* Thumb.

ROSACEAE (POMACEAE)

Maltese=*nespla*. Italian=*nespolo del Giappone*. French=*neflier du Japon*.

The tree is native of China, where it is called *lo-quat*, and is also native of Japan where its name is *biwa* or *beewa*. It is an evergreen tree of noble appearance and large dimensions, and grows fast, beginning to bear fruit when about four years old, and reaches adult size in about twenty years. There are at Boschetto large loquat trees over eight metres high with a girth at the base of the trunk of about two metres, and a circumference of the crown of foliage of over twenty metres. These trees are the direct descendants of the original loquat planted in those gardens in 1811, the date of its introduction in these Islands. Owing to its evergreen and thick foliage and its tall habit of growth, as well as to its utilitarian character as a fruit tree, the loquat is often planted in rows in the orange groves as a windbreak, for which purpose it is eminently suitable, as the root system of Citrus trees does not seem to disagree much with that of the loquat.

The loquat thrives best in deep red soils rather stiff and charged with clay, moderately moist but well drained. It prefers a sheltered situation with an eastern aspect. In favourable conditions the tree lives to about 80 years,

but declines visibly in vigour and productiveness after the 60th year of its life. In shallow soils and dry situations the tree is short lived, hardly reaching 40 years, and in situations which are too open and exposed the tree is dwarfed and becomes unproductive. The large lanceolate, deep green, glossy foliage of the loquat is highly ornamental, and on its account the tree is frequently planted in pleasure grounds to hide unsightly architectural features. The tree blooms in October and November, the small pale yellow blossoms being produced in large clusters or panicles at the extremity of the twigs, and exhale a delicate fragrance. The fruit grows very slowly in the winter months, but makes up for lost time towards the close of February and matures in March-May, and along with the strawberry, is the first fruit to appear on our tables, but independently of its earliness it is a desirable dessert fruit. The ripe fruit is oval, 3 to 5 c. m. long, golden yellow or yellowish orange, with a ruddy flush towards the sun. It has a thick rind which peels off easily, and contains five large angular chocolate coloured pips or kernels, often reduced to one or two large rounded kernels by the abortion of the others. The flesh is yellowish orange, sweet and refreshing, with a delicious acidity.

PROPAGATION. Our gardeners propagate the loquat almost exclusively by seed. The kernels are selected from the finest and largest fruits, and should be sown at once after removal from the fruit, as they soon lose their germinating power if kept dry for a few days. A seed bed is prepared in a cool situation, and some leaf-mould or some old and well decayed manure is mixed with the soil to keep it light. The kernels are dibbled in to depth of 3 to 5 c. m. and about 10 c. m. apart. The bed is watered frequently but lightly, just enough to keep the surface in a moist condition, and the first seedlings come up in about two weeks, but germination is frequently protracted for one or two months or more.

The seedlings are transplanted in the following February or March, when they are about 15 c. m. high, but may be allowed to remain in the bed for another year to grow stronger. They are planted in the nursery 50 c. m. to 1 metre apart, according to the size to which it is proposed to allow the young trees to grow before transplanting them to their final destination. No manure or other fermentable material is given to the soil, but some wood ashes may be strewn lightly, on the surface of the ground before watering. The natural tendency of the loquat seedling is to grow straight, and occasional side shoots are removed in order to obtain a clean straight stem of at least one metre. The young trees are transplanted to their final destination when they have reached a height of $1\frac{1}{2}$ to 2 metres. The operation is best performed in February or March, but can be done also later until May, or in autumn. The young trees are taken up with a ball of earth, with as many rootlets as possible. The soil should be packed firmly about the roots when the tree is planted, but no manure should be used, the loquat being always averse to the presence of fermentable matter about the roots, particularly when young. The trees are planted at a distance of 6 to 8 metres apart, and the soil is well soaked with water as soon as the operation is completed.

The loquat is also propagated by budding or grafting. The seedless loquat is of course propagated exclusively in this way, but all loquats can be grafted or budded on the azarole, the hawthorn and on *Photinia serrulata* (*Crataegus glabra*), as well as on the pear and on the quince. For use as stock preference should be given to loquat seedlings, two or three years old, for budding, and older stock for cleft-grafting. The propagation of the loquat by layers or cuttings is a difficult undertaking and generally gives negative results. The best varieties are usually multiplied directly from seed, but the loquat is as variable as most fruit trees, and few seedlings will come

true to type. It is therefore always preferable to propagate a desirable variety by budding or grafting on ordinary loquat seedlings, and our gardeners now frequently resort to budding for propagating the large-fruited sorts as well as the seedless loquat.

Budding is done at any time from April to September, shield budding being the method generally used. Grafting may be done in September or October, or early in March, the scion being selected of new wood, not longer than 5 to 10 c. m. with a dormant terminal bud, and is deprived of its foliage before grafting.

CULTIVATION. This consists in digging the soil two or three times a year to keep it open and clear of weeds. The first tillage is done in October or November, the second is done in December or January, and the third in March or April. Trenching or deep tillage is carried out every three or four years for the purpose of pruning or cleaning the surface roots, and also to stir well the soil and to bring down to the roots the surface layer of the soil which has been mellowed and improved by the action of the air. Some well-rotted manure may be given, but sparingly, and the use of raw or unfermented manure should be carefully avoided. A heap of fermenting manure which is allowed to remain for some time close to a loquat is sure to cause the death of the tree. The loquat requires to be watered as well as an orange-tree, and irrigation should commence early in the season, when the fruit is maturing. Regular watering will promote the growth of the tree very markedly, besides ensuring a better crop of fine fruits, and extends the natural term of life of the tree. However, the loquat is very sensible to the action of brackish water, particularly in the hot days of summer, and hard water containing much lime is also dangerous and should be aerated in an open tank for two or three days before use.

Pruning should be limited to the removal of dead or diseased wood, the removal of large branches with the consequent formation of large wounds being specially prejudicial to the health of the loquat, notwithstanding the great hardness of the wood, and the fact that it is little liable to canker. The dry foliage of the loquat is used as bedding for animals, and is also frequently made use of for the preparation of leaf-mould. For this purpose it is collected towards the close of summer, and heaped up in a clean enclosure where it is sprayed frequently with water to undergo decomposition, and in about a year it is reduced to a mould of fairly good quality for greenhouse use and for plants requiring a soil of leaf-mould, being in this respect equal or superior to leaf-mould prepared from the leaves of the carob tree. The wood of the tree is of a reddish hue, not unlike mahogany, and takes a fine polish, but has no appreciable veining; and as it is also very hard and tough it makes very good handles for tools.

Besides the common seedling types of the loquat, which are innumerable, there are about 40 distinct sorts known to cultivators in the Mediterranean region and elsewhere, and the following are grown in local gardens.

1. THE SEEDLESS LOQUAT. The fruit is large, oval, and the flesh is thick and acidulous; contains one or more small abortive seeds incapable of germination. Introduced from Sicily in 1904.

2. THE SWEET LOQUAT has originated in the Boschetto Gardens as a chance seedling. The original tree is now over 50 years old. The fruit is of the average size, rather elongated, with small, long, angular kernels. The flesh is very sweet, being quite sweet when just turning yellow.

3. THE PEAR-SHAPED LOQUAT. The fruit is large, pear-shaped, produced into a fleshy protuberance on which the stalk is inserted. This, and the following sorts usually contain only one large round kernel or two hemi-

spherical kernels with rounded edges. The pear-shaped loquat also originated in the Boschetto Gardens, and often comes true from seed.

4. THE LARGE OVAL LOQUAT. The fruit is large oval, juicy, very fleshy and sweet.

5. THE LARGE ROUND LOQUAT. The fruit is large, round, very fleshy and juicy, but becomes sweet only at full maturity.

DISEASES.

The worst enemy of the loquat is root-rot, usually due to *Rhizoctonia Mali* D. C. which seems to attack the roots of the loquat with greater virulence than those of the apple. The roots become covered with a thick web of white mycelium, which afterwards turns brown or pink-brown, or brownish violet. The disease at first appears on the smaller roots, 1 to 2 c. m. in thickness, attacking and killing the tissues for about one third of the circumference of the root, and spreads rapidly along the root to the main roots, in the mean time the mycelium spreading entirely around the smaller roots and killing them. When the disease has reached the main roots and established itself upon them the tree is doomed, but may live for some years if the diseased tissues are scooped out until the healthy wood is reached, and the wound disinfected thoroughly with a strong solution of sulphate of copper (1 in 100), and then painted over with tar. The mycelium of *Rhizoctonia* is often associated with that of another formidable enemy, the well-known fungus *Armillaria mellea* Vahl., whose mycelium seems to be able to remain dormant on bits of dead roots for a considerable time after the death and removal of the tree which it had killed.

The foliage is liable to the parasitism of several fungi such as *Stigmatea Mespili* Sor. but the infection is never so important as to interfere with the fruit-bearing capacity of the tree.

The branches and twigs of the loquat are frequently attacked by the larva of the moth *Zeuzera Aesculi* L. which constructs tunnels directed upwards, or in case of thick horizontal branches, directed across the branch between the wood and the bark, but generally in an upward direction. The loquat is free from the attacks of the two beetles whose larvae are so destructive to the trunk of the pear and the apple.

The fruit is sometimes punctured by the fruit fly towards the end of April or early in May, when the last fruits are ripening on the tree, but the loss incurred is never considerable. On the other hand several birds feed with avidity on the ripe fruit, the principal offenders being the sparrows ; but the jackdaw, the thrushes and the chats are sometimes found fault with, and the beautiful golden oriole seeks the loquat grove for the express purpose of feasting on the fruit, during the few days of its sojourn in these Islands.

THE ALMOND.

Prunus Amygdalus Stok.—*Amygdalus communis* L.

ROSACEAE—AMYGDALAEAE.

Maltese=*leuza*. Italian=*mandorlo*. French=*amandier*.

The Almond is native of Turkestan and Central Asia, and has been long cultivated or naturalized in Southern Europe and North Africa.

The almond is a tree from 4 to 8 metres high, and agrees well with all soils and all situations, adapting itself to dry soils and rocky ground as easily as the carob, but prefers deep soils and the sheltered situations of valleys where it grows to a large size and yields heavy crops. Its powerful root-system enables it to thrive well when associated with such rough tenants of the soil as the carob, the fig-tree, the olive-tree and the prickly pear,

but at the same time it is not of such overbearing nature that it cannot be associated with the vine, the loquat, the stone fruits and kernel fruits, and even with Citrus trees, if there is enough depth of soil to afford ample room for the roots.

The almond is the harbinger of the new year. In Malta it commences to bloom at about Christmas, and most trees are in full bloom in January. A few trees especially among the sweet almonds, flower in February, and certain sorts of sweet almonds bearing large fruits are not in bloom before the close of February or early in March, that is only a few days before the flowering of the peach and other stone-fruits. The flowers of the almond vary in colour from pure white to flesh colour or a lively pink, and those of the bitter almond being very early are in request for decorative purposes at Christmas time and in January. In exposed localities the flowers are liable to be injured by the wind, and in spring the tender foliage is easily destroyed by the north-east wind which is so often saturated with salt spray brought over from the sea. The tree, however, agrees well with our soil and climate, and its cultivation on a large scale is highly remunerative.

The almond is extensively used in confectionery, and the oil extracted from the sweet almond, as well as from the bitter almond is a valuable laxative, often used for the ailments of infancy. This oil is also used in the manufacture of soaps of superior quality. The roasted or candied sweet almond is an article of dessert appreciated by all classes of the population, and the kernel of the green fruit is a delicacy for the table, either in the fresh state or worked into confectionery. The husks or hulls of the almond, as well as the shells of the nut make excellent fuel for ovens, and the wood besides being in request for firewood, has a good veining and is used by cabinet makers. The roots are used for dying coarse cloth and fishing tackle.

PROPAGATION. The almond is propagated by sowing its seed (the nut or stone), by its own suckers, by cuttings of the root, by cuttings and layers, and by budding or grafting.

The sweet almond comes true from seed, that is the nut or stone of the sweet almond very generally gives origin to sweet almond-trees, although cases are known in which a stone from a sweet almond tree has produced a bitter almond. It is also generally admitted that a sucker taken from a sweet almond tree growing on own roots, may occasionally develop into a bitter almond, and the same remark applies to plants raised from cuttings of the roots of the sweet almond. Moreover, it is generally held that a sweet almond growing on own roots, and repeatedly cut down, may alter its nature so far as to become a bitter almond as a reversion to the original type, should afterwards a sucker rising from the base of the stem be allowed to develop unhindered. The reverse is not known to happen, that is a sucker taken from a bitter almond tree never develops into a sweet almond, although it is stated that a seed or stone of the bitter almond may occasionally develop into a sweet almond tree. The flower of the bitter almond has the style of the pistil longer than the outer stamens, but in the flower of the sweet almond the style is equal to the outer stamens, this being the only real difference between the bitter and the sweet almond when not in fruit.

However it is not recommendable to propagate the sweet almond directly by seed, for the reason that the produce will vary so much in shape and size from one tree to another, that it will be hardly marketable. The produce of grafted or budded trees, if not more abundant, is certainly finer and more uniform in quality, and therefore fetches better prices. The bitter almond is supposed to be more vigorous than the sweet almond; it certainly grows to a larger size and is perhaps more resisting to drought and bad treatment, but the only reason for

preferring the bitter almond for use as stock instead of the sweet almond, is that bitter almonds are procurable at about half the price of sweet almonds, their germination is better assured, and perhaps the seedlings grow more quickly to budding or grafting size.

Where it is not possible to plant a young almond with ease, owing to the rocky nature of the ground, or owing to lack of facilities for watering a newly planted tree at least during the first summer, it is advisable to sow the bitter almonds directly where they are to remain, and then to bud them or graft them after two or three years when they have grown to suitable size. This method is also recommendable in the case of trees to be grown along walls of terraced fields or gardens where it is desired to utilize the subsoil of the adjoining ground at a higher level. In all other cases it is preferable to sow the seeds or nuts in a nursery, where the seedlings can receive all the care which they require to make quick growth. The soil is prepared by deep tillage and manuring, and the nuts are dibbled to a depth of about 5 c. m. and about 50 c. m. apart; the soil is kept well clean of weeds and watered lightly but frequently to keep it well moist in dry weather until germination is completed. The best time to sow the almond is in October or November, and germination follows in January or February. Sowing in December or January will require greater attention as regards watering in dry weather, and even with all due care failures are frequent. It is not necessary to crack the shell of the almond before sowing, by a light blow on its edge with a hammer, but the practice will be found useful in late sowing, as it hastens the process of germination, provided that the shell is not broken open as that will expose the kernel to the depredations of insects.

The soil around the young seedlings is stirred occasionally to keep down weeds and to prevent the formation of surface cracks which would cause the soil to

dry too soon. When germination is completed it is not necessary to go on watering, but of course if watered occasionally the seedlings will continue to grow all the summer and will be fit for budding when they are hardly more than a year old.

The almond throws up suckers sometimes at a considerable distance from the stem. These suckers can be transplanted in December and are often made use of for the purpose of propagation, and if they are strong enough they can be budded or grafted in the following year. In order to obtain suckers it is only necessary to expose or cut a few roots in autumn, and as a rule the exposed or wounded parts will throw up suckers in the following January or February. These suckers should be earthed up and encouraged to form rootlets, so that when transplanted they may stand a better chance of success. Cuttings of the roots about 2 c. m. in thickness and about 20 c. m. in length, with or without rootlets, will strike root readily and throw up strong suckers if planted in well manured soil in a cool situation. Gardeners who are in a hurry to obtain stock without much trouble may sever a few roots in November or early in December, pulling up the farther end close to the surface of the ground or just above it, where the severed end will throw up suckers early in spring and become an independent plant. The severed end of the root may be grafted in the course of the same winter, or budded in the following spring.

The branches of the almond may be layered in January or February, but they are rather slow to root. Cuttings made of old wood, about the thickness of a lead pencil and 20 c. m. in length root well if planted in December or January in a cool place and kept well moist for two or three months, but the plants obtained from layers or cuttings of branches generally make slow growth, as compared with plants raised from seed or suckers.

The almond may be budded or grafted on almond seedlings or suckers, and on its own roots, as hinted above. In other countries it is also budded or grafted on seedlings of the peach and on the wild plums, and plants so raised may bear fruit a little sooner, but the practice has nothing else to recommend it, at least for our climate. The almond commences active vegetation at least two months before the peach and the plum, and by grafting on this stock the activity of the almond is greatly retarded, which is doubtless an important consideration in northern countries where frost is a constant menace. The almond is grafted on its own stock in December, and is budded at any time from January to September.

CULTIVATION. The almond has a most hardy constitution and will not resent much long periods of neglect, provided that the neglect is not associated with wilful devastations or with unskilled pruning. On the other hand, there are few trees which respond so kindly to good treatment. A good digging in autumn will promote the absorption of rain, and this is an important point as the vigour of the tree when it starts active growth in January or February, is greater and better sustained if the deep roots have had the advantage of the stimulating influence of the early autumnal rains. Moreover, early and heavy rains in autumn are followed by an early and protracted blooming, and this means that a heavy crop may be expected. The ground should be weeded once or twice in winter, and dug again in March when the sods may be broken up, and the soil levelled properly to preserve the moisture as long as possible in the dry season. The ground between the trees may be cropped regularly, and the tree will benefit from the tillage and the manure necessary for this cultivation, but it is advisable to grow only such crops as will not remain on the ground after April, so that the soil may be dug and levelled in time before it becomes too cracked and dry. The almond tree is not in need of irrigation, and is

never watered as a detail of its cultivation, except in the case of transplanted trees which should be watered frequently in the first summer, until they are properly established. However on irrigated ground the almond grows with greater vigour, is more productive and produces finer almonds, but becomes more liable to certain diseases.

The almond can be transplanted with perfect safety until it has commenced to bear fruit, the risk increasing with the size of the tree. If the stem is more than 5 c.m. in diameter at the base, the operation becomes difficult and the tree will require three or four years to recover. Transplanting is done late in November or in December, and can neither be postponed nor anticipated without much risk. In the case of peaches and plums grafted on almond stock, on which the graft is known to exercise a retarding influence, transplanting may be delayed for some time but not later than the end of January.

In good soils with a deep and open subsoil where the almond is expected to attain full size, the distance from one tree to another should not be less than 6 metres, and 7 or 8 metres from one row to another. On poorer soils a distance of 5 metres is sufficient between trees in the same row, and 6 metres from one row to another. In old quarries the almond like the fig-tree, is planted or sown along the cut surface of the rock, and its roots penetrate deeply along the surface of the rock and among the stones and rubbish of which the subsoil is made, and therefore do not interfere at all with the cultivation of field crops. However on any land of sufficient depth, the presence of almond trees offers no obstacle to the growth of field crops, as the almond never throws a thick shade, although it is already in full foliage early in spring, and its roots are spread in the deep layers of the soil and in the subsoil.

The almond tree is allowed to assume its natural hemispherical or dome-shaped form, and pruning is

limited to the cleaning out of thick growth and the removal of branches which are too drooping and are an obstacle to the proper cultivation of the land. Pruning is done in September-November when the circulation of the sap is almost at a standstill and there is little risk of exhaustion from excessive gumming. Wounds over 2 c.m. in diameter should be painted over with tar as a preventive against the dry-rot fungus.

The green fruit is picked for consumption in July and August, when the kernel is at its best. Early in September the outer covering of the fruit (hull or husk) begins to dry, and breaks open into two valves, and when the process is completed the dry almonds are picked by hand or shaken down by means of a pole or reed.

The following sorts of almonds are grown in these Islands.

a. THE BITTER ALMOND, *Prunus Amygdalus*, var. *amara* Hayne. (Maltese=*leuza morra*). Is always propagated directly by seed, so that there are numerous forms, but only trees which produce large almonds are allowed to remain to supply the bitter almonds required by confectioners etc. The flowers may be of any shade from pure white to a lively pink or rose, but the style is always longer than the external stamens. The shell is hard, but in certain forms it is softer than in others, and in these the kernel is less bitter.

b. THE SWEET ALMOND. *P. Amygdalus* var. *dulcis*. (Maltese=*leuza helua*). The flowers may be of any shade from pure white to a lively pink, but the style is always equal to the external stamens. The tree usually flowers somewhat later than the bitter almond.

HARD-SHELLED FORMS OF THE SWEET ALMOND.

i. THE LARGE ROUND ALMOND. The shell is very thick, heart-shaped, large and nearly round. The kernel is large and plump, and generally double. This variety is very productive, but the twin kernel is often distorted and therefore unsuitable for certain uses in confectionery.

2. THE LARGE LONG ALMOND. The shell is very thick and hard. The kernel is large, long and plump,—the characteristic *almond-shape*, and being rarely double or twin is preferred for certain uses. It is well productive.

3. THE SMALL ALMOND. This is a small sized form with a hard but thin shell, and the kernel is comparatively large and plump, but often twin. It is very productive and generally comes true from seed.

4. THE MONSTROUS ALMOND. The shell is hard, very large and long, enclosed in very thick, irregular and rugose valves or husks. The kernel is very large, and sometimes twin. It is fairly productive, and is excellent as *green almond*.

5. THE RUGOSE ALMOND. The shell is moderately hard and slightly smaller than that of the monstrous almond. The valves are thick and very rugose and irregular. The kernel is large and plump. This is another almond suitable for consumption in the green state, and is fairly productive.

6. THE BRUANTINE ALMOND. The shell is rather tender, but thick, terminating in a point. It is generally larger than that of the rugose almond. The valves are large, fairly smooth, and not so thick as in the two preceding varieties. The kernel is plump, of excellent flavour in the green state. The tree has large light pink flowers with a deep red eye in the centre, blooms very late, and is very productive when it has reached adult size. The fruit is excellent for use as green almond, and is also very recommendable as a dry fruit.

7. THE JORDAN ALMOND (probably a corruption of garden [jardin] almond), is largely cultivated in Spain, and has been introduced here some years ago along with Bruantine. The fruit is long and slender, the valves are thin and smooth. The shell is thin and moderately hard, generally curved along the ventral suture. The kernel is plump and long. This is an excellent sort as dry almond and is very productive.

SOFT-SHELLED FORMS OF THE SWEET ALMOND.

P. Amygdalus var. *laevis* Arc. (Maltese = *leuz melliesi*.)

8. THE MALTA TENDER-SHELLED ALMOND. The fruit is long and slender, the valves are thin and smooth. The shell is thin and tender, often somewhat hard, and rather dark coloured. The kernel is plump and full. The tree is very productive. Comes fairly true from seed.

9. THE SICILIAN TENDER-SHELLED ALMOND. The fruit is long, middling or large. The valves are thin and smooth. The shell is light-coloured, long, narrow and soft, usually slightly curved along the ventral suture, with a pointed tip. The kernel is long and plump, often nearly cylindrical. The tree is very productive and fruits early.

10. THE PRINCESS ALMOND. The fruit is large, long, and rather cylindrical, with very thin and smooth valves. The shell is very long, light coloured, tapering and curved as in the preceding form, and is very soft. The kernel is long, plump, of fine texture and quality. The tree is very productive, and comes fairly true from seed, but makes weak growth on own roots.

THE DOUBLE-FLOWERED ALMOND produces no fruit, and is grown only on account of its beautiful double flowers which bloom late in March or in April and last a long time. There are also semi-double forms of both the sweet and the bitter almond.

DISEASES

The almond is less liable to suffer from the poison left in the soil by other rosaceous trees. It is only in very dry seasons that seedlings of the almond growing in shaded localities, but weakened by prolonged drought, may be subject to die suddenly in autumn after the first rains, and then the roots will be found covered by the mycelium of fungi, chiefly *Armillaria mellea* Vahl. When the almond has well established itself and is in bearing condition, it is practically proof against this disease.

There are two dry rot fungi which are not uncommon in our orchards. That more frequently met with is *Fomes fulvus* (Fr.) Gill. which is also common on the peach, the plum and the apricot. The pileum of this fungus buds out of the trunk and large branches of the tree, particularly on the under surface, and usually several pilea bud out at different points on the branch or trunk. When the pilea make their appearance the heartwood is already destroyed, but they should be removed and burned at once to prevent the spread of infection. The other species is *Fomes robustus* Karst. var. *Amygdali* Sacc. whose pilea are large, rounded, fawn-coloured, with smooth ashy yellow upper surface, and though far less common than the preceding, it seems to be more virulent as it kills the tree in a few years. The best treatment against the dry-rot fungi, on the almond as well as on other trees, is a preventive one and consists in painting over with tar all wounds which are more than 2 c. m. in diameter, and in collecting and burning all the pilea of the fungi as soon as they bud out of the bark of the tree, before they have had time to form and spread their spores. *Puccinia Pruni-spinosae* Pers. is a rust common on the almond in midsummer, and frequently results in the complete defoliation of the tree, with the consequence that the fruit remains undersized. In bad cases, when the disease commences in June, many fruits dry on the tree, and the growth of others is so checked that the kernel is abortive or is formed incompletely, and in due time the valves do not separate, but dry and remain sticking to the shell of the almond. Another fungus which is common on our almond trees in autumn as well as in early spring, is the shot-hole fungus *Cercospora Guliana* Sacc. which seems to be closely allied to the shot-hole fungus of the peach, *Cercospora circumscissa* Sacc. Several lines of treatment have been suggested against these two diseases chiefly consisting in spraying with various fungicides, but it is better to keep up the

vigour of the tree by good pruning and deep digging in autumn, and by manuring if the soil is in poor condition.

The mildew is a rare disease on the almond, due to *Podosphaeria tridactyla* D.By., and is shown as usual by an etiolation of the growing twigs and leaves, which become covered by the powdery formation and small black dots characteristic of this disease; the leaves are small misshapen and contorted, and soon wither and are shed off leaving bare twigs with a few whitish rickety leaves at their end. The treatment suggested for the same disease on the kernel fruits may be adopted in this case.

There are three species of moths whose larvae feed on the leaves of the almond tree. The first is *Brotolomia meticulosa* L. the larva of which is 3 to 4 c. m. long, at first greenish and afterwards greenish brown. It has a protuberance on the last segment and dark transverse bands on the back, with white lines on the sides. The next is *Calocampa exoleta* Linn. whose larva is green with a yellow line on each side with two white spots on each segment, surrounded and united by a dark line, and a lateral red line with a white edge. The moth is pale greyish violet, with a dark anterior border on the anterior wings and a round spot on each side.

However, by far the worst insect pest of the almond tree is the larvae of the moth *Diloba caeruleocephala* (Lin.) Steph. These larvae make their appearance in February or earlier, sometimes when the tree is still in bloom, and for some time feed on the blossoms and the young leaves, but their voracity increases in proportion to their increase in size so that in March they eat up all the foliage as well as the young twigs and the green bark, reducing the tree to a perfectly leafless condition. There may be several hundreds of larvae on the same tree and when there is nothing more to eat they crawl down the stem and either dispose themselves to undergo their metamorphosis, or if they are still immature they proceed to

complete their fill on neighbouring almond trees or peach trees. The larva has sixteen feet, is 3 to 4 c. m. long, and its colour is milky or greenish white, faintly bluish, with a broad yellow line on its back, and a narrower but deeper yellow line on each side just above the feet. The body has numerous short black bristles situated on small point-like black prominences. There are two yellow prominences close to the head, each capped by a black dot, surmounted by a tuft of black bristles. The head is bluish grey with two black dots. Immature specimens have two broad bluish-black bands on each side of the body above the yellow lateral line. The perfect insect or moth is rarely seen. It is of a violet-brown or violet grey colour, and about 2 c. m. long with two black transverse broken lines and yellowish green spots on the wings. The insect attacks also the peach, the pear, the apple, the cherry and the plum, but prefers the almond tree. The larvae should be collected by hand, or shaken down the tree and picked up and destroyed.

Many small moths and beetles, as well as small wasps, prey upon the foliage of the almond, but the injury caused by them is never severe enough to attract attention. The scale insect *Aspidiotus Hederae*, or one of its many forms, is frequently seen on the almond, but the infestation is rarely of sufficient severity to call for treatment.

THE PEACH AND THE NECTARINE.

Prunus persica Stock. = *Amygdalus Persica* Lin.

Persica vulgaris Mill.

The Peach is probably native of China, whence it passed to Persia. It was introduced in Europe from Persia probably at the time of Alexander the Great, and was described by Theophrastus as the Persian fruit (B. C. 286). The peach was well known by the Romans who had numerous varieties under cultivation, but at

present it is grown in all regions of the globe where its cultivation is possible. The peach may not be so picturesque as the almond, but generally its blossoms are of a more lively colour and its foliage is finer and more ornamental.

The peach (Maltese = *ħauħa*. Italian = *pesco*. French = *pecher*.) is a fleshy drupaceous fruit, with a thick-shelled stone, deeply and irregularly furrowed, the rind being covered by a thick and persistent covering of short down. In the Nectarine (Maltese = *nucipersica*. Italian = *nocepersico*. French = *nectarine*, *brugnon*) the rind is perfectly smooth, and the flesh is generally of a more delicate acidulous flavour; but in other respects the nectarine is a mere variety of the peach (*P. persica* Stock. var. *laevis* Arc.) with the same cultural requirements and with practically equal liability to the same diseases.

The peach tree is far more delicate than the almond but in favourable situations may reach a height of 5 metres if grafted on the almond. Its term of life may be put at 30 to 40 years if grafted on the almond, and at 10 to 20 years if grown on own roots or grafted on the wild plum. However it agrees well with all soils, preferring a deep loamy soil to a stiff and clayey one. The blossoms are produced singly at the axil of the leaf, one on each side of the leaf bud. In certain forms the petals are fine and large and even double, and of a lively pink or carmine red, in others the petals are small, sometimes much smaller than the segments of the calyx. In open and sunny situations the tree is more productive and produces fruit of better quality, but the early sorts are known to thrive well and to produce fine fruits also in a comparatively shaded situation.

In certain years the production of the peach as well as of the nectarine, the plum, and the apricot, remains much below the average. This may be due to a shower of rain which has washed off the pollen at the time when the tree was in full bloom, or to a sudden change of

temperature which may interfere with fertilization, or to a too dry condition of the soil and subsoil owing to shortage of rain. To obviate partly to this irregularity of production, it is advisable to plant two or three sorts of peaches or nectarines in alternate lines in order to promote the fertilization of the flowers by cross-pollination.

PROPAGATION. The peach is propagated by seed and by budding or grafting on its own seedlings, on the almond and on the wild or half wild plums.

The stones of the peach or of the nectarine intended for sowing may be stratified, or rather put up in layers with ordinary garden soil or leaf-mould, in pots or boxes. They are sown in November-January at a depth of about 5 c. m., and may be sown in the place where they are to remain, or in beds or large pots or pans where they can be tended more carefully. It is a good plan to sow them in small pots, putting one or two stones in each pot, and then leaving only one plant if both stones germinate, as this method will permit the young plant to be transferred to the ground in the following winter simply by opening a little the ball of roots, without much loss of rootlets. Germination takes place in March or April. The seedlings are trained on one stem until they reach the height of at least 50 c. m. before being allowed to ramify. Seedlings grown in a bed may be left there for two years, as generally they will be too weak in the first winter; but those grown together in pots or pans must be potted off singly in the first winter before their roots become pot-bound, as then it will be difficult to extricate them without much injury. By the following winter most of the seedlings which have been potted off separately will be sufficiently strong to be planted out or may be shifted into larger pots to become stronger if desired.

If the seedlings are allowed to fruit they are found generally to vary more or less from the type, and may turn out good or improved forms deserving propagation

as new sorts. Seedlings are often used as stock for approved cultivated varieties and may be budded or grafted when their stem has reached the thickness of about 2 c. m. However, the peach and the nectarine grown on own roots, or budded or grafted on peach or nectarine seedlings are short-lived and very liable to gumming, and therefore propagation by seed should be followed only when it is proposed to raise new varieties, although of course chance seedlings may be allowed to fruit or made use of as stock.

The other method of propagation consists in budding or grafting on the almond or on the plum. All sorts of plums may be used as stock for the peach and the nectarine, and this method is generally followed in France and other continental countries, where the sloe-tree or black-thorn (*Prunus spinosa*) is the preferred stock for all forms of the peach and nectarine, but the use of the cherry plum or mirabella plum (*P. myrobalana*) and of the bullace or wild damson (*P. domestica* var. *insititia*) is also known to give good results. The peach grafted on these wild plums is generally very productive, but here at least it never attains a fair size and is short-lived. Grafting or budding on the almond is the method commonly followed by our gardeners, and should be preferred to all others. Peaches or nectarines grafted on the almond partake of the vigorous nature of the stock, make strong growth, attain a large size, are comparatively long-lived, and are very resistant to drought and adapt themselves to soils of inferior quality without much difficulty.

Both the bitter and the sweet almonds are used as stock for the peach and nectarine, the bitter almond being generally preferred although it has no real superiority over the sweet almond. The almond may be sown in place, and afterwards budded or grafted when strong enough, that is in two or three years, but this method can be followed only if it is proposed to grow the peach in small numbers along the boundaries of an

orchard or of a kitchen garden. For other purposes it will be more convenient to sow the almond in the nursery, dibbling the stones about 50 c. m. apart, in soil which has been well tilled and manured. In the nursery the seedlings will be cultivated with greater care and in about two years will be strong enough to be budded or grafted. Watering in summer will cause the seedlings to make quicker growth, so that it is often possible to commence budding when the plants are hardly more than a year old, and the young tree having developed a strong root system will establish itself more easily when it is transferred to its final destination.

Budding is best done early in March when the almond stock is already in full movement of sap, and the peach or nectarine is just beginning to swell its buds, the method generally used being ordinary shield budding. The bud of course, should be still dormant, and may be selected from last year's wood or even from older wood, but in any case should have no flower buds although it is often difficult to find suitable leaf buds, without the usual complement of a flower bud on one or both sides. Should there be this difficulty the flower buds may be rubbed off gently before taking up the shield with its leaf bud. From May to September the bud is taken from the new wood, the leaf being removed by a clean cut just below its blade. The stock is often budded close to the ground, in order to get bushy trees, but for open situations it is preferable to have trees budded as standards or half-standards, from 50 c. m. to one metre above the ground so that a clean stem of the almond may be had above ground which will impart its vigour to the tree.

Cleft-grafting close to the ground is done in December or January. Grafting above ground should be done with the aid of grafting wax, with which all wounded or exposed tissues should be covered, and the operation is better postponed until the close of January or the first days of February, in order not to expose the scions too

long to the action of the wind and the sun before the time comes when they should start into vegetation, particularly when the graft is made well above the ground for the rearing of standards of 50 c. m. to 1 or $1\frac{1}{2}$ meters.

The peach may be budded or grafted also on suckers of the almond as well as on the roots, as mentioned in the case of the almond. Budding on the wild plums or on peach stock may be done from March to September, and grafting is done in the same period as above mentioned.

The young trees grown on own roots or on the wild plums can be transplanted from the nursery to their final quarters in winter, from December to February. However, it should be remembered that the great majority of peaches and nectarines grown by our gardeners are budded or grafted on the almond, and that this stock is already in movement by January, and therefore it is not advisable to postpone the operation beyond the close of January as otherwise the stock will receive a check so severe that recovery may be difficult or impossible.

CULTIVATION. The peach and the nectarine are planted 3 to 5 metres apart according to the quality of the soil and the sort planted. The early peaches grafted on plum stock may be planted 2 metres apart, but if grafted on almond stock a distance of 3 metres should be allowed from one tree to another. Specially vigorous sorts of peaches or nectarines, such as peaches *Teton de Venus* and *Reine des Vergers*, and the Malta red nectarine grafted on almond stock, may be allowed a space of 5 or 6 metres if planted on good deep soils in sheltered situations. The land should be deeply trenched and manured in November, and about a month afterwards the trees may be planted. The expense incurred for trenching and manuring may be fully recouped by growing some crop, such as potatoes or peas or winter vegetables which do not interfere unduly with the development of the trees. Where the land is not trenched a pocket will be dug large enough to receive the roots in their natural position

without bending them, and the soil lightly mixed with some old manure, is packed carefully between the layers of roots, until all the roots are well covered; it is then pressed down by the foot, a good mulching of manure is given, and then the pocket may be completely filled up with earth to the ground level. If the weather is dry a good soaking with water will be necessary to cause the soil to settle well around the roots. Deep planting is not advisable, as it is preferable to have a few inches of the stock above the ground, but on the other hand a tree planted higher above the ground than its former position in the nursery is liable to suffer severely in the dry season before it is thoroughly established, and the tendency of the roots to throw up suckers becomes much more marked, being closer to the surface, and the production of suckers by a newly planted tree is always detrimental to its vigour. Newly planted trees should be cut back a little, and the number of branches reduced in order to restore the balance between the tree and its roots, so that in the following spring the new growth may push with more freedom.

A sunny situation is essential for the proper development of the peach and nectarine, particularly of all sorts maturing after the middle of July, but all sorts even the earliest are benefited by a full exposure to the sun. Therefore the old rule to plant fruit trees in lines directed from north to south, which is always wise to follow, should be strictly adhered to in the case of the peach and nectarine, so that all sides of the tree may enjoy the action of the direct rays of the sun.

Trees newly transplanted should receive a good watering in spring as soon as the buds have moved, so that the activity of the roots may receive no check from eventual dry weather, and watering should be repeated throughout the spring and summer at intervals of ten or fifteen days, in order to keep the roots in active growth as long as possible. In the second summer watering may

be commenced in May and continued at intervals of fifteen days. Although when properly established the peach will do without any irrigation, especially on deep and moist soils, it is generally admitted that if moderately watered the size of the fruit will improve appreciably without any deterioration of its quality, but excessive watering especially on clayey and moist soils may cause the fruit to become too watery and to lose its flavour, besides favouring outbreaks of gumming and root-rot.

The productiveness of the peach orchard is kept up by manuring the soil moderately and regularly. The best manure for this purpose is old manure from the cow shed or the stable, applied every fourth year in autumn and the soil is trenched at the same time. Trenching should be done at a depth of about 15 c. m., and if the trees are grafted on plum stock, and are therefore very prone to throw up suckers, it is advisable not to trench deeper than 10 c. m. and in no case to exceed a depth of 15 c. m. in order not to favour the formation of suckers by wounding the superficial roots. The manure is strewn along the bottom of the trench and lightly digged in by a hoe, the trench being then filled in by the surface soil from the adjoining trench, and the ground levelled properly when the operation is completed. The application of phosphatic and potassic manures in moderate quantities is conducive to greater fertility as well as to the production of fruits of better quality. The potassic manures, in the shape of wood ashes at the rate of 10 kilos per are (1000 kilos per hectare) or of kainit or chloride of potash at the rate of 250 kilos p. hectare, may be applied every four years in autumn in the interval between one trenching and another. Phosphatic manures, as superphosphates or Thomas's slag may be applied when trenching is completed, before levelling the small heaps resulting from the operation, in the proportion of 3 to 5 kilos per are (3 to 5 quintals per hectare). The stimulating influence of phosphatic manures is soon revealed by an

increase of vigour and productiveness, as well as in an improvement of the size and quality of the fruit.

The soil of the peach orchard should be weeded and tilled at least three times during the year, as suggested for the pear tree. It is possible also to grow catch crops of vegetables in winter or early spring, as in the case of orchards of other deciduous fruit trees, but the shade thrown by the thick foliage of the peach and nectarine is an obstacle to the growth of vegetables and other irrigated crops in summer. Indeed the cultivation of crops requiring frequent and abundant irrigation is, as already stated, a real danger to the peach tree and to all other stone fruits, as the permanent moist condition of the soil and subsoil provokes attacks of chlorosis, gumming and root-rot, from which the trees never fully recover, and their term of life is considerably shortened.

In these Islands the peach tree is not trained to any particular shape, but is always allowed to assume its natural dome-shaped or spreading form, and this is the shape best suited to the tree in our subtropical climate. However the practice of growing the peach as a bush is not the best to follow, as the central upright branches soon appropriate the vigour of the tree, develop a wasteful luxuriance of foliage and twigs and become comparatively unproductive. It is therefore better to train the tree roughly to a vase-shape from the first year after grafting, and this is easily done by reserving three to six branches situated at approximately the same level, and training them at equal distances apart, leaving a clear space in the middle. In the second year the vase-shape will be fully established, and a little trimming every winter is all that is necessary to keep the tree well in shape. The vase shape may be started at ground level from one of the scions or from both, if both are successful, but the best results are obtained from young trees budded or grafted as standards at 50 c.m. to 1 metre above the ground, as in that case the natural tendency of the peach

and nectarine to produce spreading or recumbent branches is accentuated and the vase-shape is then almost natural to the tree, and these lower or spreading branches being moderately vigorous and within easy reach of the radiating heat of the soil, are invariably well laden with fruit

The peach has a tendency to form too many twigs, many of which die in the course of the winter and others have to be thinned out to keep up the vigour of the tree. This is what may be called the cleaning operation of winter, and is too often neglected with the result that the tree becomes old and comparatively unproductive as soon as it has reached full size. The dry twigs if allowed to remain will lacerate the leaves and damage the fruit whenever a wind is blowing, and the dense foliage resulting from an excessive number of twigs consumes the vigour of the tree to no purpose, and fosters the growth of injurious pests. The inner branches and lower spurs of the trees which are too shaded by thick vegetation or have ceased to be productive, should be removed at the same time and the tree trimmed to shape, by keeping within just limits the natural tendency of the branches to assume a straggling or drooping habit. All wounds caused by the removal of branches along the main stems should be painted over with tar, not only to check gumming which in a healthy tree may be of little consequence, but also for the more important object of preventing access to the spores of dry-rot fungi.

Old trees which have been neglected for a long time may be rejuvenated by pollarding. The operation should be done towards the close of autumn or early in winter, so that the tree may have full time to elaborate the dormant buds, which will then push out in spring without much difficulty. Pollarding should be done on branches 2 to 5 c.m. in thickness, in order that the wound may not be too large to heal. The cut is made in a slightly slanting direction, and the operation is completed by

painting the wound with tar as a preventive for dry rot, and by cleaning the stems and branches of their lichens, either by scraping them off with a steel-wire brush, or by means of common whitewash or strong ash-lye applied by a painter's brush.

The fruit of the peach and nectarine will acquire its full flavour if allowed to mature well on the tree, as the percentage of sugar is at its best only in the last two or three days and then the full development of the delicious fragrance and pleasant acid flavour follow suit. Indeed in the case of the nectarine the fruit should be gathered at perfect maturity and then kept in the fruit room for a day or two to develop all its exquisite qualities. However, the grower for the market who has often to send over his fruit for long distances, cannot afford to allow his fruit to attain full maturity, as it travels badly, and on arrival many fruits will be found damaged and unfit for sale. The market grower generally prefers to cut the fruit as soon as it begins to show signs of maturity and is well coloured, that is when it is still rather hard, and can be packed and forwarded for some distance with little risk of injury. At the fruiterers' shop the fruit may remain for a day or two, until it is well ripe, but of course fruit treated in this way cannot compare in quality with the fruit grown by the amateur for his own table.

The peaches may be classified into three groups. (a) Freestone peaches in which the flesh separates easily from the stone. (b) Clingstone peaches (French=*pêches pavies*) the flesh of which adheres firmly to the stone, even at full maturity. (c) Yellow peaches (French=*pêches alberges*), having a yellow peel and yellow flesh, more or less adhering to the stone. The blood or red peaches (French=*pêches sanguines*) have blood red flesh and are generally clingstones.

The nectarines are classed into two groups. (a) Freestone nectarines (French=*pêches nectarines*) and (b) Clingstone nectarines (French=*pêches brugnons*). The yellow nectarines are mostly clingstones.

The following are the peaches and nectarines grown in these Islands.

PEACHES.

1. EARLY MALTA PEACH. (Maltese=*ħauħa bicria*). The fruit is middling or small, well pointed with a deep side groove, and very hairy. The peel is yellowish green or pale yellow, with a pink flush towards the sun. The flesh is pale greenish yellow or cream yellow, of fine texture, juicy, sweet, with a fine aroma. Matures towards the close of June and in July. It is a freestone peach. This and the next are two ancient local sorts and are very productive.

2. MALTA PEACH. (Maltese=*ħauħa ta Malta*. French=*Belle de Paris*, or *d'Italie*). The fruit is middling or large, almost round with a shallow groove, but sometimes pointed. The peel is pale yellow, well haired, with a large red or deep pink flush towards the sun. The flesh is creamy white, sometimes red close to the stone, of buttery consistence, juicy, sweet, fragrant, and of excellent quality, and separates well from the stone. Matures in August. This peach is now rather extensively grown in Southern Europe and France under various names, and is an esteemed market sort. Travels well, and is also a desirable peach for the table.

3. GROSSE MIGNONNE. (Maltese=*ħauħa francisa*). The fruit is large or very large, round, sometimes slightly depressed at the navel, with a deep groove. The peel is thin but tough and peels off easily, it is well hairy with a velvety touch. The colour is greenish white or very pale yellow, broadly flushed crimson or dark red. The flesh is white or greenish white, rose or pink close to the stone, very juicy and sweet, with a fine perfume. It is a freestone and matures in August. The tree is well productive.

4. SEA EAGLE. (M.=*ħauħa bajda*). The fruit is large or very large, round, sometimes irregular, with a

shallow groove. The peel is greenish white or pale cream, faintly flushed pink towards the sun. The flesh is greenish white or white, rather firmer than Grosse Mignonne but like it in other respects, and matures at the same time.

5. TETON DE VENUS (M.= *hauha francisa tal ponta*). The production is irregular, sometimes very heavy in two or three successive years. The flowers are small, with red petals smaller than the calyx. The fruit is middling or large, but may be very large or enormous, slightly oval, with a well marked groove, and a large and prominent navel. The peel is very hairy, greenish yellow or yellow, sometimes flushed pink, thin and tough, and peels off easily. The flesh is well detached from the stone, is creamy white, pink or rose in contact with the stone, melting, juicy and sweet, with a delicious flavour. Matures in September. When at its best this peach is unsurpassed.

There is a local form, probably a seedling of the above which matures early in August. The fruit has the same appearance, but rounder, and the flesh though of good quality is not so well flavoured.

6. ALL SAINTS' PEACH. (Italian= *Poppa di Venere d'Ognissanti*). The fruit has the same appearance as the preceding, but is much firmer in texture, although the quality is good, considering the late season. Matures in October.

7. AMSDEN. (M.= *hauha ta giunju* or *hauha ta Urzi*, from the name of the person who first introduced it). The tree is vigorous and productive, but never grows to full size. The fruit is middling, round, but with marked navel, covered with thick hair, greenish yellow or yellow, broadly flushed crimson or purple red. The flesh is greenish white or white, greenish close to the stone to which it clings firmly, and red or pink close to the peel. It is slightly fibrous, but is very juicy sweet and acidulous, and well perfumed. Matures late in June and early in July. It is a valuable market peach, of good size and beautifully coloured.

8. SNEED. The tree is fairly vigorous and a huge cropper, and grows to a fair size. The fruit is middling or small, and generally requires much thinning or will remain too small. The shape is oval with a small pointed navel, or round and plump when properly thinned. The peel is greenish yellow or very pale yellow, flushed pink or red towards the sun, and peels off easily at maturity. The flesh is creamy white or greenish white, very juicy, and adheres firmly to the stone, which is small and remains pale yellow. This is the earliest peach in cultivation and rather poor in flavour, no doubt owing to its earliness. Matures between the 15th May and the 15th June, and therefore commands a good price at the market. Introduced in 1905.

9. CÔTE D'AZUR. The tree is almost as productive as the preceding sort but is more vigorous and grows to a larger size. The fruit is of the same shape and quality, but is larger and better coloured, and the flavour is also better. Matures in June, and is a desirable market peach, fetching a good price.

10. EARLY RIVERS. (M.= *hauha inglisia*, *hauha ta lulju*). The fruit is middling or large, round or nearly round, with a small navel rather depressed. The peel is very hairy, pale yellow well flushed with pink or pale red towards the sun. The flesh is white, very juicy and sugary, with a good flavour, and partly adheres to the stone. The tree is fairly productive, and the fruit matures in July.

11. LA FRANCE. The fruit is large or very large, ovoid, with a deep groove, and often irregular in shape. The peel is only slightly hairy, greenish yellow or pale yellow, flushed carmine or clear red. The flesh is white, well detached from the stone, melting juicy, sweet, with a strong fragrance and delicious flavour. Matures in August. The tree is vigorous, with green twigs, and is fairly productive.

12. BRIGG'S MAY (French=*Rouge de Mai*). The fruit is middling, round, thickly covered with short hairs, pale yellow, broadly flushed purple red towards the sun. The flesh adheres or partly adheres to the stone, is white, juicy, and of good flavour. Matures early in July. It is a worthy companion of Amsden.

13. SANTA ANNA. The fruit is a freestone, middling in size, round and plump, greenish yellow, broadly flushed dark red. The flesh is creamy white, melting, sweet, with a fine fragrance and delicate flavour. Matures late in July or in August. The tree is very productive.

14. NOBLESSE. The tree is fairly vigorous, but well productive. The fruit is large, sometimes very large, usually ovoid, with a deep groove and very regular. The peel is covered with short silky hairs. It is thin but peels off easily, white or very pale yellow, streaked or marked carmine red towards the sun. The flesh is white, melting, of very fine texture, and is very sugary with a good fragrance and delicate flavour. Matures in August or beginning of September.

15. MALTA YELLOW PEACH. (M.=*hauha safrata Malta*). The tree is very vigorous and productive, and seems to be very liable to attacks of *Aphis*. The fruit is middling or large, but generally very uniform in size, round or slightly oval with a broad and obtuse navel. The peel is yellow, very hairy, rarely flushed pink. The flesh is yellow and clings firmly to the stone, where it is often streaked red. It is rather firm, but juicy, sugary and aromatic. Matures in July-August.

16. GOLDEN GLOBE. (It.=*Globo d'oro*). The tree is very vigorous and fairly productive. The fruit is very large or enormous, globular, smooth and slightly grooved, with a short pointed navel. The peel is covered with soft silky down, bright golden yellow, rarely flushed very pale rose. The flesh is firm but tender, streaked red close to the stone to which it adheres firmly. It is juicy and

sugary, of fairly good flavour. Matures in September. Like the preceding it is best eaten cooked, and makes good preserves.

17. REINE DES VERGERS. (Maltese=*ħauħa safra francisa*). The tree is very vigorous and productive, but is liable to persistent attacks of *Aphis*, particularly if grown in the shade. The fruit is very large, oblong, irregular, with a prominent navel. The peel is very hairy, it is greenish yellow or golden yellow, orange yellow at full maturity, with a large deep red flush towards the sun. The flesh is deep yellow or orange-yellow, streaked red particularly close to the stone, from which it partly separates when well ripe. The flesh is rather firm, of fine texture, sugary and very aromatic. Matures in September-October, and keeps well and long. When quite ripe it is a good table peach, and makes excellent preserves.

18. SAINT ANNA YELLOW. The fruit is middling or large, round, with a short pointed navel. The peel is well hairy, yellow, pale grayish pink towards the sun. The flesh is deep yellow, firm but juicy and sweet, half-melting at full maturity, reddish close to the stone to which it adheres rather firmly. Matures in July-August.

19. THE LARGE WHITE PEACH OF MUSTA. This is an old local seedling which originated near Musta, and was grown rather extensively on account of its great productiveness. The fruit is large, sometimes very large, round, with a deep groove and small indistinct navel. The colour is greenish white, faintly coloured rose towards the sun. The flesh clings firmly to the stone, and is greenish white or creamy white, juicy, sugary and of good flavour. Matures in August.

20. THE BOSCHETTO PEACH. (M.=*ħauħa tal Buschett*). This is a seedling originated in the Boschetto Gardens and fruited for the first time in 1917. The tree is vigorous healthy and well productive. The fruit is very

large, round or slightly oblong, often reaching 12 c.m. in diameter, with a well marked and large navel, creamy white, tinted pink on the sunny side. The rind is thin and tough, peeling off easily at maturity. The flesh is well detached from the stone, and is very thick, creamy, melting, sweet with a delicate aroma and acidity, delightfully fragrant. It is evidently a seedling of *Teton de Venus*, but is larger in size and more uniform in character. Matures in August.

21. THE RABATO PEACH. (M.=*ħauħa ta Sta. Agata*). A seedling originated recently in the neighbourhood of Saint Agata Catacombs, Rabato, and is being propagated on account of the size, attractive appearance and fine quality of its fruit. The tree is of middling vigour, but grows to a good size, and is fairly productive. The fruit is very large, round, with a well marked groove and a prominent navel. The colour is greenish white or creamy white, sometimes streaked crimson and flushed pink on the sunny side. The rind is delicate and peels off easily at maturity. The flesh is very thick, detached from the stone, and is creamy and melting, with a very good flavour. Matures in July and August.

NECTARINES.

22. THE MALTA WHITE NECTARINE. This is the celebrated local white nectarine, generally considered the best of our stone fruits. The tree is vigorous and very productive, with thick twigs dull red on the upper side. The fruit is middling or large, round or slightly oval, very smooth, with a shallow groove and small indistinct navel. The peel is white or waxy white at full maturity, rarely coloured pale flesh or dotted red towards the sun. The flesh is white completely detached from the stone, is very melting, juicy and sweet, with a delicious fragrance and a very agreeable acidulous flavour. The stone is small, plump, nearly round. Matures in July or early in August. It is an ideal fruit for all purposes and keeps fairly well. Comes fairly true from seed.

23. **THE MALTA RED NECTARINE.** This is another ancient local variety, inferior to the preceding but superior to most foreign sorts recently introduced in the Island. The tree is very vigorous and very productive, with rather thick, red twigs. The fruit is middling or large, round or slightly oval, smooth, shallow-grooved, with a short pointed navel. The peel is thin but tough; the colour is greenish yellow or pale yellow, almost entirely washed red or carmine red, more intense on the sunny side, paler and often limited to large and irregular blotches on the shaded side. The flesh is creamy white, well separated from the stone. It is melting, very juicy, sweet and well perfumed with a delicious acidulous flavour. Matures in July or early in August. This variety is now more grown than the white nectarine on account of its supposed greater resistance to the fruit fly.

24. **THE MALTA LARGE RED NECTARINE.** The tree is very vigorous and fairly productive. The fruit is large or very large, spherical, with a fairly deep groove and an indistinct navel. The peel is thin and delicate, it is greenish yellow or pale yellow, well washed all over with clear red, of a deeper shade towards the sun, and heavily marbled or blotched red on the shaded side. The flesh is well detached from the stone, creamy white, a little greenish on the shaded side, very juicy and sugary, with a delicate perfume and a delicious vinous flavour. Matures in August, and must be handled with care, the peel being easily injured. This is an excellent nectarine, but keeps badly.

25. **THE ARMIEL NECTARINE.** This nectarine originated as a seedling, in the old Armiel Nursery and was propagated at San Antonio Gardens in 1908. The tree is very vigorous and productive. The fruit is large or very large, oval, smooth, with an indistinct navel. The peel is rather thin but tough. The colour is pale yellow, broadly washed claret, marbled red on the shaded side. The flesh is free from the stone, and is creamy yellow,

melting, sweet, of very good flavour and fine fragrance. This variety is superior to the old red nectarine as a market fruit. Matures in August.

26. THE YELLOW NECTARINE OF PADOVA. The tree is fairly vigorous and productive. The fruit is large or very large, round or slightly oval, with a deep groove and indistinct navel. The peel is bright yellow or golden yellow, often flushed pink or dotted crimson on the sunny side. The flesh does not adhere to the stone, and is deep yellow, rather firm, but of very fine texture, half melting, well perfumed, with an agreeable vinous flavour. Matures late in August or early in September, and keeps well.

27. NECTARINE GALOPIN. The tree is vigorous and well productive. The fruit is very large, nearly spherical, with a well marked groove and a small pointed navel. The colour is greenish yellow or pale yellow, washed dark red, marbled purple red towards the sun. The flesh is greenish white, well detached from the stone, close to which it is often tinted red. It is very juicy, sugary, and of fine texture, with a nice fragrance and a very good flavour. Matures late in August or early in September.

28. NECTARINE "FERTILE DU POITOU". The tree is vigorous with slender red twigs and is very productive. The fruit is middling or large, oval, well pointed, with a deep groove. The peel is thin but tough, entirely washed purple red, darker towards the sun. The flesh separates easily from the stone, and is creamy white, melting, fairly juicy, sweet, with a good flavour and very fine fragrance. Matures late in July or early in August, and keeps well. Introduced in 1908.

DISEASES.

The "yellows" of the peach (Italian=*giallume*) is an obscure form of chlorosis probably of an infective nature. It attacks more frequently seedling peaches, or peaches grafted on peach seedlings or on plum stock and growing

in shaded situations. Trees growing in very sunny situations may have their foliage discoloured by the action of the sun's rays, but this alteration which is of a purely physico-chemical nature is easily distinguishable from "yellows" in which the leaf becomes veined or marbled yellow, or entirely pale yellow with some green at the base of the leaf and along the principal nerves, and scions or buds taken from diseased trees should be avoided as they generally produce sickly trees and communicate the disease to the stock. The diseased foliage is shed early in autumn, and if the disease is in an advanced stage the tree dies. The complaint is cured or at least greatly modified in its incipient stages, by watering the tree with a solution of green vitriol (*ferrous sulphate*) towards the close of April or May when the tree is still in active growth, but the soil is already getting dry. However, the use of organic manures, especially if not thoroughly fermented, may cause the disease to take an acute form and to kill the tree in a few weeks.

The "rosette" is another obscure disease closely allied to chlorosis, and is also supposed to be infective as a bud or scion taken from a diseased tree will not only reproduce sickly plants, but may communicate the disease to a healthy tree if budded or grafted upon it. This disease is rare with us, and is characterized by the production of small deformed leaves, set close together so as to form a "rosette" at the ends of the twigs and spurs. Trimming back the diseased twigs may bring about some improvement, but the disease is usually incurable.

The shot-hole fungus of the peach (*Cercospora circumscissa* Sacc.) is rarely met with on our trees. The lesions produced by this fungus consist in small round whitish spots which dry and break through, leaving round holes. The best treatment against this disease consists in spraying with sulphur-lime mixture. More common is *Phyllosticta Persicæ* Sacc. which produces dark roundish spots with minute darker dots, and enclosed by a red

margin. In upper Italy *Cercospora persica* Sacc. forms whitish spots on the upper surface of the leaf; and *Clasterosporium Amygdalearum* Sacc. which is also unknown here but is frequent all over the continent, causes the formation of dry circular or roundish brown yellow blotches, surrounded by a dark red or blackish margin. *Corineum Beyerinckii* Oud. is another fungus rather frequent in Italy which forms small irregular red patches or blotches which afterwards turn brown, on the under surface of the leaf.

The rust of the plum, *Puccinia Pruni-spinosae* Pers. is occasionally seen on the leaves of the peach in autumn, but a much more frequent parasite is *Sphaerotheca pannosa* Lev. which is the cause of the mildew of the peach as well as of the rose. This mildew develops as a mealy powder on the growing twigs of the peach in summer, and is more frequent on young trees, and on trees growing on irrigated lands. The mildew of the peach may be kept in check by dusting with powdered sulphur containing 3 to 5 p. cent. of sulphate of copper, or by spraying with a solution of sulphide of potash or with sulphur-lime mixture.

Exoascus deformans Fckl. is the cause of the well known peach leaf-curl. The disease may develop early in spring along with the new foliage, but is more frequent about midsummer following in the wake of an attack of *Aphis*. As a result of this infection the foliage becomes blistered, wrinkled and curled, and the growing twigs become swollen and contorted, with the formation of an excessive number of slender lateral twigs, which usually die off in winter. The disease also sometimes attacks the fruit in Italy, where it is frequent enough on the fruit of the plum, but in these Islands neither the peach nor the plum is ever attacked by the fungus. The diseased twigs should be cut back to the healthy wood, as it is not possible to expect from it either the production of fruit or of healthy wood.

The peach perhaps more than the almond, is liable to the attacks of the dry-rot fungi, *Fomes fulvus* Gill. and *F. robustus* Karst. *forma Amigdalii* Sacc. It is presumed that the spores of these fungi find their way to the wood through breaks in the bark, but chiefly through the wounds caused by pruning, and as a preventive measure the wounds should be cut clean to assist the bark to close up soon, and painted over with tar, particularly in the case of wounds which are 2 c.m. in diameter and over, and are not expected to heal before two or three years.

The root-rot fungus *Armillaria mellea* Vahl. is a frequent cause of trouble, particularly on peach trees growing on own roots or grafted on plum-stock. Newly transplanted trees grafted on the almond also offer a weak resistance to this fungus. However, peaches growing on own roots or grafted on the plum are subject to die off suddenly in winter or early spring. In these cases the roots are invariably found in a rotten condition and more or less covered by a white or brownish mycelle, and as this happens as frequently on moist lands as in sunny and dry situations the infection may be due to a species of *Rhizoctonia*, probably *R. violacea*, or to *Dematophora necatrix* Hart. In any case, the sudden fatal termination is more apparent than real, as the disease probably had been lurking unobserved throughout the preceding summer, as witnessed by the severe attack of gumming which had been going on in the summer, the excessive exudation of dirty red gum being invariably an evidence that there is serious trouble with the roots.

Aphis Persicae Sultz. is unfortunately too frequently a source of disappointment, and may attack the growing twigs from early spring to late autumn. When an attack of *Aphis* commences in spring, it spreads to all or most of the growing ends of the twigs, causing the young fruit to dry and drop off the tree, thus destroying the crop and seriously jeopardizing the crop for the following year. The leaves become blistered and contorted entirely out of

shape, the twigs cease to grow, or make irregular and twisted growth, and the punctures of the insects favour infection with *peach leaf curl*. Moreover the honey dew exuded by the *Aphis* besides attracting hordes of ants which assist in the destruction of the remaining fruit, soon besmears all the foliage and favours the growth of the sooty fungi which contribute to give to the tree a very ugly appearance. The *Aphis* of the peach is small and of a light green colour, and the winged insect lays its eggs close to the buds of the twigs or at the extremity of the twigs among the small tufts of sickly twisted leaves, which seem to be glued to the twig and remain on the tree for a considerable part of winter. Dusting the affected trees with Schloesing's precipitated sulphur containing nicotine, or spraying with a ten per cent. watery solution of a mixture made of nitrobenzine 1 part, amylic alcohol or fusel oil 3 parts and soft soap 2 parts, is useful to check the disease in its early stages. In winter the sickly extremities of the twigs should be trimmed back, all tufts of dry leaves plucked off those twigs which are apparently healthy, and the whole tree thoroughly white-washed with fresh slacked lime, repeating the operation after the interval of fifteen days to make sure that all the hybernating eggs of the *Aphis* have been destroyed. This cheap and energetic treatment will be found to give very good results.

Erinosis of the peach, due to the species of *Phytopus* is a rare disease of the foliage in early spring and has no practical importance; so also is the injury caused by the larva of *Psylla Persicae* Fb. the peach flea, which occasionally attacks the foliage of young trees. *Lecanium Persicae* L. the peach scale, attacks the peach in Italy and other continental countries, but is not present in our orchards, but *Aspidiotus Hederae* is a frequent source of trouble on our peach and nectarine trees growing in shaded situations, and a winter treatment with sulphur limewash may become necessary. A small brown species

of *Lachnus*, belonging to the *Aphideae* is often found in large numbers on the stems and branches of peach trees growing in the shade, but the damage caused by them is never important.

The fruit-fly *Ceratitis capitata* is the cause why the cultivation of our excellent peaches and nectarines has been neglected in the last two or three decades. Peaches and nectarines maturing after the end of June are invariably visited by the fly, and in badly infested districts the crop is entirely destroyed, being often impossible to find one peach or one nectarine which has been allowed to ripen without being punctured by the fly. After a severe winter or a cold spring the early peaches maturing before the end of June generally escape destruction as the fly would be then too much reduced in numbers to cause much havoc, and the same thing happens with the earlier nectarines, but peaches maturing in midsummer or after, are invariably destroyed year after year so that the grower is often induced to give up their cultivation as a hopeless affair. Unfortunately there is no known remedy against the fly and the grower must try to save his fruits by putting them in bags of cheap cloth as recommended for the pear. This of course involves trouble and a considerable expense, but the bags will be useful for several years in succession, and the expense will be amply recouped by the good prices paid for fine healthy fruit.

The larvae of the moth *Diloba coeruleocephala* Lin. are often found eating the foliage of peach trees growing near almond trees which have been denuded or partly denuded of their foliage by this pest, but it seems that these larvae only resort to the peach when the foliage of the almond fails them.

In continental Europe the following species of *Lepidoptera* feed on the foliage of the peach: *Porthesia chrysorrhæa* Lin., *P. auriflua* Fb., *Acronycta tridens* Schiff. *A. Psi* Lin., *Papilio Podalirius* Lin., *Bombyx neustria*

Lin, *Lyda nemoralis* Lin., *Cerostoma persicella* Schiff., *Recurvaria vanella* Hb., *Hibernia defoliaria* Lin. and *Cheimatobia brumata* Lin., this last destroying also the flower-buds in winter and early spring.

Ants are attracted on the tree by the honey dew exuded by Aphids, or to suck the glands at the base of the foliage, and they finish by paying attention to the fruit as it approaches maturity. They practice small holes in the peel through which they reach the pulp, tunnelling into the fruit in all directions. The havoc caused by ants is sometimes serious, and owing to their known persistence it is difficult to keep them off without the use of sprays which would communicate an unpleasant scent also to the fruit. The best way to deal with these insects consists in first shaking well the tree to cause them to descend and then putting a ring of cotton wool charged with turpentine or tar around the stem to prevent them from climbing up again.

The small green wasp *Polistes gallica* Lin. corrodes the leaves to make the paste with which to build its nest, and it also visits the ripe fruit along with other two wasps *Vespa Crabro* Lin. and *V. vulgaris* Lin. The large black wasp *Xilocopa violacea* Lin. also occasionally visits the fruit of peach and nectarine to suck their juices.

The two beetles *Scolytus pruni* Ratz. and *S. rugulosus* Ratz. make tunnels in the stems of the peach in several European countries, but the only wood borer which attacks our trees is the small beetle *Bostrychus dispar* Fb. This beetle is met with more frequently on the stems and branches of the almond growing on irrigated land, and so far it is known to attack the peach when newly transplanted or if the tree is weakened through other causes. The attack usually takes place in autumn or winter and is always a severe one, the soft wood under the bark being entirely eaten up and tunnelled by the small white larvae of the insect, and there is nothing else to do but to remove the tree at once and burn it.

The two beetles *Epicometis squalida* Scop. and *Leucocelis funesta* Poda. are frequent in spring on the blossoms of the peach which they destroy in the same way as those of most other trees and plants flowering at that time, and the pretty rose-chaffer *Potosia metallica* F. v. *cuprea* Gory. is occasionally found in summer and autumn eating into the ripe fruit.

THE PLUM.

Prunus domestica Lin., *P. spinosa* Lin., *P. mirobolana* Lois.

ROSACEAE—AMYGDALAEAE.

Maltese=*pruna*. Italian=*susino*. French=*prunier*.

The following classification of our orchard plums will convey a clearer idea of the relationship between the various species, varieties and forms, and will be found of practical utility by the cultivator.

Prunus domestica Lin. The cultivated plum tree, distinguished botanically by its geminate flowers and the *pubescent calyx* and *peduncle*.

A. *Æconomica* Borkh. to which belong most of the ovoid or elongated plums.

B. *Claudiana* Poir.=*P. italica* Borkh., with globular green or purple fruits. The greengage and other Reine Claude plums are forms of this variety.

C. *Insititia* Lin., the Bullace or wild Damson.

a. *Genuina* Fiori. This is the typical Bullace (Maltese=*pruna salvaggia* or *prain*. Italian=*prugnolo da siepe*, *pruno*) often found growing wild in our valleys, and is the wild plum more commonly used as stock by our gardeners. Its fruit is small, globular, purplish-blue and usually very astringent and sour.

b. *Damascena* Lin. The Damson plum, with globular depressed violet fruits, and a roundish, obtuse seed or stone.

c. *Juliana* Lin. (Poir.) The St. Julien plum, often used as stock in continental Europe, with ovoid-globose, violet or blue fruits, and an ovoid pointed stone.

d. *Armeniodes* Ser. in D. C. with globose-yellow or greenish-yellow fruits and an obtuse stone.

Prunus spinosa Lin. The Black-thorn or Sloe-tree, distinguished botanically by its solitary flowers and the smooth calyx and peduncle. Its fruit is small, erect, dark blue and very sour, and has an obtuse stone. It is a low shrub, with ashy-white, divergent, spinous twigs, and grows wild in our valleys and in old gardens. The leaves may be ovate (*forma ovata* Ser. in D.C.), or more frequently narrow and lanceolate (*f. angustifolia* Wimm. et Grab.); the flowers are produced before the leaves, or rarely along with them (*f. coetanea* Wimm. et Grab.), and the fruit is sometimes fairly large (*f. macrocarpa* Wallr. in D.C.). The sloe-tree is frequently used as stock for the peach and the plum in continental Europe and is here used as stock for the cultivated plums and the apricots. It has practically the same resistance as *P. insititia*, but at least here, seems to exercise a dwarfing influence on the graft, and the quality of the fruit is supposed to be inferior to that grafted on the wild Damson. The sloe-tree has not given any variety yielding edible or useful fruit, but the fruit of wild trees is sometimes used for preserves. (M.=*prain* or *prain salvagg*. It.=*prugnolo*, *pruno selvatico*.)

Prunus myrobolana (Lin.) Lois.=*P. divaricata* Led =*P. cerasifera* Ehrh. The Myrobella plum, or weeping-plum or cherry-plum (It.=*ciliegio-susino*, *amoli*), is a shrub with long divergent twigs and solitary flowers. The fruit is red or yellow, pendulous, with an acutely pointed stone. This plum is native of Central and Western Asia, and under cultivation has yielded many useful varieties (*mirabelle plums*). It is also occasionally used as grafting stock for other cultivated plums.

Prunus japonica Thumb. = *P. sinensis*, to which belong all the numerous Japanese or Chinese plums now under cultivation, all of which can be budded or grafted on the same stock as our cultivated plums. They are all remarkably vigorous, resisting and fertile, and seem to impart their vigour to the weaker stock on which they are grafted.

The plums grown on own roots or grafted on plums thrive well in all soils and in all situations which are not too dry. A situation exposed to the north and somewhat shaded is the best for them, and they prefer a moderately moist soil, without stagnant moisture. The tendency to throw up suckers is less on deep rich soils, as then the root system sinks deep and the tree assumes a vigorous habit, grows to its full size and is constantly fertile. On shallow soils which are poor and too stony, suckers are thrown up in great numbers, and they quickly exhaust the tree to the detriment of its vigour and fertility; the tree then offers little resistance to root-rot and gumming and is short-lived.

The plum grafted on almond stock grows quickly, attains a large size and yields heavy crops. The quality of the fruit is sometimes found fault with, particularly if the tree is growing on clayey soils. The graft seems to bind well with the almond stock, but there is always some check in the free exchange of sap between the graft and the stock. However the almond makes excellent stock for all sorts of plums, including the Japanese plums and is especially recommendable for plantations on red soils and dry or sunny situations.

PROPAGATION. The stones of wild plums and also the stones of cultivated European plums may be collected when the fruit is ripe and stratified in pots or boxes with a mixture of garden soil and vegetable mould or more simply with common sand, and may be sown in December or January, in soil which has been well tilled and

mixed with rotted manure. Sowing may be done thickly, distributing the seeds or stones about 5 c.m. apart, and covering them with a light porous mixture of garden soil and old manure or vegetable mould to the depth of about 3 c.m. Germination takes place in the following spring, and the young seedlings are carefully weeded and watered throughout the summer. The seedlings are transplanted to the nursery in the following winter or in the next if they are yet too weak. Their subsequent treatment depends on the purpose for which they are grown. For grafting close to the ground it is enough to insist on a clean straight stem about 10 c.m. high, but if the seedlings are meant for the production of standards they are topped to 5 c.m. above the ground and the best shoot which springs up from the base is reserved and tied to the heel to grow straight until it has reached the height at which it is desired to bud it or graft it. The propagation of plum stock from seed is rarely practiced by our gardeners, and in view of the fact that a sufficient quantity of this stock is at least as easily raised by other methods, there appears to be no reason why it should be specially recommended. The propagation of the plum by seed with the object to produce new and improved sorts more vigorous and better acclimatized is of course a totally different matter, and may be taken up by the amateur or by the more scientific grower.

Cuttings of all wild plums $\frac{1}{2}$ to $1\frac{1}{2}$ c.m. in thickness, and 20 c.m. long, taken in winter, will root without difficulty. They should be stuck in well prepared soil for about $\frac{2}{3}$ of their length, in a vertical position, and the soil should be kept well moist in spring when the cuttings are rooting, and afterwards watered regularly throughout the summer. In the following winter the rooted cuttings may be planted out in the nursery 50 c.m. apart, and budded in the following spring or grafted in the next winter. Cuttings made of slender twigs, with a heel of the old wood, will root with the same facility, but will

take two or three years to reach the proper size for grafting. It is also possible to bud the branches of the wild plums in spring or summer, and in the following winter whether the buds have pushed or not, the branches are made into cuttings which will root all the same. In this way the operation of budding is anticipated, and in spring the energy of the cutting which is emitting roots will go to the development of the graft, so that nice budded plants will be had in the same year. This method is used by French nurserymen for the propagation of the plum and apricot on plum stock, and has been tried here with good success. The same method has been applied by some growers for the propagation of the pear on quince stock.

Continental nurserymen have a ready way to raise large quantities of wild plum stock. The practice known by its French name *recépage*, consists in topping the wild plum from 5 to 10 c.m. above ground; in the following spring many suckers and shoots are thrown up from the stump and around its base, and these shoots are earthed up with a mixture of garden soil and old manure or leaf mould, and moistened frequently with water during the active period of their vegetation. In winter it will be found that all the shoots are well provided with roots, and can be separated from the mother plant and planted at proper distance in the nursery. The process is repeated for two or three years in succession until the mother plant shows signs of exhaustion and then a shoot may be allowed to replace the mother plant, and in the following year, if sufficiently strong, the operation may be renewed on the new stem. This method is never practised purposely by our gardeners, but in cases of failure of cleft grafting on quince and plum stocks the shoots which spring up from the base or around the stock are earthed up, and the rooted shoots or suckers are separated in the following winter and used as stock in the same way as ordinary suckers.

All plums can be propagated by layers, and this method is recommendable for those sorts of cultivated plums which it is desired to grow on own roots, and which do not strike so readily from cuttings as other sorts. However in the case of the wild plums propagation by other means is so easy that no gardener will take the trouble to multiply them by layers. Layers are best made early in spring as soon as the buds begin to swell, and they should be watered in spring and summer to promote the formation of rootlets, and then if properly rooted may be separated and planted off in the following winter.

As in the case of most other fruit trees the cultivated plums are more commonly propagated by budding or grafting. Budding on young almond stock can be done at any time from February to September, but the best time is March, as at that time the almond stock is in full sap and active growth, and dormant buds of the plum of last year's growth, are still available. Grafting on almond stock, should be done in December or January. As already mentioned the plum budded or grafted on the almond grows very fast and lasts longer, besides attaining full size and yielding good crops. However certain varieties do not seem to agree well with almond, and in their case it is advisable first to bud or graft with a sort of plum which agrees well with the almond and then to bud or graft the intermediary plum with the desired sort.

Budding on plum stock is best done early in spring, as soon as the sap of the stock is well in movement. The stock should not be thicker than 2 c.m. and stems of only 1 c.m. are better as the bud pushes more easily on young wood. Budding in September gives good results if the cultivator is careful to put the sap of the stock in movement by an abundant watering some days before. Grafting is done in January or February, standards being grafted towards the close of February, just before the buds begin to swell. As a rule the wild form of *Prunus domestica*,

and especially those of its variety *P. insititia*, give better results as stock for the cultivated plums than the *P. myrobalana*, and it is generally assumed that the sloe-tree *P. spinosa*, is inferior to both, its use being recommendable only for badly drained soils where it is less liable to suffer from root rot than other wild plums.

CULTIVATION. The size to which a plum tree grows varies a great deal according to the soil and the situation, the stock on which it is grafted and the more or less vigorous habit of the sort of plum which is grown. Trees grown in open situations or grafted on the sloe or black-thorn need not be planted more than $2\frac{1}{2}$ metres apart with perhaps 3 metres from one row to another, but those grown in good soils and sheltered situations even if they are grafted on the bullace or on the cherry plum, will require a distance of 3 metres apart in the row, and 4 metres between the rows, and at least the same distance should be observed in the case of plums grafted on almond stock. The trees should be planted rather deeply, so that the main roots may not be exposed to injury during tillage. These injuries to the main roots should be carefully avoided as they are frequently the starting point of root rot, and even if they escape this fatal infection, they are sure to provoke the development of too many suckers which exhaust the tree and shorten its life.

The soil should be weeded and tilled as in the case of the peach and the almond, and light crops of winter vegetables may be grown between the rows of trees, provided that during the period in which the plum tree is in active vegetation, that is from the moment that the buds begin to push, and until the end of summer, no crops are allowed to remain on the ground, which may draw too much on the resources of the soil or on its natural moisture.

Trees newly planted should be watered regularly in spring and summer. If the weather is dry, watering

should commence along with the first appearance of new foliage, and continued at intervals of ten to fifteen days until the first rains of autumn. In the second year some watering may be done, especially in late spring and early summer to keep the vigour of the young trees and promote their growth. However, in good soils with a fairly moist subsoil, plum trees which have become well established, will derive little benefit from irrigation. In fact it is not possible to grow summer vegetables in the plum orchard, because the frequent watering which is necessary for the vegetables, besides impairing the quality of the fruit will cause the plum trees to gum freely and to die off after a short term of sickly existence.

Gumming of a dangerous character is also too frequently the result of the excessive use of stable manure and of other badly fermented organic fertilizers. Manures too rich in nitrogen behave in the same manner, and therefore the complaint cannot be ascribed solely to the fermentable material. It is not to be supposed that the plum tree is not in need of fertilizers, but these should be used with caution. It is a good plan to apply stable manure as a top dressing in autumn when the soil is tilled for the first time after the rains, and in the autumn of the following year the soil is trenched superficially to a depth of 10 to 15 c.m. thus bringing the fertilised upper layer of the soil in contact with the roots. On light porous soils which are frequently poor in potash, a dressing of wood ashes, along with some superphosphates may be applied in autumn just before trenching, and this treatment of the soil along with the operation of trenching should be done every fourth year. Green-manuring necessarily imparts to the soil much fermentable material and on that account is not very recommendable for the plum tree. The best leguminose plant for this purpose is the bitter vetch (*Vicia* or *Ervum Ervilia*) as it decays quickly when interred. The bitter vetch may be sown broadcast in December or January, at the

time of the winter tillage, and in March or April when the plant is in full bloom it is dugged in, and the soil trenched in the following autumn.

In our orchards the plum tree is grown as a bush and occasionally as a standard, and owing to its light habit and foliage it is never trained to any particular shape. Pruning is limited to the removal of dead or diseased wood, and to the thinning of branches which cross each other, and therefore their blossoms and fruit are liable to injury with every breeze. Trees grafted on the wild plums should not be subjected to root-pruning. In years of heavy production the fruit may be thinned, otherwise it will remain too small and consequently will compete badly with finer produce. Our gardeners are singularly averse to this operation, and as an alternative they usually have recourse to irrigation where possible, watering the trees twice or thrice in May-July to keep up the vigour of the tree and cause the fruit to swell properly.

The following sorts of plums are cultivated in our orchards :

1. THE ST. JOHN'S PLUM. (M.=*Pruna ta San Guann.*) The tree is vigorous and a fast grower, and is always well laden with fruit. The leaves are rather narrow and lanceolate. The fruit is middling, oblong or pear shaped, very elongated, with a young slender stalk and a shallow groove. The colour is canary yellow or golden yellow with a whitish bloom. The flesh is yellow, mealy, juicy, sweet and of good quality, completely separated from the stone, which is very long, flat, pointed at both ends. The fruit matures in June, and is our earliest plum, but its peel is liable to crack during maturity. This plum strikes well from cuttings, and is often propagated directly by cuttings or by its own suckers.

2. THE SMALL YELLOW PLUM. (M.=*Pruna safra irkiska*.) The leaves are ovate, or ovate acuminate.

The fruit is middling or small, roundish or oval, yellow. The flesh is very juicy, very sweet and of good flavour, sometimes partly adherent to the stone. Strikes well from cuttings and is usually grown from its own suckers. It is cultivated here and there, and is met with growing half-wild or naturalised in old gardens. Its suckers are also used as stock for other varieties. Matures in July.

3. THE SMALL DARK VIOLET PLUM. (M. = *prunus sonda helua*). The tree is very vigorous, and when full grown bears heavy crops. The leaves are ovate, dark green. The fruit is middling or small, and round, the colour is dark violet almost black, covered with a thick whitish bloom. The flesh is deep yellow, rather firm but very tender and excessively sweet, for which reason the fruit is often preyed upon by birds, and is well separated from the stone. This is another ancient plum frequently found growing half wild in old gardens and is always propagated directly by cuttings or suckers, these being also used as stock for other plums.

4. THE LARGE ROUND VIOLET PLUM. (M. = *Ghain il bakra* or *ghambakra*). The tree is vigorous and fairly productive, with large roundish ovate leaves. The fruit is large, round, with a shallow groove, and its colour is dark claret or purple violet. The flesh is thick, yellow, juicy, fairly sweet and acidulous, partly adhering to the stone. It is a fine table plum, and is also good for drying. Matures in July-August, and keeps well.

5. THE LARGE OVAL RED PLUM. (M. *Ghambakra tauualia* or *prunus di frati hamra*). The tree is fairly vigorous and very productive, with oblong lanceolate leaves. The fruit is large or very large, oval or elliptical with a shallow groove, of a violet red colour. The flesh is thick, fairly juicy, sweet and of a good flavour, well detached from the stone which is long and pointed at both ends. This is a beautiful table plum of good

quality, much in favour with market growers, It is very good for drying. Matures in July or early in August, and keeps very well.

6. THE LARGE PEAR-SHAPED YELLOW PLUM. (M.=*pruna di frati*). The tree is fairly vigorous and well productive, with narrow lanceolate, light green foliage, and slender greyish twigs. The fruit is large or very large, pear-shaped, with a long slender stalk. The colour is golden yellow semi-transparent, covered with a white bloom. The flesh is golden yellow, very juicy, very sweet, with a delicate perfume and an agreeable slightly bitterish flavour. The flesh adheres firmly to the stone which is very long and narrow, and sharply pointed at both ends. The skin is liable to crack, especially near the stalk. This is an exquisite table plum, justly esteemed but never very abundant on the market. Matures towards the close of August or in September. Strikes well from cuttings, but is best propagated by grafting on the almond to secure vigorous and productive trees.

7. THE GREEN-GAGE OR GREENGAGE. (M.=*pruna hadra* or *pruna bajda*, French=*Reine Claude* or *Abricot vert*). The tree is vigorous and very productive, with roundish oval leaves and dark grey twigs. The fruit is large, oval or sometimes round, green or greenish yellow with crimson dots on the upper part towards the sun, and is semi-transparent. The flesh is greenish yellow, transparent, juicy, very sweet, of good fragrance and delicious flavour. This well known plum is now largely cultivated, owing to its excellent table qualities and high productiveness. Matures in July or early in August.

8. "PERNICIONA A FRUTTO GROSEO". This is an Italian plum introduced from Upper Italy. The tree is vigorous and fairly productive, with ovate lanceolate foliage. The fruit is very large, regularly oval, yellow, broadly flushed pink. The flesh is yellow, semi-tran-

sparent, juicy and very sweet, with a delicate flavour, and adheres or partly adheres to the stone, which is long and pointed at both ends. Matures in August.

9. PLUM "GIANT". The tree is vigorous and very productive. The fruit is large or very large, pear-shaped, with a short thick stalk. The peel is thick, deep pink with a white bloom. The flesh is thick, firm, yellow, sweet, well detached from the stone and excellent for drying or for preserves. Matures in August-September. This is an American plum introduced from France in 1904.

10. PLUM "ABBAYE D'ARTON". This is a French plum of the very best quality for drying. The tree is vigorous and very productive. The fruit is large or very large, of a perfectly oval shape. The peel is greenish white, almost entirely covered pale rose, flushed violet and marbled red on the sunny side. The flesh is yellow, of fine texture, rather firm, juicy, sweet and well detached from the stone. Matures in August-September.

11. PLUM "DE PONTBRIANT" (M.=*prunella* *San Anton*), introduced from France in 1904). The tree is very vigorous, grows to a large size in good situations and is very productive. The fruits are large or very large round, a little flat at the base, with a thick long stone. The colour is purple red, shading to violet, covered with a bluish white bloom. The flesh is very thick, yellow, juicy and sugary, with a good flavour at perfect maturity. Matures in August.

12. PLUM COE'S GOLDEN DROP. The tree is vigorous with reddish twigs, but does not attain large dimensions, and is not regular in its production. The fruit is very large, oval, elongated, slightly grooved, and very slightly pointed or pear-shaped near the stalk. The peel is thick, golden yellow, dotted or marbled red towards the sun. The flesh is yellow, rather firm, but of fine texture, sugary, with the fragrance of an apricot,

and is well detached from the stone. Matures in September and keeps well.

13. PLUM "REINE CLAUDE DE BAVAY". The tree is very vigorous and is fairly productive when it reaches full size. The fruit is very large, round or ovoid, with a broad groove. The peel is very thick, greenish yellow, shaded gold and marbled red on the sunny side. The flesh separates well from the stone, is rather firm, of middling quality, very sugary and has a fine fragrance. Matures late in September.

14. PLUM "REINE CLAUDE NOIRE". The tree is very vigorous, with thick erect greyish branches, and is very productive. The fruit is large, round or ovoid, of violet black colour, with a bluish bloom. The flesh is well detached from the stone, and is of the same exquisite quality as that of the greengage. Matures in July.

15. PLUM "TARDIVE MUSQUEE". The tree is very vigorous, grows to a large size, and is very productive. The fruit is middling, or sometimes small, round or ovoid, slightly grooved. The peel is thin, of a dark purple-black colour, covered with a thick bluish bloom. The flesh is greenish yellow or yellow, sometimes partly adherent to the stone, tender, melting, juicy, very sweet and very fragrant. Matures late in September or in October. Unfortunately this good late plum is liable to be attacked by the fruit-fly.

16. PLUM MAGNUM BONUM. The tree is vigorous, but dislikes a dry situation, and is little productive. The fruit is large or very large, of a fine oval shape, with a slight groove, yellow, often partly washed pink. The flesh is yellow, tender, sugary, and well fragrant. Matures in August.

17. PLUM "MIRABELLE GROSSE". The tree is vigorous and very resisting to drought, but is not so productive as in colder climates. The fruit is small, round, yellow, sometimes marbled pink. The flesh

is yellow, detached from the stone, melting, sugary with a fine flavour, and is particularly good for preserves.

Other sorts of plums have been introduced lately, and are cultivated here and there in single specimens, viz: Monsieur a fruits jaunes, Bolmer's, Washington, Imperiale di Milano, D'Agen, Goliath, Gloire d'Epinay, the Langley, etc.

A few sorts of Japanese plums are also cultivated in our orchards, the following are the best known.

1. BOTAN or ABUNDANCE. The tree is very vigorous and very productive. The fruit is very large, round of a golden yellow colour, washed red. The flesh is yellow, tender and of good flavour when well ripe. Matures in August.

2. KELSEY or BOTANKIS. The tree is vigorous and highly productive. The fruit is very large, round or heart-shaped, of a golden colour, bluish carmine red towards the sun. The flesh is yellow, of good quality. Matures in August.

3. HATANKIO MARU. The tree is very vigorous and always very productive. The fruit is large, round, with a deep groove, greenish orange yellow, with orange yellow flesh of good flavour when well ripe. Matures in July.

4. SATSUMA. The tree is fairly vigorous and productive. The fruit is large or very large, round, deeply grooved, of a purple red colour, with a bluish bloom. The flesh is blood red, firm, but juicy and tender. Matures in August.

The Japanese plums are very beautiful fruits ; they travel well and keep very well for a long time, but must be well ripe to be appreciated. They produce excellent preserves. The tree is invariably much more vigorous and resisting than the European plum.

DISEASES.

By far the most common fungous disease is the plum rust due to *Puccinia Pruni-spinosae* Pers. which sometimes provokes a very early denudation of the tree, with the result that the fruit fails to develop properly and its quality leaves much to be desired. Moreover the tree is then apt to flower in autumn and when this happens next year's crop may be seriously affected. The diseased leaves develop small yellow or brownish pustules on both surfaces of the leaf, but chiefly on the under surface. Afterwards the whole leaf becomes dotted with yellow spots and drops off. The disease recurs year and year, but only affects the health of the tree and the quality of the fruit when the attack commences early in summer and the leaves are shed off too early. The development of an attack seems to be closely connected with meteorological conditions and is unfortunately little amenable to treatment. As a preventive measure the diseased leaves may be collected and burned, and the soil tilled deeply once or twice early in autumn.

The mildew of the plum is a rare disease in our orchards. It is due to *Podosphaera tridactyla* DBy. and is characterised by the usual formation of white powdery covering on the young leaves and twigs, which about midsummer become dotted with minute black dots. The disease is never frequent or troublesome, and is kept in check by dusting with sulphur, or by spraying with a solution of sulphide of potash or even with Bordeaux mixture. The shot-hole fungus *Cercospora circumscissa* Sacc. is rarely seen on the plum. To *Exoascus deformans* Fckl. is due the production of the so-called witches' brooms: the affected branch develops a dense growth of small slender twigs with small and usually deformed leaves, and is unproductive. These witches' brooms should be cut back and burned, but they have been noticed here only on a few occasions. Another species

of *Exoascus* (*E. pruni* Fckl.) is common all over the continent and in rainy springs provokes the well known diseased condition of the fruits called "bozzacchioni" by Italian writers. The diseased green fruits become much swollen and irregular, with an internal cavity, and soon become grey or brown and rot off. These fruits are cut off along with the twigs on which they grow and burned to prevent the spread of the fungus for the following year. This diseased condition of the fruit of the plum has been referred to by Dante in the following lines, *Purg.*

Ben fiorisce negli uomini il volere
 Ma la pioggia continua converte
 In bozzacchioni le susine vere.

To *Exoascus Insitiae* Sad. is ascribed the formation of witches' brooms on the wild plum or bullace in Italy and Germany.

Other species of fungi attack the foliage of the plum in continental Europe. *Sphaerella Bellona* Sacc. produces whitish spots surrounded by a brown margin, and soon causes the leaf to drop off. Grayish spots with minute black dots are produced on the upper surface of the leaf by *Ascochyta chlorospora* Speg. Small round or nearly round spots of a brown colour with a darker margin are caused by *Phyllosticta prunicola* Sacc. and *Hendersonia foliorum* Fckl. Round blistered blotches of a dark brown colour are caused by *Didymaria prunicola* Cav., and *Coryneum Beyerinckii* Oud. produces reddish blotches on the upper surface of the leaf. *Cladosporium condylonema* Pass. produces brown irregular spots, which become wrinkled, and show minute olive-green pustules, *Clasterosporium Amygdalearum* Sacc. produces roundish yellow blotches which afterwards turn brown, and are surrounded by a dark red margin; and *Polystigma rubrum* D.C. produces large, thick, roundish blotches of a reddish yellow colour. *Dermatella Prunastri* Pers. attacks the bark of the branches and twigs, causing it to

form cracks along which the tissues are reduced to a brownish mass.

The roots are liable to two forms of root-rot, that caused by *Armillaria mellea* Vahl., and that due to the presence of *Dematophora necatrix* Hart. which is hardly less dangerous and is manifested by a close network of white or whitish mycelium which covers the root and destroys the woody tissues reducing them to a soft and brown mass. *Fomes fulvus* Fr. is a frequent cause of dry rot on the stems and branches of our plum trees, and this species is replaced on the continent by two other dry rot fungi, viz: *Polyporus ignarius* Fr. and *P. nigricans* Fr.

The plum is subject to harbour several species of *Aphis*, viz: (a) *Aphis Pruni* Fb. of which the wingless insect is oblong and of a light green colour, covered by a white powder. (b) *A. Persicae* Sulz. the wingless insect being light green, and then dull green, and finally greenish yellow with transverse black lines. (c) *A. Insititiae* Koch. of which the wingless insect is reddish or rust colour with a dark brown back. (d) *A. Humuli* Schrk. the wingless insect of which is light greenish yellow with a deep green line on the back *A. Pruni* Koch. (non Fb.) of which the wingless insect is oblong and green with black markings. The first two species are sometimes met with on our plum trees, and they may cause some injury to the foliage as well as to growing twigs, but an attack of *Aphis* on the plum is far from being so dangerous as in the case of the peach and nectarine, and the treatment may be carried out on the same lines as suggested for the peach.

The erinosis of the plum, a rare disease in our orchards is due to *Phytoptus phlaeocoptes* Nal. In Italy small galls in the shape of nodules are formed on the leaf and especially along its margin by *Volvulifex Pruni* Am., and tiny bottle-shaped red galls on the upper surface of the leaf are caused by *Bursifex Pruni* Am. Along the

midrib small pocket-shaped galls are caused by the yellow larvae of *Cecidomyia Pruni* Kalt.

The scale insects *Mytilaspis pomorum* Bché. and *Aspidiotus Hederae* Vallot. are frequent parasites of the plum, which in continental Europe is also liable to infestation by *Lecanium Persicae* Lin. Another species of *Lecanium*, probably *L. Prunastri* Fonsc. is common on plums and apricots in local orchards, and badly infested trees may be submitted to winter treatment with sulphur lime wash or simply with ordinary whitewash applied twice with an interval of fifteen days.

The fruit-fly *Ceratitis capitata* Wied attacks the fruit of late ripening plums, but except in the case of Tardive Musquée whose peel is very thin, the injury caused to other plums is quite unimportant.

The moth *Diloba caeruleocephala* Lin. occasionally attacks the blossoms and foliage of the plum, but as the larva hatches and develops on the almond long before the plum is in leaf, it is probable that its presence on the plum is merely accidental, and due to the close proximity of almond trees from which the larva has migrated in quest of food.

There are many species of moths and butterflies which attack the foliage of the plum in Italy and other continental countries, and probably there are several species of moths, particularly of the *Microlepidoptera* which prey upon the plum and the apricot in these Islands, but the injury caused by them is never so important as to become dangerous or even to attract much attention. *Zeuzera Aesculi* Lin. attacks the stems and branches of the plum in Italy and in Germany, but though frequent in our orchards on the apple, the pear, the pomegrante etc. it is not known to attack the plum.

Bostrychus dispar Fb. is a small beetle known to be injurious to our plum trees in a weakly condition, but in continental Europe the following species of

beetles are regular parasites in the stems and branches, viz: *Scolytus Pruni* Ratz., *S. rugulosus* Ratz., *Magdalis Pruni* Lin., *M. Cerasi* Lin., *M. aterrima* Fb. and *Phytoecia cylindrica* Lin.

Perhaps the worst enemy of the plum and of the apricot grafted on plum-stock is the beetle *Capnodis tenebrionis* L., belonging to the family *Buprestidae*. The larvae of this beetle is known to attack also the base of the trunk of the pear, the quince, the apple, the hawthorn and the service tree, but unlike the larva of the beetle *Cerambyx miles* Bon. which is such a dreaded enemy of these trees, it attacks also the base of the stem and the large roots of the wild plum. The larva lives chiefly between the bark and the wood destroying the cambium and ultimately killing the tree. As many as 50 larvae have been found under the bark of the same tree. and the destruction of many large apricot and plum plantations is generally due to this insect. The action of this pest is the more dangerous because usually there are no signs of its presence above the ground, and when the tree become unproductive and exudes much gum, the attack is already too far advanced, the tree generally succumbing in a year or two. In localities infested by this pest it is advisable to graft the plum on bitter almond stock, and to graft the apricot on apricot seedling, or better to top-graft the apricot on the plum growing on almond stock.

THE APRICOT.

Prunus Armeniaca Lin. = *Armeniaca vulgaris* Lam.

Maltese = *Berkuka*. Italian = *Albicocco*, *Armellino*, *Crisomolo*, *Percuolo*,

French = *abricotier*.

The Apricot, formerly written apricock, is a native of China, Turkestan and Mongolia as well as of the Caucasus. Its name "berkuka" from which most

European names are derived means "lightning maker", in allusion to the colour of the fruit when it is ripening. It was known to the ancient Romans who called it *praecocia*, and its cultivation has spread to all regions where the vine can be grown. It is a tree from 6 to 10 metres high, with more or less heart-shaped, alternate leaves, and white or pale flesh coloured flowers with a reddish calyx. The fruits are round or oblong with an indistinct navel, and are covered by a pubescence resembling that of the peach, or may be quite smooth (*var. levis* Borzl.) like a nectarine. The peel and the flesh have always an orange yellow colour, and the stone is smooth and generally detached from the flesh. The variety *dasycarpa* Ehrh. has ovate-lanceolate leaves and stalked fruits which are of a dark red colour, with reddish flesh adherent to the stone. The kernel is generally bitter, but is sweet in certain varieties. The apricot has less affinity with the almond than either the peach or the plum, but is often grafted on the almond stock, and this apart from other considerations, shows that it is less far removed from the almond than the cherry.

The apricot adapts itself to all soils and all situations, but prefers deep porous soils, on a moist subsoil, and does best when grown on own roots, and budded or grafted on own seedlings. The apricot has not the laxative qualities of the plum, but is more nourishing, and in the east it is used often in the treatment of fevers. Its aroma is very persistent, and though it is almost devoid of acidity it makes very palatable preserves. The fruit is also dried like that of the plum, and the sorts having a sweet kernel are largely grown in Asia Minor, the flesh or pulp being made into preserves and the stones or their kernels used in confectionery in the same manner as those of the sweet almond.

PROPAGATION. The Apricot may be propagated by seed and by budding or grafting on apricot seedlings, on the wild plums, or on the almond. Certain sorts of

apricot come fairly true from seed, but as in the case of most other fruits, seedlings of the apricot are liable to vary more or less from the type, being sometimes exceedingly productive but producing smaller fruits, and as often turning out very shy bearers. At any rate the apricot grown from seed or grafted on apricot seedlings is always very vigorous, grows to a large size, and lives longer than trees budded or grafted on the plum or on the almond, and it is a pity that this method of propagation is not more frequently followed by our gardeners. The stones of the apricot may be stratified in a box with ordinary garden soil and sown in the following January or February in the same way as the almond, and germination takes place in March or April. If the seedlings are properly watered they continue growing until late in summer, and some of them will be large enough to be budded in the following spring, and the remainder may be grafted in winter. In two or three years the young trees may be transplanted in winter to their final destination. The apricot grown on own roots is less liable to suffer from root-rot, and is more resisting to adverse conditions of the soil and situation than if grafted on the plum.

However in the large majority of cases the apricot is propagated by grafting or budding on plum stock in the same way as the cultivated plums. All sorts of apricots do well on this stock and seem to impart to it some of their vigour. Budding may be done from March to September provided that the sap of the stock is in active movement. Grafting is done in winter from December to February or even early in March until the buds of the apricot begin to swell. In both cases it is better to bud or graft close to the ground, and then rear the young tree as standard, if desired. If the situation is at all exposed, trees reared as bushes or trained to the vase shape are more productive than standards.

The apricot grafted on almond stock grows fast enough, and soon becomes a fine tree, yielding good crops year after year, but the union between the stock and the scion is always precarious, and the tree is subject to be blown down or broken off at that point, and even to die off suddenly without any apparent cause. When transplanting young trees grafted on almond stock the gardener has to be very careful as the least rough handling is sufficient to cause the graft to leave its hold on the stock, and although certain sorts of apricots seem to agree with almond stock better than others, it is not advisable to make use of this stock for the apricot, the only exception to this rule being the apricot Luizet which is known to unite well with the almond. Apricots grown on own roots or on plum stock may be transplanted from December to February or early in March; those grown on almond stock should not be transplanted later than January.

CULTIVATION. On good soils and in sheltered situations the apricot should not be planted less than 5 metres apart and 6 metres from one row to another. On poor soils the distance may be reduced to 3 or 4 metres from tree to tree, and to 4 or 5 metres between the rows. The details of cultivation are the same as given for the peach and the plum, but the apricot derives more benefit from moderate watering, without any injury to the quality of the fruit. The apricot is often very capricious as regards productiveness. Certain forms flower abundantly but produce little or no fruit before they have reached full size, and most varieties are liable to irregular production, in some years yielding heavy crops and in others producing only a few fruits or none at all, and so far this irregularity has received no satisfactory explanation. Certain varieties of the peach are also liable to this phenomenon, but in their case it is found that the flower buds have suffered severely from cold winds or from protracted cold or frosts in winter, with the result

that they dry and drop off in early spring without blooming. The flower buds of the apricot, particularly those of the upper branches are also liable to suffer in the same manner and to drop off in spring without blooming at all, but reference is here made to the not uncommon fact that the apricot may be entirely covered with well formed flowers but no fruit is set, although the blooming period may have coincided with a spell of very favourable weather. It has been surmised that the failure may be ascribed to cold weather in winter or to some other cause of weakness such as the exhaustion of the soil induced by an intensive cultivation of vegetables etc. but in the absence of precise information on the matter, it is only possible to recommend good cultivation, with deep tillage and manuring. In fact it is known that the apricot responds at once with greater vigour and a notable increase in production if the soil is well trenched and manured, and perhaps of all stone fruits the apricot and the cherry are the least liable to injury from liberal dressings of organic manures.

For the apricot grafted on plum stock deep tillage and deep trenching are as little recommendable as they are for the plum grown on the same stock for the reason that the wounds on the upper roots which are unavoidably produced by the operation may cause an undue development of suckers which exhaust the tree, and the manure is therefore better applied as a surface dressing repeated every other year and digged in late in autumn or in winter. However, as the apricot grown on own roots rarely throws up any suckers, it is possible in this case to have recourse to deep tillage with manuring as a corrective or remedy against unproductiveness.

Cross pollination affords another means of combating this uncertainty of production in the apricot, as it is in the case of most other fruit trees. For this reason the plantation should consist of alternate rows of two or three sorts, selecting one or two sorts of the earlier and

more productive apricots, and therefore possessing stronger reproductive stamina, to fertilize the large fruited varieties.

The best form to give to the apricot is the vase-shaped form, and this shape can be obtained easily by following the method suggested for the pear, the apple and the peach. Trees yielding satisfactory crops are also obtained by training them in the form of a bush, or a low dome, but care should be taken to keep up an open habit of growth and never to allow the vegetation to become too dense. In sheltered situations the apricot has a natural tendency to assume a tall pyramidal shape, and this habit is not in any way detrimental to the fertility of the tree, as when it has passed the period of fast growth and nearly reached full size, the branches become well provided with fruit spurs and the tree enters definitely into a period of sustained production.

Pruning should be limited rather to a process of cleaning, by removing all dead or diseased wood, relieving the dense growths to expose the fruiting branches to the direct action of the sun and the air, and trimming the tree to shape. If the fruit spurs are too numerous or show signs of exhaustion it will be necessary to thin them, and this operation will result also in the production of new spurs to take the place of old and exhausted ones. All pruning operations should be performed in winter or from the moment that the leaves are shed until the buds begin to push, and any large wounds which could not be avoided should be painted with tar. Old trees which have grown out of shape or have become too exhausted may be rejuvenated by pollarding the main branches late in autumn or early in winter, if possible performing the operation on branches which are not more than 5 c.m. in diameter, cutting the wood in a slightly slanting direction just above a likely bud, and painting over the wound with tar or with a non-drying grafting wax. Trees trained as bushes or low pyramids should

have their leading branches shortened in winter, otherwise they will soon grow out of shape, with the result that the tree becomes unproductive for some years, that is until good fruit spurs are formed on the new wood.

The fruit of most sorts of apricots loses all its acidity and becomes rather mealy at full maturity, but this slight defect is more than compensated by the development of its best aromatic qualities and the greater percentage of fruit sugar, which then attains its maximum. However if the fruit is gathered before it is fully ripe it keeps much better and will travel well for considerable distances. Sun-dried as well as evaporated apricots, as in the case of dried plums and prunes, now form an important article of commerce, and therefore the commercial cultivation of these fruits need not be limited to the demands of the home market.

The following sorts of apricots are cultivated in our orchards :

1. THE PURPLE-BLACK or PERSIAN APRICOT. (French=*de Perse a fruit noir*. Maltese=*berkuk isued*, sometimes called *zabricò*). This is a well marked variety (*Prunus Armeniaca* Lin. var. *dasycarpa* Ehrh.) sometimes considered as a distinct species. It is a tree of vigorous growth, with ovate-lanceolate leaves, the flowers are smaller than those of other apricots but are provided with a long peduncle or stalk. The fruit is large or very large, round, indistinctly grooved, dark reddish purple, nearly black, covered with a thick whitish or ash-coloured pubescence. The flesh is reddish yellow, somewhat fibrous, but melting, juicy, well perfumed, sweet and acidulous. It is a cling-stone. The tree is very productive, and the fruit keeps fairly well. Matures towards the close of June or early in July.

2. THE MAY APRICOT. The tree is vigorous and very productive. The fruit like that of the following sorts, is a free-stone. It is middling or small, deep yellow, without any flush. The flesh is very melting, juicy, with

a fairly good flavour. Matures in May or in the beginning of June. Does not keep well, but fetches good prices owing to its earliness.

3. THE ALEXANDRINE APRICOT. (French=*rouge d'Alexandrie*. Maltese=*lixandrina*.) The tree is fairly vigorous but grows to a large size. It is very productive. The fruit is small or middling, round or slightly oval, rather irregular, has a deep groove with unequal edges. The peel is smooth without any pubescence. The colour is orange yellow, with a crimson flush and deep red dots. The flesh is firm, juicy, sweet and acidulous. Keeps very well, but is more valuable for tarts and preserves than as a table fruit. Matures in June or early in July.

4. THE DAMASCUS APRICOT or KAISKA APRICOT. (Maltese=*damaschina*. Italian=*di Siria*.) The tree is vigorous and productive. The fruit is middling or large, round, and a little flat or depressed at the sides. The colour is deep orange yellow, sometimes flushed red. The flesh is melting, somewhat mealy, very sweet and has an excellent flavour. Matures in June or early in July.

5. THE ROMAN APRICOT. (Maltese=*Berkuka ta l'Imnaria*. Italian=*albicocco Romano*.) The fruit is large or very large, round or slightly oval, with a deep narrow groove. The colour is deep yellow washed vermillion on the sunny side, often with brown lines or dots. The flesh is yellow, somewhat fibrous, but is juicy, melting and sugary, and has a very good flavour. Matures late in June or early in July. Requires a warm and sunny situation to fruit well.

6. THE LARGE SHELL-SHAPED APRICOT. (Maltese=*berkuk xakkufi*. Italian=*albicocco grosso bianco precoce*.) The tree is vigorous and fairly productive. The fruit is very large rather flat on its sides, with a deep narrow groove. The colour is waxy yellow, or yellowish white with a smooth peel. The flesh is firm but juicy, sweet and

of fairly good quality. The fruit divides easily into two halves like a shell. Matures towards the close of June or in July, and keeps long and well.

7. THE ROYAL PEACH APRICOT (French=*royal, pêche*, or *pêche de Nancy*. Maltese=*zabricò*, probably a corruption of *pêche-abricot*). The tree is fairly vigorous and well productive in moist and sunny situations. The fruit is large or very large, generally round. The colour is deep golden yellow or orange yellow, very juicy, melting, sugary with an exquisite apricot flavour. Matures in July or early in August. Keeps well.

8. APRICOT KING HUMBERT (Italian=*Re Umberto*). The tree is very vigorous, grows to a large size and is fairly productive when it settles to fruit. The fruit is very large, oval in shape, slightly flattened on the sides, with a narrow groove. The colour is orange yellow and golden yellow, with a large vermillion red flush. The flesh is orange yellow, melting, juicy, sweet and well perfumed. Matures in July or early in August. It is a first class apricot, but not sufficiently productive for the market grower.

9. APRICOT SUCRE DE HOLUB, is of Hungarian origin. The tree is vigorous and very productive in sheltered and sunny situations. The fruit is large, round or somewhat conical or top-shaped. The colour is very pale orange yellow, shaded or mottled red towards the sun. The flesh is pale yellow, melting without any fibrosity, juicy, sugary with a delicate fragrance. Matures in July or early in August, and keeps very well.

10. APRICOT "ROUGE DE ROUSSILLON". This is a recent French sort. The tree is vigorous and well productive. The fruit is large or very large, round or slightly oval, deep orange yellow, dotted red. The flesh is orange yellow, melting, very sugary, and of exquisite quality. Matures early in July and keeps fairly well.

11. APRICOT PAVIOT. This apricot and the following are also of French origin and have been introduced recently in the gardens of amateurs. The tree is very vigorous, but seems to be little productive. The fruit is very large, round and slightly conical, and irregular. The colour is deep orange, or orange red, marbled red, or flushed crimson towards the sun. The flesh is orange yellow, melting, without fibrosity, very juicy and sugary, and well perfumed. Matures late in July or in August. It is an ideal fruit, but too often a shy bearer.

12. APRICOT "PRECOCE DE BOULBON". The tree is vigorous and well productive. The fruit is large, oblong, flat on its sides, and somewhat irregular at the apex. The colour is golden yellow, flushed red and marbled blood red on the sunny side. The flesh is orange yellow, melting, juicy, sugary and well perfumed. Matures late in June or early in July.

13. APRICOT "DE JOUY". The tree is vigorous and well productive in sunny and sheltered situations. The fruit is large, oblong or oval, regular in shape, with an indistinct groove. The colour is orange yellow, flushed carmine red towards the sun. The flesh is deep yellow, very sweet and juicy, with a strong fragrance. Matures early in July.

14. APRICOT "LUIZET AMELIORE". The tree is very vigorous and fairly productive. The fruit is very large, oval or oblong, with a deep groove. The colour is orange yellow shaded pink and red towards the sun. The flesh is orange yellow, often shading to pink, rather firm, sugary and well perfumed. Matures in July. The stone has a sweet kernel. This is the only apricot so far known which thrives as well on the almond stock as on plum stock.

DISEASES.

With the apricot as with the plum, the most frequent fungus disease is *rust* caused by *Puccinia Pruni-*

spinosae Pers. On both surfaces of the leaf, but chiefly on the under surface, are formed numerous small yellowish brown or chocolate brown powdery pustules. The disease is more prevalent in the close of summer or in autumn, and the pustules produced by the fungus on the leaves of the apricot are larger than those produced on the leaves of other stone fruits. The mildew of the apricot is rather more frequent than that of the plum, on young trees, and is also due to the same fungus *Podosphaera tridactyla* DBy. In Italy and other countries of the continent *Corineum Beyerinckii* Oud. and *Clasterosporium amygdalearum* Sacc. attack the foliage of the apricot in the same way as that of the plum, and *Dermatella Prunastri* Pers. attacks also the living bark of the twigs of the apricot.

The dry rot fungus *Fomes fulvus* Fr. is rare on the apricot in our orchards, and in Italy and Germany it is replaced by *Polyporus ignarius* Fr. and *P. nigricans* Fr. The root rot fungi attack the apricot grown on plum stock frequently enough, but trees grown on own roots or on almond are far less liable to suffer.

Aphis Pruni Fb. occurs sometimes on the young growths of the apricot, but the injury caused by this *Aphis* is never very important, and generally passes unobserved. The wingless insects which are light green powdered white, are found as usual on the undersurface of the leaf, which assumes a blistered and contorted aspect.

All apricots maturing in July and after, are frequently attacked by the fruit fly (*Ceratitis capitata* Wied.) and in districts badly infested by the fly the crop of the large-fruited late ripening apricots may be partly or wholly destroyed by this insect. The fruit is punctured by the fly when it is just turning yellow, so that it is not always possible to ward off the attack by collecting the fruit as soon as it approaches maturity and allowing it to complete the process of ripening in the fruit room.

Most of the butterflies, moths, and beetles which attack the plum in continental Europe are also common to the apricot, but in our orchards the only beetle which is sometimes met with on the stems and branches of weakly apricot trees is *Bostrychus dispar* Fb., but apricot trees grafted on plum-stock often succumb to the insidious attacks of the beetle *Capnodis tenebrionis* L., whose larvae live, often in numerous colonies, on the tender tissues between the bark and the wood, of the stem and of the large superficial roots.

THE CHERRY.

The following classification will explain the relationship which exists between the various types of cultivated cherries and of the stock on which they are grown.

1. *Prunus Avium* Lin. = *Cerasus Avium* Moench.
C. nigra Mill. = *C. dulcis* Borkh. (French. = *cerisier merisier*. Italian = *ciliegio*. Maltese = *cirasa*). This is the Wild Cherry or Gean tree, native of Europe and Western Asia. It is a tall tree sometimes exceeding 15 metres in height, and never or rarely throws up any suckers, producing flowers in umbelliform clusters a short time before the leaves or along with them. The branches are thick and erect. The leaves are rather long, acuminate, doubly serrated, united in clusters at the extremity of the twigs. The flowers are white, on long stalks. The fruit is pendulous, ovoid or heart-shaped, and the flesh is rather firm, sweet and adheres to the stone. The species includes the following varieties or forms.

I. TYPICA, in which the fruit is roundish or ovate, with a very juicy pulp.

(a) *Actinæa* Lin. (sub. *P. cerasus*) *P. nigricans* Ehrh. = *C. avium* var. *silvestris* Ser. in D.C. producing fruit less than 1 c.m. in diameter, of a purple black colour, the flesh and the juice being blood red. This is an exclusively wild form.

(b) *Macrocarpa* Ser. in D.C. The fruit is 1 c.m. in diameter or more, purple-black, with red or blood red juice. Certain forms of cultivated cherries, called *guignes* are derived from this or from the following two forms.

(c) *Rubella* Ehrh. The fruit is reddish, the flesh is white or slightly red, and the juice is colourless.

(d) *Dulcis* Lin. (sub *P. Cerasus*). The fruit is of a yellowish white or waxy white colour, and may be flushed red. The juice is colourless and very sweet.

II. *DURACINA* Lin. = *P. Cerasus* var. *bigarella* Lin. *Cerasus duracina* D.C. The fruit is heart-shaped, and the pulp or flesh is firm and rather dry. The juice is colourless or almost colourless, and sweet. To this variety belong most of the cultivated sorts known as bigarreau cherries. (Italian = *durone*. French = *bigarreau*).

III. *JULIANA* Lin. (sub. *P. Cerasus* Lin.) = *Cerasus Juliana* D.C. The tree has a dense habit of growth, the leaves are glabrous on the under surface. The fruit is heart-shaped, sweet, juicy, with rather soft flesh, and may be red, purplish black or white. This is the Gean Cherry or St Julian's Cherry. To this variety belong most of the true cherries. Italian = *ciliegio*. French = *cerise* (proprement dite).

2. *Prunus Cerasus* Lin. = *Cerasus vulgaris* Mill. = *C. Caproniana* Ser. in D.C. The tree is native of central and eastern Europe, the Caucasus, Asia Minor, the region of the Urals and Siberia. This is the common cherry and is a small tree not higher than four or five metres, producing many suckers around the stem and also at considerable distance away from it. The leaves are stiff smooth and shining. The flowers are smaller

than in the preceding species but more open. The drupe or fruit is long stalked, with the flesh detached from the stone. (It.=*visciolo*. Fr.=*cerisier franc*). It includes the following forms.

I. CAPRONIANA Lin. (Rchb.) The leaves are ovate-acuminate, doubly serrated. The fruit is spreading or half pendulous. This is the hautbois cherry. (It.=*amarena*, *marena*. Fr.=*griotte*. M.=*amarena*).

(a) *Acida* (Ehrh.) The juice is pale red, very juicy and very acid.

(b) *Austera* (Ehrh.)=*C. Caproniana* var. *griotta* Ser. in D.C. The fruit is blood red or deep purplish black. The flesh is of the same colour, acid and bitterish. This form is naturalised in our valleys and gardens being common at Xlendi, Nadur, Boschetto, Ghain il Cbira, Melleha etc. and is used as stock for the other cultivated cherries.

(c) *Pallescents* (Ser in D.C.) with yellow fruits and colourless juice.

II. MARASCA (Rchb.)=*Cerasus Marasca* Host. The leaves are ovate and crenate, and the fruit is pendulous with a very long stalk and of a lively red colour. This is the Marascha Cherry (It.=*marasca* or *amarasca*). The fruit is made use of in the manufacture of liqueurs (*maraschino*).

III. PUMILA Lin.=*P. Chamaecerasus* Jacq.=*Cerasus Chamaecerasus* Lois. This is the ground cherry, and is a purely wild form, with small ovate-lanceolate and crenate leaves, and produces small purplish red fruits with very acid juice.

3. *Prunus Máhaleb* Lin.=*Cerasus Mahaleb* Nouv. Duk.=*Padus Mahaleb* Eorkh. This is the Mahaleb Cherry or perfumed cherry, (Fr.=*cerisier odorant*, or *c. de Sainte Lucie*. It.=*ciliegio canino*. M.=*cirasa salvaggia*). It is a thorny shrub or small tree, with roundish ovate leaves, and erect corymbose racemes of small white

and very sweet scented flowers. The drupes or fruits are very small, ovoid, black, uneatable. This cherry is largely used as stock for all cultivated cherries, and is native of Europe, Western Asia and Kurdistan.

The common bird-cherry (*Prunus Padus* Lin. = *Padus Avium* Mill.) also native of Europe and Western Asia, is of no importance to the fruit grower.

The Maltese name *cirasa* is derived from the Latin name, and this shows that the cherry is a comparatively recent introduction in the Island. Probably its introduction dates from the rule of the Order of St. John, and there are no really local sorts of cherry, that which is more commonly cultivated and called *cirasa ta Malta* or Maltese cherry being the Bigarreau commun or Coeur de poulet, an ancient variety widely grown in Sicily, Italy, France etc. The cultivated cherries were known to the ancient Greeks and Romans who probably obtained them from Asia Minor. With the Roman victories in Asia Minor several good sorts of cherries were introduced into Italy, whence they soon spread all over Europe, but it is probable that local wide or half wild sorts were already in cultivation in most countries of Southern Europe before the introduction of the improved Asiatic varieties.

The cultivated cherries properly belong to a climate colder than ours and to a soil in which siliceous and clayey matter predominates, although the presence of a large percentage of calcareous matter is not a bar to their cultivation. Therefore in our subtropical climate they should be grown in the cooler hilly districts and upper valleys, and they demand a sheltered situation with a northern aspect and a soil rich in organic manures. In open situations the cherry is often unproductive, and liberal dressings of manure seem to be essential for a heavy production. Another important factor of success is the quality of the soil in relation to the stock on which the cherry is grown. Until lately it has been the custom

of our gardeners to bud or graft the cherry exclusively on the suckers of the hautbois cherry (*Prunus Cerasus* var. *Caproniana*) as above mentioned. This stock produces trees of fine size, but requires a soil of stiff and clayey nature to thrive well, and hence all attempts to grow the cherry on this stock in the red light porous soils of certain hilly districts have been almost always attended with failure. For these red porous soils the cultivated cherry should be budded or grafted on the Mahaleb cherry which was introduced for use as stock in these Islands by the writer in 1908, with very good results. On the Mahaleb stock the cherry attains a fair size and is very productive, and its cultivation becomes possible even on dry soils, provided that they are properly manured and that the situation is well sheltered. Moreover on this stock the cherry grows with great vigour and is much less liable to suffer from gumming which so frequently kills the cherry grown on the hautbois stock. Even for stiff and clayey soils, on account of the heat and drought of this climate, the Mahaleb stock is always preferable to that of the hautbois cherry, although of course for moist and very cool situations this last has its own advantages.

The cherry tree both when in bloom and when the ripening fruit is hanging in clusters is very picturesque and ornamental, and the fruit is always welcome on the table not only on account of its pretty appearance and its earliness, but also for its intrinsic value as a desirable article of dessert consumed either crude or cooked. The fruit of the bigarreau cherries (Italian=*duroni*) keeps well and travels well for long distances, and other sorts are used in continental Europe for the preparation of various liqueurs.

PROPAGATION. The seeds or stones may be collected as soon as the fruit is ripe and stratified in a box or pan with a mixture of leaf-mould and sand. They may be sown as soon as they are collected from the tree, that is

in June and with due attention many of them will germinate at once in the course of the same summer, but before sowing, the stones should be stratified for one or two weeks in leaf-mould and kept moderately moist, or they may be slightly cracked by striking them lightly with a hammer, to make germination more easy. If they are to be sown in the following spring the mixture of leaf-mould in which the stones are stratified should be moistened with water occasionally, otherwise if they get too dry for a long period their germinating power may be impaired. In one or two years the seedlings will be strong enough to bear transplanting to the nursery, late in winter, and their subsequent treatment is the same as with other stone-fruit seedlings.

The cultivated cherries are never propagated directly by seed, except when this is done with a view to the production of new or improved varieties. The hautbois cherry may be multiplied by seed for the purpose of raising stock, but suckers are produced so freely around old trees, that the gardener can easily obtain the quantity required for his use. However, the Mahaleb cherry produces few or no suckers and is propagated almost exclusively by seed. The small stones of this cherry preserve their vitality better than the stones of the other cherries above mentioned, and are sown in February or March. They germinate very freely, requiring no special attention, and the seedlings make rapid progress reaching the required size for budding or grafting in about two years. In the first winter they may be planted out in the nursery about 50 c.m. apart, and may be grafted or budded in the following winter or next spring. The seedling of the Mahaleb is very vigorous and resisting, and if transplanted with ordinary care there will be few failures. The gardener should keep one or more plants of this cherry in an outlying corner of his orchard, and allow them to fruit so that he may have a supply of seed always available for sowing.

The cherries can be propagated by cuttings. Well ripened cuttings of the gean-tree (*Prunus Avium*) and of most of its varieties or forms, planted in a shaded situation in the open air in winter will root without much difficulty. Cuttings of *P. Cerasus* and *P. Mahaleb* root in the same manner. Herbaceous cuttings, made of growing twigs, with or without a heel of the old wood, planted in sand, under a glass bell, are sometimes made use of for the propagation of the ornamental or double flowering cherries.

The cultivated cherries are best propagated by budding or grafting. They are budded or grafted on seedlings of the wild cherry or gean tree, on seedlings or on suckers of the common cherry, and on seedlings or sometimes on suckers of the Mahaleb cherry. Budding may be done from April to September, and it is preferable to bud close to the ground, or about 10 c.m. above the ground level, even if it is proposed to rear the cherry as standard. Grafting is performed in winter, from December to February, cleft-grafting close to the ground being the method generally adopted by our gardeners.

On the wild cherry (*P. Avium*), or on seedlings of the cultivated cherries, budding or grafting may be done at some height above the ground, for the formation of standards, but on the Mahaleb cherry it is advisable to bud or graft always close to the ground level. The hautbois cherry and other forms of the common cherry (*P. Cerasus*), may be budded or grafted as half-standards, but it is also better to perform the operation at ground level, although the production of a swelling at the point of union between the stock and the bud or scion is less marked than in the case of the Mahaleb cherry.

For dry soils and hot climates the use of the Mahaleb stock is preferable by far to all others, and it seems to impart its resisting qualities to most sorts of cultivated

cherries which if grown on the wild cherry or on the hautbois cherry will succumb to the heat of summer after a few years of uncertain existence. The Mahaleb cherry is used as stock in France and other continental countries for dwarf forms, but in our hot climate the cherry grown on Mahaleb stock grows at least as large as the largest tree grown on other stock.

CULTIVATION. The cherry should not be planted less than 4 to 5 metres apart, and this distance is hardly sufficient for trees grown in favourable situations. In the cool upper valleys or in localities on the north side of high cliffs, with a deep and moist soil, and well sheltered from winds, the cherry in a few years becomes a tree of large size. In these shaded situations hardly any other fruit tree will thrive well, and in the absence of a full share of sunlight field crops will give poor returns. In such situations the cherry has few requirements. The land should be tilled twice or three times during the rainy season to keep down weeds and to favour the retention of moisture, and a good trenching of the soil, every fourth year in winter, with a liberal dressing of well rotted manure, will keep up the trees in full production.

Trees newly planted should be watered as soon as the moisture of the soil begins to fail in spring, and watering should be continued at regular intervals during the summer. In the second year the trees may be watered a few times in summer, and afterwards if fully established no irrigation will be necessary.

PRUNING. The cherry is not trained to any special shape, its tall erect branches being ordinarily sufficiently well aerated to require any thinning or training, and most sorts belonging to the section of "bigarreaux" grow naturally into fine pyramids. Pruning is therefore limited to the removal of dead or diseased wood, and to the removal of twigs and branches which are too much in the way to permit the proper cultivation of the soil. By

trimming or shortening the growing branches and twigs in April or May, the tree is induced to form an abundance of fruit spurs and these ensure a copious yield of fruit.

The following sorts of cherries are grown in these Islands.

1. COMMON BIGARREAU. (French = *bigarreau commun*, *coeur de poulet*. Maltese = *Cirasa ta Malta*). The fruit is large, irregularly heart-shaped with a broad shallow groove. The colour is typical shining cherry red, sometimes marbled yellow, with a long and thick stalk. The flesh is white, reddish close to the stone, firm but tender, juicy, sweet with an agreeable vinous flavour. Matures in June or early in July. This cherry is grown extensively in several countries, and is highly productive. Prefers a siliceous soil, well manured, but does fairly well in our calcareous soils, and like most cherries should be grown as standard or tall pyramid.

2. MAY DUKE. (French = *Anglaise hative*). The fruit is middling in size, almost spherical, but depressed at the base, where the stalk is inserted in a shallow cavity. The colour is a lively cherry red, splashed dark red. The flesh is white, transparent, very juicy and sugary with a delicate acidity. The rind is very thin and easily injured, and therefore the fruit keeps badly. This is a prolific sort belonging to the section of the true cherries. Matures late in May or early in June.

3. ELTON. The fruit is large, round or slightly heart-shaped, with a marked groove, and a very long and slender stalk inserted in a deep cavity. The colour is yellowish white, heavily shaded carmine. The flesh is rather firm but quite tender, yellowish white, transparent and sugary, with an agreeable acidity. Matures late in May or early in June. Belongs to the bigarreaux section.

4. BIGARREAU GROS-COEURET or MARCELLINE. The fruit is large, heart shaped, with a well marked groove.

The colour is shining reddish yellow marbled red or dark red. The flesh is yellowish white, firm and crisp, sweet and acidulous. Matures late in June and keeps well.

5. BIGARREAU ESPEREN. The fruit is large or very large, oval, with a marked groove, with a long and thin stalk inserted in a deep and open cavity. The colour is yellow, flushed and marbled red. The flesh is firm and crisp, white or yellowish white, very juicy and sugary, and has a good flavour. Matures late in June or in July. Keeps well. The tree grows fast and is a good bearer.

6. BIGARREAU NAPOLEON. In shape the fruit is similar to the preceding, but is larger and more plump, with a thick and long stalk. The colour is shining pale rose, flushed or marbled red. The flesh is firm and crisp yellowish white, sugary, and of good quality. Matures in July, and keeps well.

7. BIGARREAU REVERCHON. The fruit is large, heart-shaped, more or less irregular, with a short and thick stalk. The colour is shining deep purple, shaded or marbled darker. The flesh is firm and crisp, yellowish white, sugary and agreeably acidulous. Matures late in June or early in July.

ROYAL DUKE. (Fr.=*Royale*). The fruit is large or very large, nearly spherical, with a broad groove, and a very long and slender stalk. The colour is very dark purple, nearly black, and the flesh is purple, somewhat crisp, very juicy and sugary, with a very agreeable vinous flavour. Matures late in June or in July. This excellent cherry is now cultivated in the neighbourhood of Notabile, and keeps fairly well although the rind is thin and rather delicate. It is a bigarreau.

9. BUTTNER'S YELLOW (BIGARREAU GELBE BUTTNER). The fruit is middling, round or heart-shaped with a long and very slender stalk inserted in a deep cavity. The colour is yellow or waxy yellow, semi-

transparent. The flesh is rather soft, pale yellow, very juicy and sugary. Matures late in June or in July. The tree is middling in vigour and very productive.

DISEASES.

The diseases and pests of the cherry in these Islands require further study. However the following are so far known to be present. *Puccinia Cerasi* Cast. the rust of the cherry, which is met with sometimes on the hautbois and rarely on the cultivated cherries, is characterised by the formation of small yellow pustules usually on the under surface of the leaf. *Phyllosticta prunicola* Sacc. causes the formation of numerous small round dry spots on both surfaces of the leaf. *Septoria Cerasi* Pass. produces roundish dark red spots on the leaves of the hautbois and of the true cherries here as well as in France, and *Podosphaera tridactyla* DBy. is the cause of the mildew, a rather rare disease in local orchards, but common enough all over the continent.

In Italy, France and Germany the cherry is liable to the following fungous parasites. *Phyllosticta Prunivium* Allesch. produces yellowish brown spots on the upper surface of the leaf, surrounded by a red margin. *Gnomonia erythrostoma* Auersw. belonging to the order *Sphaeriaceae*, causes yellow spots on the leaves, which spread quickly and kill the leaf, and the leaf dries but remains attached to the twig. This disease which also attacks the fruit, interferes seriously with the production and the development of the tree, and may cause its death after repeated attacks. To *Cercospora cerasella* Sacc. is due the formation of round pale brown spots on the leaves, and *Septoria effusa* Desm. found in Austria and Italy, dots the leaves with spots of reddish colour. *Clasterosporium Amygdalearum* Sacc. attacks also the foliage of the cherry, producing roundish yellow spots surrounded by a dark red margin; and large roundish blotches at first greenish red and then brownish with a

dark margin are caused by *Phyllosticta vulgaris* Desm. To *Cylindrosporium Padi* Karst. and *C. Cerasi* Mass. is due the formation of round pale red or reddish yellow blotches on the upper surface of the leaf, with a yellowish shining spot on the corresponding part of the under surface. *Coryneum Beyerinckii* Oud. attacks also the cherry, producing on the lower surface of the leaf red blotches which soon turn brown and dry. The diseased foliage should be collected and burned, and in the case of the mildew the usual treatment may be applied consisting in dustings with flowers of sulphur or spraying with a weak solution of sulphide of potash, or with Bordeaux mixture.

Fusicladium Cerasi Sacc. destroys the green fruit covering it with a greenish black mould. *Exoascus Cerasi* (Fckl.) Sad. causes the curl of the cherry, *E. minor* Sad. another species unknown in this Island, but possibly closely related if not identical with a similar affection on young almond trees frequent enough in many parts of the Island, causes a general thickening of the young twigs.

The dry rot fungi *Fomes robustus* Fr. and *F. fulvus* Fr. are occasionally found on our cherry trees, but the cherry in France, Italy and Germany, is liable to other forms of dry rot, viz: *Poliporus sulphureus* Fr. *P. hirsutus* Fr. which exist here but so far have not been detected on the cherry, and also *P. cinnamomeus* Trog., *P. cinnabarinus* Fr., *P. ignarius* Fr., *Daedalea unicolor* Fr. and *Lenzites variegata* Fr.

Several small birds, notably the sparrows, are very partial to the fruit of the cherry, and on many occasions in districts where these birds are common, the cherry trees have been entirely deprived of their fruits by these marauders, which usually eat off the pulp leaving the stalks with the stones still attached to them. The inge-

nious scare-crows which are put up by the gardener may deter the wary sparrow, but are quite ineffective against other birds, and the only way out of the difficulty is to gather the fruit as soon as it is well coloured.

The scale insects *Aspidiotus hederæ* Vallot. and *Lecanium oleæ* L. are common on our cherries, and *Pulvinaria Oxyacanthæ* L. and *Lecanium Prunastri* Fonsc. are frequent on the cherry all over the continent.

Many species of insects are common parasites of the cherry in Italy, France and Germany, and it is probable that some of them are also to be found occasionally on our trees, but it is certain that so far none of them has been sufficiently troublesome to attract attention. The undermentioned are a few of the more common parasites in continental Europe.

Aphis Cerasi Fb. of which the wingless insect is red or reddish when young, and later takes a shining black colour; and *A. Persicæ* Sulz. the wingless insect of which is light green when young, and then passes from olive green to yellowish green with black transverse lines. *Diplosis Cerasi* Low is a small gnat whose larva causes the tender leaves to become blistered and sickly.

The larvae of the small moths *Grapholitha variegana* Hb., *G. pruniana* Hb., *Argyresthia ephippella* Fb. and *Cheimatobia brumata* Lin., and the beetles *Rhynchites cupreus* Lin., *Phyllobius oblungus* Lin., *Ph. argentatus* Lin., *Otiorrhynchus rauchus* Fb., *O. picipes* Fb., and *Polidrosus sericeus* Schall. prey upon the buds in winter and early spring; and the young shoots are often destroyed by the beetles *Rhynchites pauxillus* Germ., *Rh. conicus* Ill., *Rh. auratus* Scop. and *Peritelus griseus* Ol.

The foliage in spring and summer is preyed upon by the larvae of the following moths and butterflies: *Anarsia lineatella* Zell. *Lithocolletis cerasicolella* H.S., *L. spinicolella* Stt., *Lionetia Clerkella* Lin. *Hypomoneuta cognatella* Hb., *Lyda Piri* Schrk., *L. nemoralis* Lin.,

Tortrix cerasana Hb., *T. sorbiana* Hb., *Teras Holmiana* Lin., *Swammerdamia pirella* Vill., *Recurvaria nanella* Hb., *Bombyx lanestris* Lin., *Diloba caeruleocephala* Lin., *Aporia Crataegi* Lin., *Porthesia chrysorrhoea* Lin., *P. auriflua* Fb., *Vanessa polychloros* Lin., *Miselia Oxyacanthæ* Lin., *Catocala Paranymphe* Lin., *Asteroscopus Sphinx* Hufn., *Lasiocampa quercifolia* Lin., *Acronycta tridens* Schiff. *Ocneria dispar* Lin. and *Hibernia defoliaria* Lin. Several beetles viz: *Magdalis Cerasi* Lin., *M. Pruni* Lin., *Criptocephus flavipes* Fb., *Melolontha vulgaris* Lin., and *Rhizotrogus solstitialis* Lin. also feed on the foliage. The larvae of the moths *Cossus ligniperda* Gb. and *Zeuzera pyrina* Lin. cause much havoc by their tunnels in the wood of the stems and branches, but although the last named is common in these Islands it is not known to attack the cherry.

The larvae of the beetles *Scolytus Pruni* Ratz., *S. rugulosus* Ratz., *Liopus nebulosus* Lin. *Saperda scalaris* Lin., *Polygraphus pubescens* Fb. and *Magdalis Pruni* Lin. live in tunnels between the bark and the wood, and also in the outer layers of the wood itself, often causing the death of the tree when they are too many, or by repeated attacks, but fortunately we have no wood borer attacking the cherry in these Islands.

Finally, the larvae of the cherry fly, *Spilograpta Cerasi* Fb. lives in the pulp of the fruit and destroys it. These small white grubs are common in the cherries imported from Sicily and Italy, and are generally mistaken for the grubs of the ordinary fly (*Ceratitis capitata* Wied.) to which they are very similar; but the cherry fly is so far unknown in our orchards, nor is it likely that it can ever become established here, as its later broods are hatched in the berries of *Lonicera tatarica* which does not exist in these Islands except perhaps as rare isolated specimens in flower gardens.

THE JUJUBE.

Zizyphus sativa, Gaertn. RHAMNACEAE

Maltese = *zinzel*. Italian = *giuggiolo* or *zizzolo* French = *jujubier*.

This tree, believed to be a native of China, has been cultivated in these Islands from a remote period. It is a large thorny shrub or tree, sometimes with a trunk measuring up to 30 c.m. in diameter, and is leafless in winter. The small elliptical foliage is of a shining green colour and is very ornamental. The flowering sprays have graceful drooping habit, and die off and are shed every year, soon after the foliage. The small greenish flowers are succeeded by olive-shaped fruit, which ripen in summer, acquiring then a shining brick-red or coppery-red colour, and are very sweetish, containing a special glucoside. Each fruit contains one stone-shelled seed like that of the olive.

The tree is propagated chiefly by suckers, which are produced freely around it, often at a considerable distance from the stem. These are transplanted in winter and strike easily even if they happen to be put poorly provided with roots. Propagation by seed is difficult and hardly ever resorted to, but seed gathered at maturity and stratified, or sown at once, in a sandy soil, will germinate in the following spring. The jujube-tree thrives well in all soils and all situations, but prefers a sunny situation, where in a few years it becomes a fine tree and fruits abundantly. The tree has a straggling habit, with twisted branches, and being well armed with stout sharp thorns, would make a very effective hedge with proper treatment.

It is the practice with old gardeners to hang large heavy stones on the jujube, especially at the flowering period, with the object of increasing the production of

fruits. The heavy weights accentuate the natural tendency of the branches to become distorted, and the consequent obstacle to the flow or return of sap may induce the flowers to set more freely. As a matter of fact it is generally recognised that trees so treated are more productive. The same practice is often resorted to in the case of the pear-tree, with the same apparent results.

THE WALNUT.

Juglans Regia L.

Maltese = *geuza*. Italian = *noce*. French = *noyer*.

The walnut thrives well in any soil and in all situations, but prefers a deep soil moderately moist and a cool situation, where it makes rapid growth and attains to a large size. In dry and too open situations the tree has a tendency to spread out and remain a dwarf. It is liable to die off suddenly in soils heavily charged with organic manure, particularly if also badly drained.

The tree is raised exclusively by seed, the small seed of half-wild sorts being generally preferred for raising stock, and the plants when the stem is about 3 c.m. in thickness, are grafted with the large-seeded cultivated varieties. The graft is generally performed close to the ground, in January or February. Budding may be done early in summer, making use of buds taken from the young wood well ripened, but the walnut is rarely propagated by budding. Several varieties come true or nearly true from seed, and therefore are more often propagated directly, sowing well formed walnuts from a typical tree. Sowing may be done in January, and February, and walnut plants or young trees with a stem not more than 5 or 6 c.m. can be transplanted safely during winter.

The walnut has a powerful root system, and if planted close to an underground tank will probably damage the rendering. It is also capricious as regards productiveness, often producing heavy crops, and as often refusing to bear well for several years in succession. But it is highly ornamental, and in suitable places becomes a tree of magnificent proportions. The foliage is aromatic, and both the foliage and the fleshy husk or pericarp con-

tain much tannic acid and yield a dark brown dye. The oil extracted from the seeds is a good salad oil, and being a drying oil is also much used by painters. The wood of full grown trees is well known for its beautiful veining and other qualities for which it is much sought after by cabinet makers.

The walnut is grown sporadically in the Maltese Islands, and there are a few large trees at San Antonio and Boschetto. The half-wild ungrafted walnut of Italy, is that more frequently met with, but at San Antonio there are Sorrento walnut trees of large size and apparently of great age. Other Sorrento walnut trees have been planted recently here and there in the Island, including the Boschetto. The Sorrento walnut is noted for its size, its oblong-elliptical shell of a dark colour, and its cream coloured kernel of exquisite taste wrapped in a dark brown rind. The introduction of other varieties is of quite recent date. Thus, the "Bijou" walnut was introduced from France in 1910. It is perhaps the largest of all walnuts, of very regular shape and has a thin light coloured shell. The kernel is white, of good quality, enclosed in a light yellowish rind. The Mayette and Parisienne are two French varieties introduced from France in 1911. The Tyrol walnut (*Juglans regia* L. *var. tyrolensis mihi*) was introduced from Milan in 1904, and is a strong growing variety noted for its rather small walnuts, flattened at the stalk-end, and nearly round in shape, with a thick rusty-brown shell, and a creamy coloured kernel wrapped in a thick rind which is usually of a lively crimson red colour. This walnut was introduced in Malta in 1904, and is a fast grower. The Tyrol walnut and to a certain extent also the Bijou and the Sorrento walnuts come true from seed. The walnut as stated above, will bear transplanting when young, but is best sown where it is to remain. It is also frequently sown in pots and when two or three years old, the young plants are transferred to their final abode during winter. This tree takes from 6 to 10 years to fruit.

The Walnut has few enemies in these Islands. The mycelium of *Armillaria mellea* Val. may develop on large wounds of the roots or of the base of the trunk, and ultimately kills the tree. All such wound should be painted over with tar. The larva or grub of the moth *Zeuzera pirina* or *Z. aesculi* bores into the trunk or smaller branches of the walnut, as it does in the case of many other trees, and the tree is often grievously damaged in consequence. The tendency of the grub is to tunnel upwards, and usually can be reached and killed by a bit of copper wire worked upwards through the small hole in the bark by which the excreta of the grub are shed.

On the Continent the walnut is subject to the ravages of the small beetle, *Peritelus griseus* Ol., which is 7-8 m.m. long, of a black colour, spotted brown and grey. This beetle eats off the young shoots in spring and summer. Another small beetle, *Bostrychus bicolor* Hbst. produces tiny but ramified tunnels under the bark, and the well known May beetle (*Melolontha vulgaris* L.) is a frequent parasite on the roots. Other beetles attacking the trunk and main branches are *Mesora curculionides* L., *Saperda scalaris* L., and *Liopus nebulosus* L. against which it is recommended as a preventive to whitewash heavily the bark on the stem and branches.

A scale-insect, *Lecanium juglandis* Bche., is common on the walnut in Italy and Germany.

The moth, *Cossus ligniperda* Fb. produces long tunnels in the stem and branches, and when sufficiently numerous may cause the death of the tree. Other moths attacking the walnut in Italy are : *Gracilaria juglandella* Mun. *Dasychira pudibunda* L. *D. fascelina* L., *Bombyx neustria* L., *Amphipyra pyramidea* L. and *Cheimatobia brumata* L. A species of Phytoptus, an acarid, attacks both surface of the leaf, producing small reddish galls ; and another acarid, *Phyllereus juglandis* Am., causes the *eriosis* of the walnut with its charac-

teristic hairy formations. None of these insects has as yet been noticed on the walnut in these Islands.

Two minute fungi, viz: *Phomopsis juglandina* (Fuck) Sacc. and *Macrophoma juglandaria* Sacc., are frequently found on the dead twigs of the walnut at San Antonio, Boschetto and Gneina, but probably are only saprophytic. However, many species of fungi are known to attack the walnut in Continental Europe. Thus *Cryptosporium nigrum* Bon., produces round or irregular brown spots on the leaves, and *Gnomonia leptostyla* Ces & De Not., causes the formation of irregular greyish brown blotches with dark dots on the under surface of the leaf. *Phyllosticta juglandina* Sacc. and *Ph. Juglandis* Sacc. produce large irregular blotches on the foliage, surrounded by a dark margin. *Microstroma juglandis* Sacc. produces blotches of a light green colour on the tender foliage, with a network of white mould on the under surface; and *Marstonia juglandis* Sacc. causes roundish blotches of a rusty grey colour, with small brown dots, on the under surface of the leaf. *Phyllactinia suffulta* Sacc. causes the well known *male bianco* of the walnut, covering both surfaces of the leaf with a white mould, upon which later on, minute black dots make their appearance. *Exoascus juglandis* Berk., a blister fungus, is found also on the leaves of the walnut in Italy. Various species of *Polyporus*, such as *P. sulphureus* Fr., *P. squamosus* Fr., *P. cinnabarinus* Fr., *P. fomentarius* Fr., *P. ignarius* Fr., as well as *Daedalea cinnabarina* Secr., are found on the stems and thick branches of the walnut all over Europe, but none of them has been noted on the walnut of these Islands. *Armillaria mellea* Val. is a frequent cause of root-rot in Italy, and has been noted once or twice on walnut trees at Boschetto.

The fruit or nut of the American walnut or Black walnut (*Juglans nigra* L. North America) is sometimes eaten like that of the common walnut, but this tree is chiefly grown for its valuable timber, and as an ornamen-

tal tree for avenues. It has been introduced several times in these Islands, but so far with very little success. The foliage and habit are like those of the common walnut, but its growth is said to be more rapid. The timber is of a beautiful violet brown colour, finely veined, is close-grained and heavy, and takes a fine lustre. The satin walnut, or white walnut (*juglans cinerea* L. North America) is another forest tree whose timber is similar to that of the common walnut, but is much more easily worked and takes a better lustre. It is also not liable to the attacks of insects. This tree has not been introduced in these Islands.

THE PECAN NUT-TREE

Carya olivaeformis Nutt. JUGLANDACEAE.

Maltese=*pecan*. Italian=*pecan*. French=*pecanier*.

The tree is native of North America, and certain improved sorts are now propagated on a considerable scale to meet the ever growing demand for pecan nuts. It is a deciduous tree of tall habit, from 8 to 15 meters high, resembling a walnut tree, but with narrower and toothed leaflets, and thinner reddish brown twigs with black buds. The tree flowers in March or April, the catkins of male flowers being produced profusely from the old wood, and the pistilliferous flowers being produced in small clusters at the apex of the old wood. The nuts mature in September or October. The pecan nut, also written pekan nut, resembles a walnut in conformation but is more slender, and usually has a thinner shell. The kernel tastes like that of a walnut and though smaller in size, is considered more delicate in flavour.

The tree agrees well with our soil and climate, and thrives in all situations, but prefers a deep moist soil, where it makes rapid growth and soon becomes a large tree. It was introduced in these Islands in 1910 by Mr. Francesco Brincat, Head Gardener at Ta-Braxia Cemetery, and the first tree raised at San Antonio fruited for the first time in 1919. There are now various pecan nut trees growing in the Public Gardens raised from nuts sown in 1911 and 1912.

The tree is propagated by seeds or nuts which are sown in pots in December-February, and germinate in March-April; but in the United States selected sorts are propagated by budding or grafting on seedlings, much in the same way as walnut trees. The tree seems to be hardier than the walnut tree, and has a better consti-

tution. If planted in good situations and in good soil, the tree has few requirements, and may be cultivated just like a walnut tree. It is best grown in pots and then transferred to its final destination when about a meter high, as it is liable to suffer rather severely if transplanted from the open ground.

The larva of the moth *Zeuzera pirina* sometimes attacks the pecan nut tree, boring into the branches and twigs, and behaving in the same manner as in the case of the walnut, the apple, the pomegranate etc., but so far there is no other insect pest or fungus parasite injurious to the pecan nut tree in these Islands.

THE HAZEL-NUT

Corylus Avellana L.

Maltese=*gellenza* Italian=*nocciuolo*. French=*noisetier*.

This shrub is cultivated in our gardens more as a curiosity than for its utilitarian character. It is readily propagated by suckers from December to February, and with some difficulty, also by well ripened and woody cuttings during the same winter months. It is also easily grown from seed, which is sown in February or March. The hazel thrives best in a cool and rather shady situation, and does well in any soil provided it is not too dry.

With us, the male catkins are produced in autumn or in winter, and the female flowers appear early in spring and consequently the blooming period of the male flowers does not usually coincide with that of the female flowers. This is probably a peculiarity due to the climate, with the result that as a rule the female flowers fail to set, or if they do the nuts rarely form the kernel. However, artificial fertilization will give good results. The male catkins may be gathered when they are fully developed, well dried in the shade, and kept until the appearance of the female flowers in spring.

Besides the commoner varieties, usually raised from seed, the following are met with here and there in local gardens: *Bergeri*, *atrosanguinea*, *elongata* and *macrocarpa*.

The Oriental hazel-nut, *Corylus Colurna* L., is a large shrub and was introduced in 1906, but succumbed after a few years of precarious life, probably not agreeing with our calcareous soil.

THE CHESTNUT

Castanea sativa L.

Maltese=*kastna*. Italian=*castagno*. French=*marronnier*.

All attempts to grow the chestnut in the Maltese Islands have invariably failed. Imported young trees, planted in likely situations, promised to establish themselves during the first season, but died after two or three years of indifferent health. In Italy the chestnut is stated to thrive well on calcareous soils, and its failure with us is probably due to the fact that at our latitude this tree requires a higher altitude than that available anywhere in these Islands; and therefore we find that even young plants raised here from seed, with all the care bestowed upon them, rarely survive the 3rd year. The same remarks apply to the Japanese chestnut (*tamba-kuri*), *Castanea crenata* Sieb. et Zucc., which was introduced in 1906, with negative results, the young plants imported in excellent condition, rapidly deteriorating and dying within two years.

THE PISTACHIO-NUT TREE.

Pistacia vera Lin. ANACARDIACEAE.

Maltese = *pistaccia*. Italian = *pistacchio*. French = *pistachier*.

The Pistachio-nut tree is native of Syria, Asia Minor, Persia and Cyprus, and is now grown extensively in Sicily where it was introduced presumably by the Arabs, and is also largely cultivated in Asia minor and Syria. It is a deciduous tree, 4 to 5 metres high, with imparipinnate alternate leaves of 3 to 7 large broad oval leaflets, smooth and dull green in colour. The tree is dioecious; the male tree produces the small greenish flowers in small clusters or panicles from the side buds, the panicles of flowers of the female tree being much larger and more branched. The fruit (pistachio-nut) is $1\frac{1}{2}$ to $2\frac{1}{2}$ c.m. long, oval, rather angular and pointed at the extremity, greenish white, generally with a crimson flush on one side at maturity, just before drying. The kernel is of a bright green colour, wrapped in a reddish or crimson membrane, and enclosed in a white thin shell of bony consistence. The kernel has a pleasant taste and is largely used in high class confectionery, the pistachio-nuts always commanding very good prices.

The tree thrives in well drained and dry soils of whatever nature, but requires a warm and sunny situation preferably exposed to the south or south-east. The rocky sides of cliffs exposed to the south or south-east, with many fissures and pockets of earth, are the ideal home of the pistachio-tree, but it will thrive satisfactorily anywhere provided that the soil is well dry and well drained, and therefore not liable at any time to harbour stagnant humidity which is absolutely fatal to the tree.

The pistachio-nut tree is long lived, and in favourable situations is well productive, but the production is sometimes irregular owing to defective fertilization, an

imperfect pollination generally resulting in a considerable proportion of nuts which are apparently well formed but have an abortive kernel or no kernel at all. A male tree is considered sufficient for the pollination of ten female trees, and for the purposes of pollination the male tree of *Pistacia Terebinthus* Lin. the Chio or Cyprus Turpentine tree, or Terebinth, is just as good as the male of *Pistacia vera*, and indeed is said to yield a produce of better quality. In fact in the extensive plantations of Sicily, only the female Pistachio tree is propagated by grafting or budding on the terebinth and pollination is done by male individuals of the terebinth which are planted or are allowed to remain unbudded and distributed at proper distances in the plantation expressly for this purpose.

PROPAGATION. The tree can be propagated by seed, but the pistachio-nuts lose quickly their germinating power if kept in a dry condition, and therefore should be stratified with sand and leaf mould as soon as they are collected from the tree, and are sown in the following March or April. They fail to germinate if more than a year old. A large proportion of the seedlings,—about 50 per cent—will be male trees and therefore useless as producers, and the female trees will produce fruits of all shapes and sizes, so that the produce of a seedling plantation will not be of a uniform quality as required in commerce. Another important consideration consists in the fact that the pistachio-nut tree being generally pollinated,—at least in Sicily,—by the male of the terebinth, the seedlings obtained will be hybrids between the two species. Such hybrids (*Pistacia hybrida* Gasp.) produce small roundish fruits having all the qualities of the pistachio-nut, but too small to be useful, except perhaps for the purpose of raising stock on which the cultivated pistachio tree may be grafted or budded.

The tree may be propagated by budding or grafting on its own seedlings, but the general rule is to bud it on

seedlings of the terebinth. The Algerian or North African Terebinth (*Pistacia atlantica*) which is very common throughout North Africa is also said to furnish an excellent stock for the pistachio-nut tree, being more vigorous than the terebinth. In Sicily the tree is budded almost exclusively on the terebinth (*Pistacia Terebinthus*) which grows wild on rocky ground and in the fissures of volcanic rocks.

The terebinth is easily propagated in quantity by sowing the ripe seed in beds, in March or April, and the seedlings are planted out in winter when they are about two years old. At this age they bear transplanting fairly well and with little risk of failure, and they are planted directly in their final quarters to avoid the trouble and danger of having to transplant again when they are older. Planting should be done in January or February, the seedling which will be 15 to 30 c.m. high, is inserted deeply into the ground, and the soil pressed down firmly around it. Should the weather be too dry in spring it will be necessary to water the seedlings, once or twice to help them to establish themselves, and afterwards they require no further attention. The terebinth seedlings are budded after two or three years, if strong enough, and the operation is best performed at ground level or at a height not exceeding 50 c.m. Budding is done during all the time that the sap is in movement, that is from April to August, and the buds should be taken preferably from the new or green wood. Grafting should be done late in winter, just when the buds begin to swell, but as a rule budding is preferable to grafting and gives better results. Only the female pistachio tree is thus propagated, but should there be a scarcity of male terebinths for pollination, it will be necessary to bud a few seedlings with the male terebinth or with the male pistachio tree, or to bud occasionally one of the suckers which are thrown up rather profusely from the base of the budded terebinth stock. All attempts at propagation by grafting

or budding on the Mastich tree (*Pistacia Lentiscus* Lin., Maltese=*deru*) which is common everywhere in our valleys have invariably given negative results.

CULTIVATION. The cultivation of the pistachio-nut tree has never been taken up in earnest by our gardeners, and up to the present there are few pistachio-nut trees in the Island, although the tree thrives here if possible better than in Sicily. The only difficulty in the way of a more extended cultivation consists in obtaining a sufficient quantity of terebinth stock with which to start the plantation, but the terebinth has been grown in San Antonio Gardens for many years, and considerable numbers of seedlings have been planted on rocky ground in the Boschetto where they are thriving admirably so that it will be easy to raise as many seedlings as may be required.

The pistachio-tree when well established requires hardly any attention. The shoots or suckers which spring around the base of the stem should be removed, and pruning which is performed in winter, is limited to a cleaning process, removing all dead and diseased branches, and trimming back as may be necessary to keep the tree in shape. No irrigation is necessary, even on very dry soils, but good tillage and an occasional manuring will improve the vigour of the tree and its productiveness.

The budded plants commence to bear fruit after five or six years, and the production increases in proportion to the size of the tree. The useful life of the budded tree may be calculated at 50 to 60 years, but trees which have ceased to be productive owing to old age, may be rejuvenated by cutting them down, and budding one or two of the vigorous shoots which are immediately thrown up by the old rootstock or stump.

The pistachio-nut matures late in August or in September. At maturity the fruit becomes greenish white

with a light pink or crimson flush, and the valves or hulls become parted at the apex, and in a few days the nut drops down. The fruit should be picked by hand, as the use of a stick to strike it down is sure to injure the buds which are meant for next year's crop, besides causing an abundant flow of resin which may exhaust the tree. The hands of the labourer employed in picking the nuts become black with this resin, which is washed off with difficulty, and often not before a good soaking with petroleum. The nuts are thrown into a tub with water, and the empty ones rise to the surface and are thrown away. The nuts are then spread out in the sun on a clean floor to dry, turning them over repeatedly until they are perfectly dry, and then may be put in bags and stored in a dry and well ventilated room.

The principal three commercial varieties of the pistachio-nut cultivated in Sicily are (1) 'Napoletana' (2) 'Fimminedda' (3) 'Nuciddara', the first mentioned being the earliest to ripen. The variety known as 'Minnularu' is the longest, sometimes reaching about 3 c.m., but is said to be little productive, the best variety being 'nuciddara' which is the same occasionally grown in our gardens.

DISEASES.

The foliage of the Pistachio-nut tree, as well as that of the terebinth, is liable to the attacks of *Uromyces Terebinthi*, (D.C.) Winter. This fungus makes its appearance in July or August, and on the terebinth it causes irregular brown spots or blotches on both surfaces of the leaf, but chiefly on the under surface. On the leaf of the pistachio tree the fungus causes the same lesions, but the dark rusty coloured fructifications on the under surface of the leaf are larger and much more frequent, so that the tree is sometimes deprived of its foliage long before winter. The attacks generally succeed each other for several years, and may be severe enough to affect the formation

of flower buds and to interfere with the productiveness of the tree in the following year. The diseased leaves may be picked and burned, and the soil under the tree dugged deeply in autumn to bury the hybernating spores along with the decaying foliage. Several species of mould attack the ripe fruit if not dried properly before storage, but are really of a saprophytic nature.

A common and very curious parasite of the terebinth and to a less degree of the pistachio-nut tree, is *Pemphigus cornicularius* Pass., a minute Hemipterous insect which deposits an egg in the terminal bud of a young shoot as soon as it has stopped growing, and a gall is produced having the shape of a cylindrical horn-like production, from 8 to 15 c.m. long, and 1 to 2 c.m. in thickness. Within it there is a numberless progeny of the original egg, procreated parthenogenetically. These minute insects are of a dull lead colour, covered by a whitish powder, and many of them are provided with wings and fly off in a small cloud as soon as the gall is torn open. In rare instances two horn-like galls are produced from the same bud, but as a rule they are solitary, although the same tree may bear quite a large number of these singular productions. The same gall is also found on the pistachio-tree, but then it is generally very long (15 to 20 c.m.) and more or less twisted into a spiral or curved like a scythe. It was generally supposed by gardeners that the fertilization of the tree was due in great measure to the presence of these galls (*scornabeco*), but it is now recognised even by the more ignorant that these galls are merely the result of parasitism, and have no connection with the tree's fertility.

Other forms of galls of the terebinth and the pistachio-tree, in Sicily and Italy, are produced by *Pemphigus utricularius* Pass., *P. semilunarius* Pass. and *P. follicularius* Pass. but they are not known to exist in these Islands. *Aploneura Lentisci* Pass. is another Hemipterous insect which causes the formation of galls

on the mastich-tree (*Pistacia Lentiscus*) in the shape of reddish follicles along the margin of the leaf. It is common everywhere in our valleys, but never attacks the foliage of other species of *Pistacia*.

The two scale insects *Lecanium Oleae* Lin. and *Aspidiotus Lentisci* Sgrn. are frequent on the three species of *Pistacia* above mentioned, but the terebinth and the pistachio-tree being leafless in winter are not liable to suffer much from the black scale, and *Aspidiotus Lentisci* which is probably a form of *Aspidiotus Hederae*, may be troublesome only in close and badly ventilated localities.

The larva of the small moth *Ephestia elutella* Hbn. is a frequent cause of trouble in Sicily, eating into the kernel of the pistachio nut. The egg is deposited in June or July, and the larva penetrates into the kernel, and continues its development within the dry fruit in the store room, becomes a chrysalis in December and hibernates within the nut until June, when it comes out a winged insect ready to renew its cycle of life.

THE STONE-PINE OR EDIBLE-PINE

Pinus Pinea Lin. CONIFERAE. (PINACEAE).

Maltese=*Prinjoli tal ichel* or *Znuber tal ichel*. Italian=*Pino da Pinocchi*.

French=*Pin pignon*.

The Stone-Pine is native of Southern Europe, and is one of the very few species of *Pinus* which agree very well with our soil and climate. It is a tall tree, at first with a pyramidal habit, afterwards acquires a rather globose shape, and later takes definitely an umbrella-shaped form which gives it a picturesque appearance. The stone-pine agrees with all soils and thrives well in all situations, preferring deep and moist soils and sheltered situations where it makes quick growth and soon becomes a tree of fine size, but shows a remarkable power of endurance in dry and poor soils and in exposed situations.

The tree is propagated exclusively by seed. The seeds or stones are sown in March or April, in beds well prepared with leaf-mould and old manure. Germination takes place in about three weeks, and the young seedlings should be kept rather dry to protect them from rot to which they are very liable. When the seedlings are one or two years old they are taken up in March or April, if possible with a small ball of earth, and planted out in the nursery about 1 metre apart, where they soon establish themselves and develop into fine young trees in four or five years. However, unlike its congener the Aleppo-pine, the stone-pine when more than four years old bears transplanting very badly, and in any case should be transplanted always with a good ball of earth, and not before April or later than June. On this account the stone-pine is often grown in pots, as then it can be transplanted at any time with little risk of failure; but plants grown in pots soon get pot-bound and when

transplanted never become so thoroughly established as plants taken from the nursery-bed with a ball of earth.

The stone-pine which has survived the first six months after removal, becomes thoroughly established in about two years, and then requires no further attention beyond an occasional cleaning of dry twigs and boughs. It is watered frequently in the first summer and a few times also in the second summer, but afterwards no watering is necessary, although of course watered trees make quicker growth. The first cones are produced when the tree is about 8 years old, and mature in October or November. They are collected by pushing them up with a pole, as they easily break off and drop down. The cones may be dried in the sun to cause the scales to part and open, and the stones drop off or are shaken out. The cones are also broken up by a sharp blow dealt on the apex, which causes the cone to split open.

The first stone-pines were probably planted in Malta in 1870. The soft-stoned pine (*Pinus Pinea* var. *fragilis*) was introduced in 1902, and there are now several fine trees of this sort in the Boschetto Gardens.

This tree, like the Aleppo-pine, is liable to the attacks of a species of moth, *Evetria buoliana* Schiff whose larva, in April or May, feeds on the growing shoots which it destroys by tunnelling through the tender tissues of the growing stem. In other countries, and probably here also, this moth is kept in check by a minute Ichneumonid fly, *Perilampus batavus* Smits Van Burgst. which feeds upon its larva. A species of scale-insect, *Eriococcus Araucariae*, is also frequent on young specimens of the stone-pine, but its attacks are not followed by appreciable ill effects. *Lecanium Oleae*, the olive scale, is also found occasionally on young stone-pines, and on the honey-dew excreted by this species and by *Eriococcus* develops the sooty fungus, *Fumago vagans*, to which is due the dirty and sooty appearance frequently presented by young pine-

trees. *Pinus Gerardiana*, the edible pine of the Himalayas was introduced in 1914, but all seedlings died quickly, as the species will not bear the presence of lime in the soil.

THE CUSTARD APPLE.

THE NETTED CUSTARD APPLE OR BULLOCK'S HEART

Anona reticulata Lin. ANONACEAE.

This tree is an old denizen of local gardens and is propagated exclusively by seed. The seed is sown in pots or pans in March or April, and the seedlings are potted off singly in the following March, just before they start to make fresh growth. When 3 or 4 years old they are generally strong enough to be planted in their final destination. The tree, if not too old can be transplanted safely from one place to another, if the operation is performed with care during winter when the tree is leafless, or a short time before it starts growing in spring.

The tree requires a deep and porous soil, moderately moist but well drained, and a sunny situation protected from cold winds. In such situations the tree attains a large size and produces a thick shade, but is not always liked when planted close to dwellings, on account of the overpowering perfume of its foliage. The tree flowers profusely throughout the summer, but is usually a shy bearer. The dark green fruit is generally oblong, or heart-shaped and may weigh $\frac{1}{2}$ kilo or more, but is often irregular in shape and size. When ripe, the fruit becomes of a reddish brown colour, and is strongly perfumed. It ripens in October or November, and should be gathered in as soon as the colour begins to turn brown, otherwise it soon drops from the tree. In a few days the fruit becomes soft to the touch, and perfectly mature.

It is a common practice to hang on this tree, as well as on the other sorts of the Custard apple, when in flower, a few fleshy branches of the prickly pear (*Opuntia Ficus Indica*), in the belief that they aid the fruit to

set more easily. There seems to be no reasonable ground for this operation, but the smooth, flat branches of the prickly pear may afford a better resting place for pronubal insects, than the hairy foliage of the Custard apple.

The Custard apple has few enemies. It is sometimes attached by the black scale (*Lecanium oleae*), but the injury is never severe. A more dangerous enemy is the fig-tree scale or tortoise scale (*Ceroplastes Rusci*), which at times may seriously interfere with the development of the tree, and may even kill it if the infestation is a severe one. The best remedy consists in thoroughly white-washing with lime the tree in winter when it is leafless. Spraying with soap and paraffin emulsion, or with lime and sulphur mixture may be done in summer and autumn. The fruit-fly sometimes attacks the fruit, just when it begins to ripen.

THE CHERIMOYER OR PERUVIAN CUSTARD APPLE.

Anona Cherimolia Lin. ANONACEAE.

The foliage of this tree is of a more lively green than that of the Netted Custard apple or Bullock's Heart, and the fruit is more often heart shaped, marked out by angular markings and turns into a light green colour when ripe. The pulp is of a creamy colour and consistence, and deliciously perfumed and flavoured. The tree is generally much more productive than the Bullock's Heart, and the fruit is altogether superior in quality, so that it has superseded the Bullock's Heart in popular favour. The tree has been introduced in Malta towards 1820 or soon after the Bullock's Heart, and its requirements in the matter of cultivation are identical with that species. It is subject to the same diseases, and is more liable to the attacks of the fruit-fly, the delicate rind of the fruit being more easily penetrated

by the ovipositor of that insect. Both species may be grafted or budded on each other, but it is the general practice to grow them directly from seed saved from the earliest and largest fruits.

THE PRICKLY CUSTARD APPLE OR SOUR-SOP.

Anona muricata L. ANONACEAE.

The tree grows to a larger size than the two preceding species. The foliage is much larger, of a light green colour, and smooth on both surfaces. The fruit is large and irregular, covered with the hardened extremities of the carpels, which give it a prickly appearance, and become slightly brownish green at maturity. It has the perfume of the Cherimoyer but to a less degree, and is decidedly acid or sour in taste. The tree has a more sturdy habit of growth than the other two species, but its requirements and cultivation are the same. The tree had disappeared from our gardens, probably owing to the inferior quality of the fruit, but was introduced again in 1902.

THE SCALY CUSTARD-APPLE OR SWEET SOP.

Anona squamosa L. ANONACEAE.

The Sweet-sop is a shrub requiring a hotter climate than ours for its proper development. It is usually cultivated as a pot plant, and placed in sunny and sheltered corners where it thrives well in summer. The fruit is small, round, finely sculptured into small regular scales, and ripens in October. It is sweet and deliciously flavoured. The leaves are small but elongated, and the seeds are narrower but longer than those of the other

species. The seed may be sown in March or April, and the seedlings potted singly in April, when they are a year old. But few seedlings survive the first winter, and nearly all are lost by the third year. Occasionally a plant may live for six or seven years and fruit once or twice, but sooner or later it succumbs to the effects of the climate in winter or early spring, even if sheltered under glass.

THE GUAVA.

Psidium Guajava Lin. MYRTACEAE.

Maltese = *guava*. Italian = *guava*. French = *goyavier*.

This fruit-tree is grown more often as curiosity, but in suitable situations it is very productive, and the fruit makes an excellent jam of delicate flavour. The tree is best grown from seed saved from large fruits of the golden yellow egg-shaped variety, which is preferable. The seed is sown in March, and the seedlings when one year old are potted off singly in small pots in April, shifting them into larger pots every year until they are four or five years old, when they are generally strong enough to be planted out where they are to remain. The Guava likes a deep soil and a dry and sunny situation, sheltered from cold winds, and should be frequently watered in summer and occasionally manured to insure a free growth. A stiff retentive soil is unsuitable for this tree.

The Guava sheds its leaves late in winter, and starts growing late in spring. The tips of the twigs are liable to die off in severe winters, but with proper care the tree becomes as large as an orange-tree, and fruits abundantly. The tree flowers throughout the summer, and the fruit ripens in October and November, but the fruit which sets late in the season, remains small, and often fails to mature. The first Guava planted at San Antonio towards 1818, died in 1916, so that the tree lives to a fair age in our climate. The Guava is not liable to any important disease; even the fruit-fly does not often attack the fruit.

THE AVOCADO PEAR.

Persea gratissima Gaertn. LAURACEAE.

Maltese=*avocada*. Italian=*avocado*. French=*avocadier*.

The Avocado Pear was introduced in Malta in 1905. The first tree was imported from Milan and planted in San Antonio Gardens where it fruited for the first time in 1912. Subsequently, improved varieties, viz : Pollock and Trapp were imported from Sicily, the first of which fruited in 1919. The Avocado pear is a fine evergreen tree native of the West Indies and Mexico, and thrives well in our soil and climate, but as the tree begins to flower in January and February, it requires a very sheltered situation otherwise the wind and the cold will not allow the fruit to set. A deep rich soil is also necessary, the tree being of fast growth and a huge feeder. The leaves are alternate, lanceolate, rather tough or coriaceous, and of a dull green colour, with the special fragrance of cinnamon and pimento. The flowers are produced in bunches or small panicles at the axils of the leaves. They are small, white, and have some fragrance. The flowers are formed in January and bloom in February or March, the flowering being usually prolonged into April. The fruits are more or less egg-shaped, and vary in size from that of a hen's egg in the typical sort, to that of a middle-sized mad-apple or egg-plant. The rind is of a shining green colour dotted light green in the typical sort, but may be dark greenish purple or light yellowish green, according to the variety. Matures in September or in October. The pulp is thick, buttery, greenish close to the rind, light green or greenish white close to the seed. The fruit is one-seeded, the seed being round, sometimes 3 c.m. in diameter, or more, and is enclosed in a friable tender shell, and loses quickly its germinating power if kept dry for some time, and therefore should be sown within a few days after removal from the fruit.

The avocado pear is highly spoken of as a nourishing fruit of the first order. The pulp has a peculiar fatty texture and a flavour reminiscent of pistachio-nuts and pine kernels, and requires the addition of sugar, or of salt and pepper to be relished. The seed sown in September or October germinates in November or December, and the seedlings after a brief check in January and February resume active growth in March and in the course of one or two summers acquire sufficient strength to be planted out in their final quarters.

The tree is propagated exclusively by seed, and selected varieties are best propagated by budding on seedlings during summer. Certain varieties often come more or less true from seed. In sheltered situations the tree is a prolific bearer, and the fruit if gathered and handled carefully will keep in good condition for some days, but here it is doubtful whether the avocado will ever become a fruit of commercial importance.

The fruit is not liable to the attacks of the fruit-fly, and in these Islands neither the tree nor its fruit are seriously affected by any insect pest or fungus parasite.

THE MEXICAN APPLE or WHITE SAPOTA.

Casimiroa edulis. RUTACEAE—AURANTIACEAE.

The tree is nearly allied to the orange tribe and is native of the semitropical but temperate regions of Northern Mexico. It is a tall tree with long-stalked alternate digitate leaves having long narrow acuminate leaflets, and seems to be more hardy than the orange tree. The first two trees were introduced in these Islands in 1914, and were planted in fairly good soil in San Antonio Gardens. In five years they made very quick growth, but they have not yet fruited. The tree is said to grow to a large size, with a trunk nearly 1 metre in diameter, and lives for over one hundred years. The flowers are small and greenish, produced in axillary racemes. The fruits are more or less globose, sometimes depressed and even slightly oblong, and 5 to 6 c.m. in diameter. The rind is thin and easily injured, and is of a greenish yellow colour; the flesh or pulp is white or cream, with hardly any acidity, and is very sugary with an agreeable flavour. The seeds are large, usually five, but often reduced to two or less, by abortion of the ovules, and are enclosed in a white swollen involucre. The tree is remarkably hardy and in deep soils with a fairly moist subsoil will thrive well without irrigation. It is said to be very productive, but the fruit of seedlings is often too small to be useful.

PROPAGATION. The Mexican Apple is generally propagated by seed, which can be sown in spring or at any time from April to September, and if kept long should be stratified, being liable to lose its germinating power if kept dry for a few weeks. The seedlings grow quickly, and may be potted off singly, or planted out in the nursery about one metre apart, and treated in the same manner as Citrus trees. They can be trained as

tall standards without much difficulty, and in a year or two will be strong enough to be transplanted to their final quarters in March-April or in September. Seedlings will fruit when they are about eight years old, but their fruit is generally either too small or too full of seeds, and therefore it is better to bud them with some improved sort which yields fruit of better quality. Propagation by cuttings or layers has so far given negative results.

The seeds are said to be poisonous, and the fruit is a popular remedy in Mexico for "insomnia", being supposed to have soporific qualities, but this is not confirmed by the experience of growers in California and elsewhere.

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THE KAKI, or CHINESE DATE PLUM, or KEG-FIG OF JAPAN, or JAPANESE PERSIMON.

Diospyros Kaki Lin. EBENACEAE.

Maltese=*Kaki*. Italian=*Kaki*. French=*Kaki du Japon, Plaqueminier*.

The Kaki is a deciduous tree which grows to the size of an orange tree, with alternate, ovate lanceolate foliage of a dull green colour, more or less pubescent on both sides, but chiefly on the under surface. The tree thrives well in deep loamy soils, and does better in half-shaded situations than in full sunshine. The cream-coloured rotate flowers with a four-lobed persistent calyx, are produced in spring, singly or in pairs in the axils of the leaves, and the fruit which is a large, many-seeded berry, matures in autumn, its colour varying from deep yellow to scarlet and deep blood-red or purplish red. The tree is native of China and Japan, but is now cultivated in many other countries.

The tree is propagated by seed or by budding or grafting on own seedlings or on seedlings of *Diospyros virginiana* which is the Virginian Date-plum or Persimon (often written Persimmon), or on seedlings of *Diospyros Lotus*, the European Date-plum, this last being the preferred stock with European nurserymen. The seeds of the Kaki may be stratified with sandy leaf-mould to preserve better their germinating power, but usually germinate fairly well if preserved in the ordinary way by keeping them dry in a paper packet. The seed is sown in March, and the seedlings when they are at least one year old, are transplanted to the nursery at a distance of about half a metre apart. This operation may be done throughout the winter, the best period being towards the close of February or early in March just before the buds begin to swell. The seedlings take six or eight years to fruit, and many of them usually turn out worthless

or inferior sorts, but may be budded or grafted with approved cultivated sorts. The Kaki, however, does best when budded or grafted when quite young, that is in a year or two after being transplanted from the seed bed. Seeds of *Diospiros virginiana* and *Diospyros Lotus* are dealt with in the same manner, and the seedlings may be used as stock when they are two or three years old.

Budding is done throughout the summer, but chiefly in July-August, when the new wood has ripened sufficiently to furnish good buds. Grafting is done in February or early in March when the buds are still dormant, ordinary cleft-grafting and tongue grafting being the methods most in use. In any case, it is preferable to bud or graft at ground level or at a few centimetres above the ground, and afterwards the plants may be trained as standards, if required.

Young Kaki trees, like other deciduous trees, are transplanted in winter or rather from the moment that they shed their leaves in autumn until the buds begin to swell in early spring. Some manure should be given to them, but must not be allowed to come in contact with their roots, and afterwards may be treated much in the same way as a pear tree. The distance at which the trees should be planted apart must vary according to the vigour and habit of the sort which is grown, but for most sorts a distance of $2\frac{1}{2}$ to 3 metres is sufficient. Under irrigation and in partly shaded situations, the tree makes quick growth and attains a good size, but the fruit does not seem to suffer in quality on account of the smaller share of sunshine. The fruit begins to show colour in September, but takes a long time to mature well and it happens frequently that the tree loses its foliage rather early in autumn, when the fruit is only half ripe, in which case we have the strange phenomenon of a leafless tree in full fruit. Pruning should be limited to a mere cleaning of dead twigs, at the same time trimming

the tree to shape. Large wounds caused by the removal of thick branches take a long time to heal and are always dangerous.

The fruit when ripe should be cut with care and taken into the fruit room for some days before it is consumed. It should be then perfectly ripe, or rather over-ripe, with its pulp in a melting condition, so that it can be taken up with a tea-spoon like jam or jelly. When in this overripe condition the rather resinous after-taste of the fruit is less objectionable. In Japan the fruit of the kaki is matured or "seasoned" by storing it for a few days in casks which used to contain Japanese beer, and it appears that by this process the fruit parts entirely with its astringency and resinous taste.

The tree is subject to attacks of the scale-insects *Lecanium Oleae* and *Ceroplastes Rusci*. An undetermined species of fungus causes an early shedding of the foliage, by attacking and killing the tips and margins of the leaf ; and an undetermined microbe often installs itself on large wounds of the stem and branches, and provokes the exudation of a dark, viscid liquid, which retards the healing process and may favour the development of canker. For this reason all wounds exceeding one centimetre in thickness should be protected by painting over with tar. However, the chief enemy of the kaki is the fruit-fly (*Ceratitis capitata*) which punctures the fruit and destroys it, just when it begins to show colour. The only way to preserve the fruit from the attacks of the fly consists in putting it into light cloth bags in the same manner generally practised for pears and other fruits.

The following are the principal sorts of Kaki cultivated here and there in gardens and orchards.

1. KAKI (type). This is the typical variety, bearing apple-shaped fruits, 5 to 7 c.m. in diameter, with a lively orange-coloured rind, and deep yellow pulp.

2. **COSTATA.** Fruit very large, usually ribbed, round or slightly spheroidal, 6 to 9 c.m. in diameter, bright orange.

3. **HAKIYA.** Fruit very large, nearly round, of uniform size 8 to 9 c.m. in diameter. The rind is blood red, and the pulp dark orange yellow.

4. **HIYAKUME.** Fruit large or very large, roundish, with a deep orange yellow rind and pulp. This is one of the best flavoured sorts and is very productive.

5. **GIBOUSHIN.** The fruit is egg-shaped, large or very large, of a dark orange yellow colour. The pulp is orange yellow, very sweet and has a good flavour.

6. **LYCOPERSICUM** or **KURO KAKI.** The fruit is very large, round or slightly oblong, of a deep red colour, and has a deep scarlet pulp.

7. **JOSHIHITO.** Fruit is large, roundish or oblong with a deep yellow rind and brownish yellow pulp of good quality.

THE PAPAW-TREE or MELON TREE.

Carica Papaya Lin. PASSIFLORACEAE (PAPAYACEAE).

Maltese=*papaja*. Italian=*papaia*. French=*papayer*.

The Papaw tree is native of central and tropical America, but is now cultivated in all tropical countries. It is a small tree from 5 to 15 metres high, usually unbranched, but may become branched if the terminal shoot is injured or destroyed. It has a thick fleshy stem and large palmate leaves, not unlike those of the Castor oil plant, but much larger, more deeply divided and borne on a long thick petiole. The tree is dioecious. The male tree has slightly smaller leaves and is more prone to branch. The male flowers are produced in large panicles, the flowers blooming uninterruptedly throughout the summer and autumn. Occasionally among the male flowers there are found one or more hermaphrodite flowers which give origin to undersized fruits. The female tree produces the sessile or short stalked female flowers singly or in pairs at the axils of the leaves and if duly fertilized they all develop into fruits, which are variable in size and shape according the variety to which the tree belongs. An average papaw-fruit is of an oblong pointed shape, slightly angular, about 20 c.m. long, and 10 to 15 c.m. in thickness, deep golden yellow when ripe, the thickness of the flesh or pulp being about 3 c.m., and tastes much like a melon. The fruit encloses a large cavity, to the sides of which the small, round, wrinkled, hemp-like seeds are loosely attached. The ripe fruit is eaten with sugar, and the green fruit is sliced and cooked in many ways. All green parts of the tree exude a milky liquid, from wounds in the bark or the epidermis, which contains papayin, a powerful peptonizing principle, now frequently used in medicine.

The tree being a denizen of the tropics, should suffer no check in its growth, but in these Islands the cold of winter is often too much for it. The growth of the tree is completely checked towards the close of November, and it gradually loses most of its foliage and the vital processes are so much interfered with that it is not resumed until the close of May or later. Unless it is planted in a very sheltered situation and has some protection in winter, the tree generally succumbs after a few years of checkered existence, that is whenever the winter cold happens to be somewhat severer than usual.

The papaw-tree is easily propagated by seed which is sown in March or April, in a shallow pot or pan, and the seedlings may be potted off singly in September, or may be left over in a sheltered place or better under glass, to be potted off in the following May. Potted plants should be kept rather dry, as any excess of moisture will cause them to rot off. In about two years they may be transplanted to their final destination, in May or June, in a soil which has been deeply tilled and manured, and must be watered regularly and liberally throughout the summer. By the end of the 3rd year, at the close of autumn, the young trees usually begin to flower, or they may do so in the following spring. One male tree is considered sufficient for 10 or more female trees, but of course seedlings produce male and female trees in about equal proportion. However, the papaw-tree can be propagated by cuttings, making use of the side shoots which are freely produced whenever the terminal shoot is injured or destroyed. These cuttings are made in summer, the shoots being cut off cleanly close to the stem, the wound allowed to dry for a few hours in order to prevent rotting, a few of the lower leaves are cut off, and the cuttings are planted in sand under a glass bell, and watered sparingly until they are well rooted. In this way female trees of desirable varieties can be propagated.

A method of propagation by root cuttings has been lately evolved in the Phillippine Islands. Medium-sized roots are selected from a full-grown tree, and cuttings are taken 10 to 15 c.m. in length. The nursery bed is made of sea sand about 6 c.m. deep, into which the cuttings are inserted and kept properly moist by frequent spraying. In about four weeks commences the information of adventitious buds, and the root-cuttings soon develop into vigorous plants.

Fruits produced in summer mature in autumn, and those produced in autumn mature in the following May or in June, if they survive the effects of cold weather. The tree agrees well with our soils, and prefers the red soils of rather sandy texture. It was first introduced in 1865, and a male tree long survived at San Antonio Gardens. The papaw-tree was introduced again by Rev. G. B. Spadaro toward 1898 who brought over the seed from North Africa, and seedling trees have fruited in several gardens, but it is now rare, most trees having been killed by cold weather.

THE BANANA.

The edible Bananas belong to the following species:

1. *Musa paradisiaca* Lin. MUSACEAE.
2. *M. Sapientum* Lin.
3. *M. chinensis* Sweet = *M. Cavendishi* Lambert.
4. *M. Fehi* Bert. Native of Tahiti Islands, is easily distinguishable on account of its erect bunch, which is never drooping as in the other species, a feature which is only met with in the banana "Kusaie" of the Hawaii Island. (*M. sapientum* var. *troglodytarum*).
5. *M. corniculata* Rumph. Native of the Malayan Archipelago.
6. *M. simiarum* Rumph. Native of Malacca, Sumatra etc. The last three species have not been introduced in these Islands, and even in their native country they have no commercial importance.

The following brief description of the first three species will be useful for the classification of their varieties.

MUSA PARADISIACA Lin. The 'fig-banana' or 'plantain' or simply 'banana'. French = bananier a gros fruits. The stem is tall, green or light green, rarely blotched purplish black. The leaves are long, and have a long stalk, and the upper surface is always somewhat glaucous. The colour may be green or light green or sometimes reddish (banana Rathkehel), or variegated white as in *M. paradisiaca* var. *vittata*. The plant throws up a large number of suckers, which must be thinned severely. To this species belong most sorts the fruit of which requires to be cooked, as well as the best sorts for the extraction of flour or banana meal, and those which are used in the preparation of fermented drinks or liqueurs. However the species includes also a few varieties the fruit of which is eaten crude and is an excellent dessert fruit. This species

includes those hardy varieties which tolerate the cold more than others, such as the common banana of Sicily introduced here in 1913, which produces a fairly long bunch with fruit of middling size, smooth, curved upwards, floury, with a sweet luscious taste. The so-called St. Michaels banana is another sort with a very tall and very thick stem, and a very large but rather short bunch, bearing very large angular fruits beaked at the end, with a sweet luscious flesh, but somewhat fibrous. This banana which was introduced here towards 1870, is in reality a cooking variety, but is generally eaten raw, and has partly superseded other more ancient sorts which are probably of better quality. These as well as other sorts introduced probably from the east, and known generally as 'fig-banana', and certain varieties introduced from Ceylon in 1914, among which are the Kolikuttu, the Alikehel and the Rathkehel or Red Banana, belong also to the species above mentioned, although the species itself is often considered botanically as a subspecies of the following.

Musa Sapientum Lin. French = bananier figuier. The species is almost exclusively tropical and therefore cannot thrive well in our climate. It is hardly distinguishable from the former species by the following characters. The stem is tall, but sometimes rather dwarf, clad with leaf-sheaths which are always blotched or streaked purplish black. The leaves are long and broad with a rather short stalk, usually deep green, and hardly glaucous on the upper surface, the stalk or petiole being also blotched or streaked purplish black. The sterile flowers drop off as soon as they bloom. It is cultivated extensively in the East Indies, Tropical Africa, the Indian Archipelago, the Hawai Islands etc., and has produced many good varieties, among which is the celebrated Jamaica banana which is a very good sort and probably the best of all tall bananas for trade purposes, as it keeps well and ships well for long distances. Another good sort is the Brazil-

ian banana which has a very tall stem, with the fruit similar to that of our St. Michael's banana, and is greatly esteemed as a dessert fruit, but keeps badly as the ripe fruit drops easily off the bunch and therefore is not suitable for export. The same remark applies to the so called Spanish banana (*M. sapientum* var. *rubra*), the foliage of which is of the same reddish colour as the red banana of India (Rathkehel), but the fruit is reddish or orange red.

It is supposed that the original home of *Musa Sapientum* and of its subspecies *M. paradisiaca* is Southern Asia, or rather the Malayan Archipelago whence they have spread all over the tropical world. Many sorts of edible plantains or bananas are cultivated by the indigenous tribes of tropical Africa, where they often constitute the staple food of those populations, but here also the banana was probably brought over by the first immigrants from Asia.

MUSA CHINENSIS Sweet, or M. CAVENDISHI Lambert or M. SINENSIS Hort. This is the well known dwarf or Chinese banana, native of Southern China and now extensively cultivated in most tropical and subtropical countries. The stem is only about one metre and a half in height, but is proportionately very thick, clad with leaf sheaths which are broadly and intensely blotched and streaked purplish black. The leaves are large, very broad, deep green on the upper surface, spotted or splashed claret or deep red in the young plant; the stalk of the leaf is very short and stout, spotted or blotched with purple or purplish black. The bunch is long, often with eight "hands," sometimes with nine or ten. The fruit is middling in size, smooth, curved upwards, yellow or dirty yellow at maturity, with cream coloured melting pulp or flesh, which is sweet and delicate in flavour, and free from all fibrosity. It is an ideal fruit for the table and for export. The plant resists to cold and to the incle-

mencies of the weather better than the various sorts of *M. Sapientum* and perhaps as well as the most resisting sorts of *M. paradisiaca*. In the Canary Islands the Chinese banana is cultivated intensively and on an extensive scale for export. It was introduced in our Islands towards 1865, and is now frequently grown in our gardens. This banana has given origin to very few varieties or forms, the best of which being that grown in Canary Islands, and this is the form grown in local gardens. A variety of the Chinese banana called Camayenne is cultivated extensively in French Guinea near Sierra Leone on the west coast of Africa, which differs from the banana of the Canary Islands on account of its much larger but fewer fruits, with longer intervals between the "hands", so that the bunch is much less compact and occupies more space when packed for export. Other sorts of *Musa Chinensis* have been noticed in India, South China and elsewhere, but the Canary Islands banana presents so many advantages and is so well received in all markets that it is not worth while to try the cultivation of other sorts which are less known.

Here it may be mentioned that the term *plantain* is given more frequently and more properly to the cooking-bananas, that is to those sorts which require to be cooked before being presented at the table, and the term *banana* is reserved for the true table bananas which do not require cooking and are generally eaten raw, although they are also frequently cooked. Others reserve the term banana for the dwarf or Chinese banana, and call plantains all the tall-stemmed sorts, whether they are eaten cooked or raw. However, the Chinese banana is not the only dwarf banana. In fact there are certain forms of *Musa Sapientum* which are very dwarf, such as the banana *Nou* of the Hawaii Islands, which according to Mrs. F. M. Nakuina hardly exceeds one metre in height. Others make use of both terms, banana and plantain for all species and sorts, without any discrimination or restriction.

In tropical countries the banana continues all the year in active vegetation, maturing its fruit without interruption, but with greater intensity during the two periods of maximum temperature. Hence the first bunch is produced in about nine months after planting, and in the meantime the suckers thrown up grow so fast that they may produce their bunch after a few months, and the production goes on uninterruptedly for several years until the rootstock shows signs of exhaustion and the plantation is renewed. It is therefore hardly to be wondered at that the banana suffers severely when the temperature falls down below 15°C . for long periods. In these Islands when the temperature falls below 20°C . in November, the banana begins to suffer visibly, and active vegetation is stopped when the thermometer marks 15°C . In January or February, with a temperature of 10° or 12°C ., there is an absolute cessation of all activity, the foliage already torn into shreds by the storms of autumn, dies off, with the exception of the two or three inner leaves which continue to resist, and generally do not dry before the resumption of active vegetation in the following spring. In severe winters with long periods of cold winds or frosty mornings, the stem of the plant may die down to the rootstock, this injury being more noticeable in March or towards the close of winter, and the plant will then take a longer time to recover, showing no signs of activity before the close of May. For these reasons an extensive cultivation of the banana in the open is not possible in these Islands, but the plant vegetates very well in favourable situations, sheltered from wind, such as the yards of country-houses, the walled gardens of Citrus trees, old quarries, and also the low-lying open fields which are well protected from the north and west winds. However, even in such situations the plant suffers from the suspension of vegetative activity in winter and early spring. The finest bunches are those which are formed from June to August when the plant is full of vegetation, and can mature in

autumn before they undergo the adverse influence of bad weather and cold, owing to which the fruit maturing in winter or early spring has a poor appearance and is deficient in flavour. For the same reason a plant which has reached full development in autumn but had not time to form the bunch before the arrival of cold weather, suffers so much from the destruction of its foliage that the bunch which is produced in spring is comparatively small and always defective. There are few favoured localities in these Islands where the banana can keep most of its foliage during winter, with the result that active vegetation is checked but not altogether suspended, and in these localities the production of fine bunches proceeds with hardly any interruption, and the cultivation of banana though necessarily on a small scale, is very remunerative. The optimum of temperature is from 25° to 30° C. in the shade, and when this temperature is exceeded, and the solar radiation as shown by the solar thermometer goes up to 65° C., the foliage may become partly or wholly scorched, particularly if the weather is calm and sultry, and irrigation is not properly attended to.

The banana requires a loose and porous soil, fairly deep and well moist, but without stagnant humidity. The plant grows well in our porous red soils, which are always somewhat sandy and are generally well drained. A certain degree of salinity of the soil is not injurious to the development of the banana, and the presence of much organic matter, such as leaf-mould and stable manure, is decidedly beneficial, because it keeps up the soil well open and supplies the potash and nitrogen in sufficient quantity to maintain the luxurious vegetation of the plant.

For commercial purposes the dwarf or Chinese banana is preferable to all others, being a good table fruit and well productive, and both the plant and the fruit are fairly resistant to cold and to the inclemencies

of the weather. The fruit also keeps long in good condition and ships well. The tall banana of Jamaica is probably the best of the tall-stemmed sorts from the commercial standpoint, as it possesses all the qualities of the Chinese banana, but it has not been introduced in these Islands and is not likely to bear well the cold weather.

PROPAGATION. The cultivated edible bananas do not produce seed, or do so very rarely, and are propagated exclusively by suckers and by truncheons or pieces of the rootstock or base of the stem having a bud or suckers in process of formation. Only the strongest suckers should be selected for propagation, preferring those which are 15 to 20 c.m. high, for the dwarf banana, and about 30 c.m. for the tall sorts, which have not yet developed the leaf blades, and therefore have a conical shape surmounted perhaps by one or more petiolar prolongations of the leaf sheaths. The suckers are separated from the mother plant by a clean cut, and are taken up with care in order to preserve the few roots which they may have, but are equally good even if they have no roots at all. The suckers are allowed to remain for a few hours in the shade, so that the wound may dry. Suckers are best transplanted in April or May, but the operation may be done with success also throughout the summer and early autumn. It is almost a general practice with planters to cut back the suckers to within a few centimetres from the base, taking care not to injure the central bud or plumule, so that when planted the suckers are entirely covered with earth; but this operation is not necessary except in the case of weak suckers or of suckers which have already formed the leaf blades.

Propagation by means of truncheons of the rootstock with one or more likely buds, is best done in the course of summer from June to September. For this object it is possible to make use of the plant which has

fruited, cutting down the stem about 10 c.m. below the base of the leaf sheaths, and cutting off the leaf sheaths just above their base, and then with a cross cut the base or rootstock is divided into four parts, reserving at least one likely bud for each part. These pieces or truncheons are allowed to remain in the shade for two or three days, so that the wound may dry, and then they are planted.

The suckers are planted at a depth of 15 to 20 c.m., and the truncheons are planted at the same depth, with their buds directed upwards, and are watered lightly every other day or twice a week until the young plant begins to grow, and it is necessary that the wound of the sucker or of the truncheon be not placed in contact with the fresh manure of the soil, in order to prevent the possibility of rot.

Suckers or truncheons of the Chinese banana are planted from two to two and a half metres apart, but the tall bananas, especially the large growing sorts, are planted at a greater distance up to four metres apart or more. The distance between the rows should be from four to six metres, according to the expected development of the plant and its suckers. In about three weeks the newly planted truncheons or suckers will have resumed active growth, and should be watered more abundantly at first twice a week, and then once a week, increasing gradually the trough around the plant to suit its development.

CULTIVATION. Having made the selection as to the sort which is to be planted, the planter should limit his attention to that sort only, so that the produce may be of uniform quality, which is an essential condition for success. The best period for planting is from the beginning of May to the middle of June, when the plant has resumed active growth, and there is yet a long stretch of warm weather for the plant to become properly established before winter. Towards the end of the

first summer or early in the second, the plant in its turn begins to produce suckers, and these may be stronger than the mother plant. If the plant is exceptionally vigorous two suckers may be allowed to remain, and the others are removed and made use of for new plantations, but as a rule it is better to leave only one sucker in the first year. However after the second or third summer the plant if strong enough may be allowed to retain three or four suckers including those which are in fruit or about to fruit, otherwise their excessive number may weaken the plant too much to produce bunches of good commercial size. All dry foliage should be removed, cutting it away without injuring the living tissues.

The formation of the bunch may take place at any time during active growth. Should it appear too early in the growing season, especially in the case of the Chinese or dwarf banana, the bunch will be comparatively small, with few and small fruits, thickly set together, and the stalk of the bunch is often so short that the bunch remains in a semi-erect position, partly wrapped up in the new foliage, and therefore very liable to rot. To avoid this danger it will be necessary to open up the foliage without cutting it, or cutting off only just enough to admit air and light. When the banana is about to fruit, it forms a swelling at the upper part of the stem, which is due to the presence of the bunch already formed and in course of active development. The last leaf is generally shorter than the others, and this is followed by the floral leaf or spathe which is very short and acute and wraps up the bunch, coming out and unfolding along with it. As soon as the bunch appears it begins to bend downwards with the flowers still closed within their purplish green bracts, but these soon expand showing the fertile flowers united together in "hands" or secondary clusters, with the fruit already half developed. In the case of the edible bananas no fertilization is neces-

sary, as the fruit never or very rarely contains any seeds. The number of fruit clusters in each bunch is in proportion to the vigour of the plant, but they rarely exceed nine or ten, although the bunch continues to expand its bracts and small clusters of abortive flowers for an indefinite period. However, there are certain varieties in Ceylon, Malacca and the Malayan Archipelago, such as "King of Thousands" and "Elephant's Trunk," the bunch of which goes on producing clusters of small but perfect fruits, so that the bunch becomes very long, and ultimately often reaches the ground.

This indefinite formation of bracts and sterile flowers may be detrimental to the full development of the fruit, and therefore it is often recommended to remove this terminal cabbage or head of bracts. This removal should be done with care in order not to provoke a prolonged flow of vital sap which may exhaust the bunch worse than the useless formation of sterile flowers. The terminal head should therefore be allowed to remain until there is an interval of about 10 c.m. between it and the last "hand" of the bunch ; the stalk is then tied tightly just over the bracts so as to obstruct the flow of the lymph, and the head of bracts is sharply twisted round and cut off. The result of this operation is to retard the ripening of the fruit, and to improve its size. When the flowering period is over the remains of the perianth or flower will dry, and unless they are removed will keep sticking to the end of the growing fruit, and in wet or moist weather will rot and may cause the tender fruit to rot wholly or in part. These remains should not be removed before they are well dry, and then they are easily picked off by hand without causing any injury to the fruit. The bunches which are formed late in summer or in autumn are exposed to injury from hail which usually accompanies the stormy weather of autumn. The small hailstones will produce whitish or greyish spots on

the fruit, which afterwards become black, owing to which the commercial value of the bunch is greatly reduced. To avoid this injury it is advisable to screen off the bunch by joining or tying together two leaves so as to form a shelter for the bunch, without touching it. It is also sometimes necessary to prop up the stem which is bearing a heavy bunch to prevent its being blown down and destroyed in stormy weather.

The bunch is cut some time before maturity. If allowed to ripen on the plant it keeps badly, is exposed to the depredations of birds and rats, and does not develop its flavour and its luscious quality so well as when its harvesting is anticipated. For local consumption the bunch should be cut as soon as the first fruits show signs of turning yellow, and is hung up in a well ventilated room to complete its maturity. Bunches produced in August or September, and therefore maturing late in autumn or in winter, should be cut when the upper fruits begin to take a clear green colour, as the process of ripening will be started and completed better under cover. The bunches which are intended for export should be cut earlier, in order to avoid the danger that the fruit may ripen during transit, with consequent loss in damaged or rotten bunches. In this case it is desirable to cut the fruit so that it may ripen soon after reaching destination as then it will keep better and will be more acceptable to the retailer.

The vigorous growth of the plant of the banana necessarily implies a rapid exhaustion of the soil, which must be made good by manuring rather heavily. The dry foliage if not appropriated for useful purposes may be burned and the ashes returned to the soil which will thus regain the greater part of the non-volatile material which it had lost. This dry foliage may be utilized as bedding for the stable or cow-shed, and having imbibed much fertilizing material may be submitted to fermenta-

tion and then returned to the soil as organic manure. However a proper method of manuring will be indispensable. Farmyard manure is a complete natural fertilizer. Pigs' manure if obtainable in sufficient quantity is better, containing more nourishing substances, and being always well consumed is less liable to provoke acidity in the soil. A surface dressing of manure should be given in spring (April-May) and again in autumn (October-November), each time at the rate of 25 to 50 kilog. for each plant or clump. For the autumn manuring it is advisable to make use of new manure mixed with much vegetable refuse, the object being to supply fermentable material to retain and increase the heat of the soil. The surface dressing of spring is associated with deep digging, which is replaced by trenching to a depth of 15 to 20 c.m. every second or third year, and therefore it will be advisable to make use of manure which has been well rotted. For light porous red soils it is very desirable to make use of wood ashes or of ashes from refuse incinerators, which contain much potash and may be considered as a valuable potassic manure. Wood ashes are best applied every second year in addition to the ordinary dressing of stable or farmyard manure, as a surface dressing in spring at the rate of 2 to 4 kilog. per plant, and should be strewn on the soil one or two days before watering, so that if they still contain any caustic potash this may be acted upon by the carbon dioxide of the atmosphere and transformed into carbonate of potash before it comes into contact with the roots.

Chemical manures are very useful as a corrective of the soil, as they furnish in a highly concentrated and readily assimilable form those substances which are required for the well being of the plant. Superphosphates and Thomas's slag finely powdered may be applied in summer when the plant is in active growth, about one month or six weeks after the spring dressing of organic manure. Our soils always contain a good

percentage of phosphates which are supplemented by the phosphatic salts contained in the organic manures, but it has been shown by experience that the use of phosphatic manures at the rate of one kilo per plant given in June or July promotes a vigorous growth. Where the soil has had a good dressing of farmyard manure the use of nitrogenous manures will not be necessary, but a deficiency of organic manure may be made good by the use of nitrogenous manures at the rate of $\frac{1}{2}$ to 1 kilo according to their nitrogen value, as a surface dressing in summer immediately before watering.

Whenever there is a deficiency of potash in the soil the vegetation may appear normal but the bunches will fail to form or are formed very irregularly. This deficiency should be corrected at once by a supply of wood ashes or of potassic manures such as chloride of potash or kainit at the rate of 1 kilo per plant, giving at first $\frac{1}{2}$ kilo in spring and another $\frac{1}{2}$ kilo in summer. The yellowish or sickly colour of the foliage may be due to cold weather or to a deficiency of moisture in the soil, and if it is observed in summer and cannot be ascribed to want of water then it is certain that the soil is deficient in nitrogen, and it will be necessary to give at once a liberal dressing of farmyard manure or to make use of the nitrogenous fertilizers above mentioned.

Irrigation is by far the most important cultural requirement of the banana, and before attempting to grow this plant the grower should be sure that he can obtain an adequate supply of water for his plantation. In the second or in the third year the plant of the banana will have reached its full development with several large suckers, and will then require its full allowance of water. Watering is done every ten days in April and May, at first lightly and afterwards more liberally. From June to August the plantation should be watered every week, and again every ten days from September

and until the soil is well soaked by the rains of autumn. Should the weather again become too dry in November it may be necessary to resume watering. It is held generally that a banana plantation requires on an average at least four cubic metres of water for each plant or clump during the dry season, and therefore area for area, a banana plantation requires for irrigation at least twice as much water as an orange grove.

Very brackish water is injurious to the banana, but the plant thrives well on water containing a moderate percentage of chloride of sodium which would be decidedly injurious or fatal for other plants such as strawberries and rosaceous plants generally. It is also known that the banana cultivated in the yards of rural dwellings seems to thrive all the better if watered occasionally with the soap suds of the household, which of course contain an excess of soda salts. Hard water containing an excess of carbonate of lime in solution is injurious to the banana as well as to most other trees and plants. Such temporarily hard water is ordinarily pumped from the deep strata of calcareous rocks, and should be allowed to rest for a day or two in open tanks to deposit the excess of lime and to become properly aerated, before it is made use of for irrigation.

The plant of the banana or rather its rootstock, if properly cultivated, will continue to yield good returns for many years, but in the meantime the suckers will have spread all round, so that the plantation will assume an irregular aspect, and cultivation becomes difficult. Moreover after the third or fourth year the formation of suckers does not proceed with regularity, and the production of bunches cannot be timed properly for the purpose of exportation. Therefore the grower will find it convenient to renew the plantation after a period of five to seven years. When this course is decided upon the land is sown thickly with a crop of some leguminose

plant, such as peas or vetches, in January, and in spring when the leguminose plant has reached full development and is in flower it is digged in, in order to enrich the soil with the nitrogen fixed by the plant in its roots, and also with the organic matter resulting from the decay of its foliage. Later on the land is trenched, burying all the dry foliage of the banana, manuring and levelling properly. During this operation the grower will reserve from the old plants the suckers required for the new plantation, selecting the best available, exceeding in number that actually required by about 10 per cent., so that he may have a margin for selection or to make good for possible failures.

DISEASES.

These are remarkably few, considering that the banana has been cultivated in most tropical and subtropical countries from the dawn of history. The fungus *Marasmius semiustus* Berk. et Curt. attacks the foliage and the stem of weakly plants, and attacks also the immature fruit, and even the bunch which has just flowered. It also attacks the bunch while yet within the stem so that it comes out black and rotten. It is probable that the infection takes place through wounds at the base or rootstock, particularly through the wide wound which is necessarily made when a stem which has fruited and matured its fruit is cut down. The infection then spreads to the lateral suckers travelling upwards within the stem, killing the tender foliage in process of formation, and destroying or damaging the growing bunch more or less severely. This disease is found in most countries where the banana is cultivated, and is probably identical with certain cases of black rot of the bunch and foliage which have been noted in spring and autumn on the dwarf banana grown in local gardens. The banana-blight of South Africa is probably another

form of the same disease. As a preventive and partly curative remedy against this disease in South Africa the banana has been sprayed with Bordeaux mixture with encouraging results. It is necessary however, to burn and destroy the infected plants, and before replanting it is advisable to trench deeply and to see that the soil is well drained, and then to plant, cultivating the young plantation with the utmost care in order to keep up the plants in full vigour and perfect health. The wounds caused by the removal of decayed stems may be cut clean and allowed to dry for a few hours, and then powdered over with flowers of sulphur containing 3 to 5% of sulphate of copper, or with charcoal dust mixed with slacked lime and flowers of sulphur.

Another disease is the *anthracnosis* of the banana, known in Australia by the name of "black smut", and is due to *Gleosporium musarum* Cke. and Masee. This disease attacks the ripe or ripening fruit transforming it into a soft black mass, but it always appears sporadically, and so far has not caused serious trouble. The infected fruit should be burned, and the fruit room should be disinfected before taking in fresh bunches from the plantation. The disease is not known here, and should not be confused with the blackening of the over ripe fruit, which is a purely physiological process, perhaps attended or promoted by the presence of saprophytic fungi, but has nothing to do with black smut.

A species of *Fusarium* has been noted on the banana in the Hawai Islands, (Higgins, the Banana in Hawai, 1904, page 31.). The fungus attacks the central part or heart of the plant, discolouring or blackening the young tissues, and proceeds from above downwards, being probably carried from one plant to another through the punctures caused by insects, but does not seem to spread directly to the young suckers or to neighbouring plants. The infected stems should be destroyed, as it is

not likely that they will recover, and may become a source of infection to healthy plants by means of the intermediary action of insects.

A disease common everywhere in tropical America, where it is known by the name of "Banana wilt" or "Panama disease" has been ascribed to *Fusarium cubense* Smith. This fungus is probably identical with that of the Hawaiian Islands, and at any rate the disease is said to be common also in India, Australia and the Dutch East Indies. It is considered as very injurious, causing widespread destruction of young or immature plants. Fully grown plants with diseased stems produce a sickly and undersized bunch which is commercially worthless.

Other fungi are found on the dry foliage, on the dead stems or on decaying fruit, but they are essentially of saprophytic nature, and are of no practical importance.

The injury caused by rats and snails is too well known, and these pests should be kept in check, otherwise many a bunch will become too damaged or disfigured to be saleable. The fruit fly (*Ceratitis capitata* Wied.) sometimes attack the fruit which has been left to ripen on the plant, but as the bunch is generally taken into a dark fruit room when yet green, the fruit fly is not allowed much scope for action. The larva of a beetle, *Geotrupes laevigatus* F. is found frequently feeding on the base of the stem just beneath the surface of the soil, and the plant may succumb if there are several larvae feeding upon it. The larvae of various species of beetles have been found within the stem of the plant in tropical countries, and may cause important havoc in large plantations.

The banana-borer (*Cosmopolites sorditus*), is a beetle common in the banana plantation of Java, Fiji Islands, Jamaica etc. It attacks the stools or rootstock of the banana and is very destructive. In Java it is kept in

check by a histerid beetle (*Plaesius javanus*), and colonies of this beetle have been imported into Jamaica and the Figi Islands to combat the banana borer which seems to be little affected by the usual methods adopted to fight parasitic insects, and is hardly less destructive to plantations which are properly cultivated. The introduction of this pest in a banana growing country should be carefully avoided.

The larva of a moth, *Castina licus*, has been found boring into the stem of the plant in Trinidad. Certain *Acari* and *Aphides* have been noted frequently on the young foliage and fruit, and if the attack persists for some time the growth may be checked and the fruit disfigured, but these parasites if at all troublesome will disappear completely by spraying once or twice with a good insecticide, such as kerosene, abol, tobacco-juice, solutol etc. The scale insects *Lecanium Oleae*, *L. hem sphaericum*, and also *Dactylopius Citri*, are frequent on the foliage and fruit of the banana, but the infestation is never so severe as to require a special treatment as in the case of Citrus trees.

THE PRICKLY PEAR.

Opuntia Ficus-indica Mill. CACTACEAE.

Maltese=*bajtar ta Ghindia*, *bajtar tax-xeuc*. Italian=*fico d'India*

French=*figue d'Inde*.

The Prickly Pear in its wild or half wild forms is native of America from Equador to Mexico, and is probably derived by cultivation from *Opuntia Tuna* Mill. which is also native of that region, but is now extensively cultivated and naturalised in all regions bordering the Mediterranean. The prickly pear is a strange looking small tree from 3 to 6 metres high, obtrusively familiar everywhere in these Islands, with flat articulate, leafless branches or "joints", which have on both sides and along the margin at regular intervals, cushions of small short bristles, commonly miscalled *spines*, and sometimes one or two spines (1 to 2 c.m. long) springing from the centre. The cushions of bristles represent the buds, and in the young branch a small cylindrical fleshy leaflet is always present just below the cushion, but soon dries and drops off, being superseded in its physiological function by the green coloring matter or chlorophyll of the fleshy branches. The flowers bloom in April and May, and in the sunshine the stamens are irritable, closing quickly on the pistil when touched by an insect or by any other foreign body. The fruit is a berry, surrounded at regular intervals, as in the branches, by small cushions of short stiff bristles which are easily brushed off. These cushions are abortive buds, and may be sometimes normal buds from which another fruit or branch may develop. The fruit may be yellow, white or red, and is largely eaten chiefly by the poorer classes, but usually contains too many hard seeds to be appreciated. The pulp is sweet and refreshing, and but

for the presence of these hard seeds which are not easy to separate, the prickly pear would rank as a most palatable and useful summer fruit. On account of the high percentage of sugar which it contains the fruit is often used to fatten swine, and the peel of the fruit which is also rich in sugar is fed to swine, sheep, goats and cattle. The tender and fleshy branches being practically spineless, are sliced and fed to cattle, sheep and other animals, and in our climate with a long and dry summer, when no green forage is available, they afford a most welcome change, given alternately with grain or dry forages.

The prickly pear grows in all situations and in all soils, even the poorest. It is usually planted in odd corners where nothing else can grow, or on rocky lands where the soil is too shallow to permit the cultivation of other trees or of field crops. It is commonly planted around farmsteads where in a few years it makes a shaded run or yard for poultry, and its fleshy branches are always at hand for use as forage in summer. In the close neighbourhood of the farmstead the prickly pear has the advantage of an abundance of fertilizing material and perhaps also of a more moist subsoil, and hence it makes fast growth and the fruits are larger, more luscious and sweeter. However the tree grows anywhere and it is not uncommon to see a fine prickly pear growing on a mound of stones or on a stone wall as a result of a branch thrown there accidentally some years before.

The tree lives for 50 years or more, but old trees become unproductive, and the few fruits produced by them are always too full of seeds, particularly if they are produced on the stems or on old wood. The fruit is considered at its best when the tree is from five to twenty years old. It matures and is consumed gradually during the summer from July to October, and keeps long and well if properly handled. As a rule only one crop of

flowers is produced in April or May, so that the fruit is practically of the same age, but by removing all the fruits as soon as the flowers have faded, and watering the tree once or twice in quick succession, a smaller crop of flowers is produced in June or early in July, which matures in autumn. These autumn prickly pears are usually larger in size, and have an elongated or pear-shaped form, and as they contain comparatively few seeds, they are in great demand and fetch a good price.

PROPAGATION. It is probable that the numerous forms of the prickly pear, bearing round or elongated fruits have originated as chance seedlings, and such seedlings are frequent in neglected corners of gardens or fields, but the prickly pear is never propagated intentionally by seed, and is not advisable to do so except for the purpose of raising new varieties. The seed saved from perfectly ripe fruits should be stratified with sand and leaf-mould in a box or pot and kept fairly moist to soften its hard covering. It is sown in the following April or May, in soil which has been well manured, or better in a mixture of sand, leaf-mould and rotten manure. The seed germinates partly during the summer, and the remainder in the following year. The seedling has small fleshy lanceolate cotyledons, and slowly develops a slender fleshy stem, which gradually increases in thickness and may branch in the following year. The seedlings may be potted off singly when they are about 5 c.m. high, and transferred to the ground when they are two or three years old, and have reached the height of about 50 c.m. These seedlings will fruit when they are six to eight years old, but instead of waiting so long to ascertain the quality of the fruit, a branch or joint may be grafted on an older tree, and it will probably fruit in the following year.

The prickly pear is always propagated by cuttings taken from the extremities of the branches. The cutting

may have from one to four or five joints, and may be single or branched, but it is better to select unbranched cuttings with three joints of which the lowest and the lower half of the middle are interred, the upper half of the middle joint and the third or upper joint remaining above the ground to form the new tree. The third or upper joint may be double, so that there may be two joints growing out of the middle joint instead of only one, but a larger number of joints may cause the cutting to become top heavy and bent down, and a crooked stem will be the result. The cuttings will root at any time, but the common practice is to plant them about mid-summer. A hole is made in the ground, from 50 c.m. to 1 metre wide, and about 30 c.m. deep, it is well watered by hand, and when the water is absorbed two cuttings are inserted, directed slightly outwards, one on each side of the hole, and the soil is filled in to its former level, so that the lower joint and half of the middle one will be covered with soil. The cutting will root in a few days, without requiring any further watering or other attention. The cuttings should be prepared a few days before, and allowed to dry a little, spreading them close to the hole where they are to be planted. This treatment is necessary to cause the wound of the cutting to heal, and prevents the possibility of rot, besides securing a quicker formation of roots. However, the extreme hardiness of the prickly pear is proverbial, and cuttings made at any time, even in winter, seldom fail to establish themselves, and indeed cuttings taken in spring with the flowers on, or just fading, strike root at once and the fruit goes on with its development and in due time matures as if nothing has happened.

Of course, the prickly pear can be propagated by grafting either on itself or on other large species of *Opuntia*, such as *O. Tuna*, *O. maxima*, *O. polyantha*, *O. brachyarthra* etc., but this method of propagation presents

no advantage whatever and cuttings strike root so easily that it is not worth while to grow the tree by grafting. The amateur may like to have a prickly pear bearing two or more sorts of fruits, and in that case he has only to cleave deeply by means of a sharp knife the upper edge of a joint, and to insert in the cleft the lower end of a terminal joint cut obliquely on both sides like a wedge, completing the operation by tying the scion firmly on the stock with a bit of twine.

CULTIVATION. The prickly pear can be transplanted with the greatest ease and with little risk of failure, at any time from March to October, but as cuttings strike root with equal certainty and become fully established in less than four weeks, nobody thinks of transplanting a prickly pear, but plants the cuttings in the spot where they are to remain. The pockets in which two or three cuttings are planted as above stated should be made at least 4 metres apart, with a distance of 5 metres from one row to another, and the general practice is to leave the cuttings to take care of themselves, and in reality no further attention is required to ensure success. The soil may be hoed in winter and again in spring, and a top dressing of manure every four years will keep the tree in full vigour and the yield of fruit will be larger and of better quality. A mulching of road dust or road sweepings and wood ashes is very much liked by the prickly pear, and the sandy and porous road dust which is usually rich in fertilizing material, soon becomes permeated by a greedy mass of rootlets.

The tree's resistance to drought is well known, the moisture stored in the fleshy joints or branches being sufficient to bring the fruit to maturity even if the soil and subsoil are perfectly dry, but on fairly moist lands the production of green joints for forage, and also of the fruit, is much larger. The size and the quality of the fruit is improved by watering the tree twice or thrice in July and

August. Watering is also necessary for the production of an autumn crop of fruits, and for this purpose the fruit of the normal crop is completely plucked or cut off with a knife as soon as the blooming period is over, and the tree is given a good mulching of manure and liberally watered once or twice. This treatment causes the tree to produce a second crop, the fruits of which though less numerous, are larger and better than those of the first crop, and mature in autumn, generally keeping in good condition throughout the winter.

The fruit intended for immediate consumption is plucked or twisted off by the hand. It is generally picked at sunrise when the spiny bristles are yet soft by the morning dew and do not give much trouble, the fruit being taken in hand by a piece of thick cloth and sharply twisted round. It is often placed in water to cool before use, at the same time brushing off the short spines with an ordinary painter's brush. If the fruit is cut very close to the joint, or with a small bit of the green tissue of the joint attached to it, and kept in a dry place it will keep in good condition for several weeks.

The following are the cultivated sorts of the prickly pear :—

1. THE RED PRICKLY PEAR. (Maltese=*bajtar aħmar*, *bajtar Ingliŝi*). The fruit is generally much elongated and of a purple red colour. The pulp is uniformly crimson red and fairly sweet.

2. THE YELLOW PRICKLY PEAR. (Maltese=*bajtar isfar*, *bajtar Malti*). The fruit is barrel-shaped, or elongated, greenish yellow shading to nankin or apricot. The pulp is deep yellow shading to nankin, sometimes with red or reddish streaks close to the peel. It is very sweet. There is a form with plump, roundish fruits, the pulp of which is sweeter.

3. THE WHITE PRICKLY PEAR. (Maltese=*bajtar abjad*, *bajtar Francis*). The fruit is barrel-shaped, oval or elongated, plump, greenish white, sometimes shaded yellow or streaked reddish. The pulp is white or greenish white, often streaked yellow or reddish close to the peel, generally not so sweet as the yellow forms, but sweeter than the red variety.

4. THE LARGE DEEP YELLOW PRICKLY PEAR. (M.=*bajtar lanchè*). The fruit is oval or elongated, more or less pear-shaped, and larger than other varieties. The peel is thin and its colour is nankin yellow, shaded and streaked purple red. The pulp is nankin yellow, generally with purplish red streaks close to the peel. It is luscious and very sweet. This and the next two sorts are forms of the yellow variety.

5. THE SEEDLESS PRICKLY PEAR. (Maltese=*bajtar ta bla zerrigha*). The fruit is quite like that of the typical elongated yellow variety, but contains few seeds. This sort originated at Siggieui.

6. THE SMALL SEEDLESS PRICKLY PEAR. (Maltese=*bajtar irkiek*, *baitar ta zergha seuda*). The fruit is oval in shape, and small or very small. In colour and other qualities it is like the yellow variety, but contains very small black soft seeds, which are less objectionable than the large hard seeds of other sorts. However, the fruit although very sweet, is too small to be appreciated. This variety originated in the eastern part of the Island, probably of Zeitun.

DISEASES.

Didymosphaeria opulenta Sacc. attacks the fleshy joints in winter and early spring, causing yellowish brown blotches with a rounded outline and minute black dots. It is probable that the starting points of the fungus are the small excoriations of the *epidermis* caused by showers of hail in autumn. However the infection is rarely so

extensive or so acute as to constitute a danger. Attacks of gangrene due to a species of bacterium sometimes develop in autumn in the wounds caused by hailstones, and whole branches may rot off as a result of this disease, particularly if its development is favoured by a spell of moist and sultry weather. The scale insect *Aspidiotus Hederae* Val. is common on prickly pears, but never causes serious trouble. The fruit fly *Ceratitis capitata* Wied. punctures the fruit in August and September, and too often a considerable proportion of the crop is destroyed by this pest.

THE DATE PALM.

Phoenix dactylifera Lin., PALMACEAE.

Maltese=*Palma*, *palma tat-tamar*. Italian=*palma a dattero*.

French=*palmier*.

The Date-palm is native of India, Persia and Arabia, but its cultivation as a fruit tree has spread to all Northern Africa, where it is naturalized, and also to Spain. It is frequent in Southern Europe as well as in Syria and Asia Minor, where it is planted as an ornamental tree on account of its majestic habit, rather than as a fruit tree. Its cultivation as a fruit tree has been attempted with encouraging results in the hot desert regions of North America. It is grown in these Islands exclusively for ornament, although it occasionally matures its fruit, and the old and tall palm trees grown in the outskirts of villages, with their crowns of dull green leaves silhouetted on the blue sky have a charm of their own and enhance the oriental effect of our terraced architecture. Very good dates are produced in the region of the Persian Gulf and in India, as well as in Egypt and Libia, where there are also excellent varieties of dates which do not dry, and are consumed fresh from the tree ; but the real home of the commercial date is in the oases of Algeria and Tunis, particularly in the oases of Biskra and Ourlana. The commercial palm-groves of Algeria and Tunis consist largely of the well known variety called *Deeglat-noor*, which is justly considered as the best commercial date in existence. The two sorts called *Mena-heer* and *Salatny*, also of Algeria and Tunis, are said to be superior to the *Deeglat-noor* in size and flavour, and no doubt will be largely cultivated in the future, but they are yet too rare to be of any commercial importance.

The oasis always consists of a natural depression in the desert, of variable extent, with natural springs, or with the underground water at no great depth and is therefore easily raised to the surface by primitive methods. The oasis is often enlarged by extending the depression in the sand, and is kept up against the encroachment of the wind by the untiring activity of the inhabitants. The summer temperature is generally over 30° C and the sky is always clear, the desert region being rainless or practically rainless, and there is little danger of autumnal rains or of any excessive degree of atmospheric moisture in September or October, which would affect the crop of dates very seriously and prevents it from ripening properly. According to an Arab proverb the date palm must have its feet in the water and its head in the sun. Under these circumstances it is no wonder that generally speaking the date palm cannot mature its fruit in these Islands, notwithstanding that the flowers had been properly fertilized, and the fruit has a well formed seed or stone quite capable of germination. There are a few date-palms which mature their fruit tolerably well, to be eatable either raw or cooked into sweetmeats, but owing to climatic conditions all attempts to grow the best Algerian and Tunis commercial varieties have ended in failure, although it is not unlikely that certain very early sorts would be more successful, such as the *Rhars* of Northern Tunis, which should mature its fruit before the commencement of the rainy season.

The date palm is dioecious, the sexes being on separate trees. One male tree is considered sufficient to fertilize at least 200 female trees. Under natural conditions the pollen is carried by the wind at considerable distances, sometimes miles apart, provided of course that at the flowering time the direction of the wind is from the male tree to the female tree. Several species of insects act also as pollen carriers for the date palm but

in the palm-groves fertilization is performed artificially as an ordinary detail of cultivation. It is not possible to distinguish between the sexes in young seedlings but when the foliage has developed to its full size, and the stem has commenced to form, the difference becomes more marked, but it is never certain before the actual appearance of the flower blades. The female tree usually has longer leaves with longer and more regular leaflets or segments, and the spines on the lower part of the petiole or leaf stalk are generally dark brown at the tip, and usually directed upwards making an acute angle with the leaf-stalk and sometimes almost in touch with it, instead of being divaricated at a right angle and directed partly inwards and partly outwards as in the male tree. The flower blades of the female are long and slender, those of the male being more plump and much shorter.

PROPAGATION. The date palm is propagated by seed or by suckers which are thrown up around the base of the stem during the first thirty years of the life of the tree. Like most fruit trees, the date-palm sometimes comes fairly true from seed, but it is liable to considerable variations, in most cases the fruit of seedling trees being quite useless. Besides, about half the number of seedling trees will be males, which of course are only useful as fertilizers. The seeds or stones may be sown in a pan or shallow pot in February or early in March, and germination takes place in four to six weeks. The young seedlings are planted out separately in small pots in April of the following year, or in autumn. If allowed to remain longer the roots will become so tangled together that it will be impossible to separate them without injury. The palms may be reared in pots shifting them from one pot to a larger one every year or two, but they can be grown in the open ground whence they can be transplanted in October or in April-May. Seedling

palms commence to bear flowers and fruits when they are seven or eight years old, and continue to bear fruit until the age of 80 to 100 years, when they cease to be productice, but if allowed to remain will continue in apparently healthy condition for many years more.

Palm trees of any size can be transplanted with comparative safety if the operation is done with due care and at the right season, that is from March to May, or from September to October ; and it is also possible to transplant them in full summer, if the heart-leaves are well protected from the action of the sun's rays. In any case the outer leaves should be removed ; leaving only the central undeveloped leaves and those immediately around them, and the tree is taken up with a large ball of earth and transferred at once to its final destination, where it should be planted at least 10 c.m. deeper than in its former position, packing the soil quite tight all round. Large trees with a tall stem should be planted deeper by 20 to 30 c.m. with the object to induce an abundant formation of new roots from the stem at a higher level than those already existing. Without this necessary precaution failure will be more frequent than success. As an additional precaution, particularly in the case of large trees transplanted in summer, from May to September, it is advisable after removing the outer leaves, to bind up the inner leaves together, over the central or heart-foliage, and to cover the whole rather tightly in a fusiform mass, by means of a piece of canvas or sackcloth. This covering of canvas is kept on the tree for three or four months and is removed, late in September on a cool or cloudy day, so as to avoid injury by the sun to the tender and half-bleached foliage. In this manner I have transplanted with perfect success a number of large trees with stems varying from 2 to 10 metres high. Newly transplanted palm trees should be watered every eight or ten days during the first summer,

and as they take about two years to establish themselves properly they should be well watered also throughout the hot season in the following year.

In all the oases of Northern Africa, as well as in Arabia, in the region of the Persian Gulf and in India, the date palm as a fruit tree is propagated exclusively by suckers, this being the only way by which a cultivated variety can be propagated always true to type, and is therefore the safest and most reliable method of propagation although it is necessarily slow and often expensive. In the first fifteen to thirty years of its life the date palm throws up a considerable number of suckers, generally below the surface of the ground or just upon it, but rarely more than a few decimetres high up on the stem. The suckers are cleaned of their primordial irregular foliage, and encouraged to grow and to form roots by watering frequently, with an occasional mulch of manure, and if they are formed above the ground they should be earthed up to favour the emission of roots. They are allowed to remain with the mother plant until their base has reached the thickness of about 20 c.m. and has become well provided with roots. The sucker is best removed from the tree in April or May ; a furrow deep enough to uncover the roots is made around it, and the sucker is pulled out towards the ground by an assistant, while the gardener separates it from the base of the mother plant by a few well directed blows with a pickaxe, or by inserting a long and strong knife as neatly as possible between the stem of the mother-plant and the base of the sucker. This is then taken up without exercising any undue traction on the roots, but these may be cut off neatly or trimmed back with a pruning knife. Traction on the roots may cause them to break off from their sockets in the base of the sucker leaving so many pits which are difficult to heal and are a source of weakness and often of failure. The outer

leaves of the sucker are trimmed back, and the inner ones are tied up together to protect the heart leaves. Planting requires some care to ensure success. A hole is made about 40 to 50 c.m. deep, and about 10 c.m. of clean sandy soil, free from manure, is laid at the bottom and pressed down firmly, the sucker is placed in a straight position, and the hole filled in with the same sandy soil, which is pressed down firmly around the sucker. Many suckers owing to their mode of attachment to the mother-plant are curved, and in that case the base is planted straight and the curved end is directed towards the south, so that the sun may have full play on that side and cause the tree to grow straight. As soon as the sucker is planted a trough is made around it and watered, watering being continued at first twice a week, and afterwards once a week. The sucker should be shaded off from the sun in the first summer, and this may be done easily by fixing a few palm leaves along with other foliage to form a cone or pyramid around the sucker. Should the suckers be poorly provided with roots, or if they have no roots at all, it is prudent to tie up the inner leaves and to protect them by rolling them up into a piece of sackcloth, which is bound up rather tightly, but without undue pressure. This sackcloth should be removed after three or four months in order not to strangle the new foliage which by that time will begin to develop.

Palm trees are planted about 5 metres apart, but in a mixed plantation with other fruit trees the distance should be greater.

CULTIVATION. The date palm thrives fairly well in a dry soil, without any irrigation, but then its growth is very slow and has always a poor appearance. In deep soils and when properly watered, the tree grows quickly and has a beautiful dull bluish green foliage, and produces large bunches year after year, which even if they

do not attain maturity are always very ornamental. In the oases of Tunis and Algeria the groves of date palms are regularly watered by flooding every eight or ten days. It is advisable not to cut off any foliage before it shows signs of old age or decay, and in any case it is very objectionable to remove young foliage, and the practice of tying up the inner foliage, or heart leaves, one or two Sundays before carnival in order to have a good supply of perfectly white and undeveloped heart leaves for Palm Sunday, is particularly reprehensible, as it results in a considerable check to the growth of the tree, whose stem assumes a rachitic aspect. This removal of the heart leaves is generally done every second or third year, but even with this precaution the palm tree is sure to suffer.

A liberal supply of farmyard manure every second or third year, is necessary to keep up the vegetation of the tree, but the soil in the immediate vicinity of the stem should not be hoed too deeply, in order to avoid injury to the surface roots growing out of the stem close to the surface of the ground or above it. The scars or heels of the old foliage and the coir which surrounds the stem cannot be removed without exposing the stem to injury, and therefore the practice sometimes adopted by gardeners to leave a smooth cylindrical stem is a cultural mistake, besides being unnatural.

The date-palm should be pollinated artificially in order to secure a more thorough fertilization and a better crop. The female flower has three ovules, of which on fertilization only one develops into a date containing a seed or stone. Unfertilized flowers sometimes develop two or three ovules which remain attached together by their base, and may grow almost to the size of a date, but contain no seed. Artificial pollination is carried out in the following manner. A leaf or two close to the female flower blade are cut off, to make room for the operator,

leaving a long stump of the leaf-stalk to which the bunch of dates is afterwards secured to prevent it from giving way under its own weight. The female flower blade already fully developed, is laid open by a longitudinal cut with a knife, or with a sharpened date stone, and one or two sprigs of male flowers are inserted into the cleft. If the sheath of the female flower blade has split and the flowers have pushed out or are in bloom, one or two sprigs of male flowers are tied over the female flower bunch with a bulrush, or with a palm leaflet, or with some other tying material which easily rots and breaks off as soon as the bunch begins to develop into fruit. The operation is repeated for each female bunch as it reaches the proper stage of development. One or two bunches of male flowers may be dried in the shade, and reserved for the pollination of late female bunches, and are even kept over perfectly dry until next year, to be at hand for the pollination of very early female bunches which may develop when fresh male flowers are not yet available.

Our dates hardly ever attain complete maturity, but half ripe dates, in October or November, are cooked in various ways or made into pastries, with or without the addition of sugar. By cooking, their astringency entirely disappears, but it is not possible to keep these dates for more than a few days after they are picked from the tree, as they are liable to turn sour and to become a fertile breeding ground of maggots of several species of flies and other diptera. In Tripoli the bunches of dates which owing to vicissitudes of weather fail to ripen on the tree, are cut and hung in a room, where they are sprayed lightly with vinegar once or twice, and protected by a cloth, and in a few days the dates become perfectly ripe, but they do not keep well and must be consumed as early as possible. This method of completing the process of ripening has been tried here with fairly good results.

DISEASES.

Of the fungus parasites affecting the date-palm in these Islands the worst is *Graphiola Phoenixis* whose yellowish tufts of fructifications are visible on both surfaces of the leaflets, as well as on the leaf-stalk. In autumn and winter these yellow tufts become brown or black, and dry off, leaving a dead spot on the green tissues ; but the disease is so frequent that it is hardly possible to find a date palm which is not suffering from an attack of this disease in varying intensity. The effect of the disease is to cause the foliage to age and decay earlier than normally and the vital functions of the tree are affected in proportion to the severity of the attack. Spraying in early spring with Bordeaux mixture or with lime and sulphur mixture has been found beneficial, but tall trees are little amenable to this treatment, and as their foliage is always exposed to the breeze, they are less liable to a severe attack.

THE VINE.

Vitis vinifera Lin. and other species. AMPELIDACEAE.

Maltese=*dielja*.

Italian=*vite*.

French=*vigne*.

The European Vine (*Vitis vinifera* Lin.) is native of Europe, Western Asia, and Northern Africa, and also of Tibet, China and Japan, and has been cultivated in these regions from immemorial times both for use as fresh fruit and for the production of wine. It grows wild or half-wild in our valleys and rocky places, and agrees very well with our soil and climate. It is practically certain that its cultivation in these Islands must have been introduced by the first Phoenician settlers, who along with improved forms of the vine must have introduced from the east also their method of cultivation, which in the course of ages has had apparently but slight variations as it still bears unmistakable signs of its Phoenician origin. The English name *vine* is often used generically for perennial climbers, and the Maltese name *dielja* (pron. deelya), literally shade maker or trailer, has reference to the shade thrown by the plant, the vine being *par excellence* the classic plant for pergolas, and to this day the vine-covered pergola is the favourite contrivance to shade off the sun in the yards and gardens attached to country residences.

The European vine agrees well with all soils and all situations, but requires a well drained subsoil free from stagnant humidity. On deep porous soils, moderately moist, with a broken and open subsoil, the vine grows very vigorously and yields heavy crops, but thrives well even on rocky ground and in comparatively dry situations. It is largely grown in France, Italy and Spain, but it is also cultivated extensively along the Rhine, in Southern Germany, Austria, Hungary, the

Balcans, Southern Russia, Asia Minor and Syria, India, China, Japan, Morocco, Algeria, Tunis, Egypt, South Africa, California, Mexico, South America and Australia. There are over 3,000 sorts of the European vine known in cultivation, but no doubt there are many more which are grown in restricted areas and are therefore unrecorded. The total area under vineyards in the various regions where the vine is grown is calculated at 10,000,000 hectares, which at an average of 5,000 vines per hectare give 50,000 millions as the total number of European vines under cultivation. The glories of the vine have been sung by poets from Homer to our days, and it is beyond doubt that this cultivation has been and is still a very important source of prosperity for all countries engaged in it; but in view of the increased production of wine and the keen competition between the chief centres of production it is highly important that wine-making should be done on strictly scientific lines by individuals or societies well-backed by capital for the purchase of suitable plant, in order to obtain uniformity of type along with excellence of quality which would secure for the product an easy sale and a firm hold on the market. This is now, and has been for a long time, the principal aim of the producers in France, Italy and Spain, and unless our vine growers and wine makers follow suit, our viticulture, however prosperous at present, will be able to compete successfully with the foreign product only so long as it enjoys the protection of a heavy import duty on wines. Over 120 sorts of European vines are cultivated in these Islands, of which only about 20 are cultivated extensively, the others being grown sporadically or on a small scale as table grapes. About 38 are local varieties, but the great majority are identical with other types cultivated along the Mediterranean region or are mere local variations of them due to the influence of the soil and climate.

The wild or half-wild vines mostly produce white grapes, and are generally grafted with good sorts for the table or for the press, and as the vine is here invariably propagated by cuttings or layers new local sorts are only obtained from chance seedlings. However, our soil and climate are most favourable for the development of the vine, and both table and wine varieties of superior quality, and more fertile and vigorous than the imported sorts, can be produced by sowing seed from carefully selected and hybridized fruit.

The cultivation of the vine in these Islands, like that of most fruit trees, has had its periods of prosperity and depression. In ancient days Kormi was the land of vineyards, and extensive vineyards must have existed also at Zabbar and in the hilly western districts as shown by the characteristic long troughs excavated in the rock for the reception of the vine, and met with everywhere it was planted. In the middle ages owing to the frequent invasions by the Arabs of Barbary, the spread of malaria, the epidemics of fevers and plague, and the emigrations to Sicily and Italy, the population became greatly reduced in numbers, and the cultivation of lands in outlying districts was neglected or abandoned. But during the rule of the Order of St. John with the return of comparative security after the defeat of the Turkish invasion in 1565, viticulture once more flourished, and the Island began to produce its own wine, and even exported some to other countries. However in the eighteenth century, the increased demand for cotton caused a wholesale destruction of our vineyards as well as of our olive-groves to make room for its cultivation, and a further reduction of our vineyards took place during the American War of Secession, when the fabulous prices of cotton induced our farmers to take up its cultivation to a hitherto unprecedented extent. Accordingly the production of grapes became limited to their

use as fresh fruit for the table, and the manufacture of wine ceased altogether, the Island becoming entirely dependent for this supply on the produce of Sicily and Greece.

Towards 1870 the planting of vines was resumed in both Islands, and twenty years later there were already considerable vineyards at Xaghra, Nadur, Kala, Zebbug and other places in Gozo, as well as in the districts of Notabile, Dingli, Fiddien, Ghemieri, Gneina, Bahria, Melleha, etc. and our viticulture entered into a new period of prosperity. During the last ten years the extension of vineyards has proceeded with great activity everywhere in both Islands as well as in the islet of Comino where there are already very productive vineyards originally started by Government. Good table wines as well as dessert wines of excellent quality are being made which compare favourably with the imported article, and although the consumption of wine by the present teeming population is rather large, we are well on the way to do without the imported produce altogether. Even the local production of so-called artificial wine at present carried out in one or two centres seems condemned to extinction at no distant date. However the bulk of the produce is still of inferior quality owing to improper or unscientific manipulation, and there is an absolute absence of uniformity of type even in the cellars of the same producer.

The regulations prohibiting or restricting the importation of vines, grapes and living parts of the vine have long saved our vineyards from an invasion of *Phylloxera*, and therefore the planting of vines and the revival of the wine industry could proceed without difficulties. In 1919 and in 1920, the Vine-*Phylloxera* was finally detected over considerable areas in Gozo as well as in Malta, but immediate steps have been taken to establish American vine-nurseries, and the reconstitu-

tion of vineyards on suitable American stock is proceeding satisfactorily. The vine mildew is kept thoroughly in check by the use of sulphur, and vine blight is only troublesome in exceptionally moist springs, so that with the protection afforded by the import duties on wines and spirits originally meant solely for the purposes of revenue, there is every reason to expect that, notwithstanding the Phylloxera, the present prosperity of viticulture will be still further increased in the near future.

At present our vineyards cover an extent of approximately 732 hectares, and consist exclusively of European vines propagated directly by cuttings and sometimes by layers, and in a few instances by grafting on the local wild or half-wild forms of the European vine. The only American vine which is fairly common and used for covering pergolas or walls is the Isabella vine (M.=*dielsia Ananas*), a variety of *Vitis Labrusca* Lin. The Isabella vine is a vigorous and fast grower, and at least in our Island is almost entirely immune from attacks of vine mildew and vine blight, for which reason it is preferred for pergolas in shaded localities where no European vine can be expected to mature its fruit owing to those diseases. It was introduced here towards 1850, and is grown as a table grape, its musky or strawberry taste causing it to be much appreciated by some persons and positively disliked by others. However it may be mixed with wine grapes in the proportion of one to two or three, and then it communicates to the wine a mild aromatic flavour and a high colour. Other varieties of *V. Labrusca* much grown in America and also in Europe are Catawba, Concord, Ives-seedling, Martha and Telegraph, which are said to be superior to the Isabella grape in every respect and are as easily propagated by cuttings, but none of them has yet been introduced in these Islands. The varieties of *V. Labrusca* are noted

for their great vigour and productiveness. They have deep green, obtusely three lobed or five-lobed leaves, with a thick covering of greyish white hairs on the under surface, sometimes yellowish, as in the Concord grape; the canes are comparatively slender, dark reddish or chocolate coloured, the bunches are small but numerous, often three or more on the same twig. The grape is rather large, with a mucilaginous or glutinous greenish pulp, with a sweet musky or foxy flavour. The rind is thick and tough, highly coloured, and the seed is thick and obtuse, deeply furrowed. The Isabella grape agrees very well with our calcareous soils, rarely suffering from chlorosis except on moist soils, but it should be stated that its resistance to the Phylloxera is the lowest of all American vines, being given at only $\frac{3}{20}$ to $\frac{5}{20}$, and the hybrids of the *Labrusca* vines with the European vines must have a still lower index of resistance.

Vitis Berlandieri Planchon, is another American vine introduced here in 1905. It is one of the most resisting to Phylloxera, its index of resistance being put at $\frac{17}{20}$, and presents the great advantage that it thrives well even in very calcareous soils and in hot climates like ours. Unfortunately it cannot be propagated by cuttings as easily as other species, but on the other hand propagation by seed is most easy, the seeds always germinating well, and the seedlings reach grafting size in a year or two. The bunches are very small, and the grape is black, small and useless. This vine makes a good stock for European vines and is therefore warmly recommended as stock for calcareous soil and hot climates.

A third species which seems to be also recommendable as stock for hot and dry climates is *Vitis rupestris* Scheele = *V. vulpifolia* Lindheimer, the sand-grape of Texas and other southern regions of the United States. This vine has a bushy habit of growth, with roundish

foliage like that of an apricot, and is very resistant to Phylloxera. One of the best varieties is *Rupestris du Lot*, its index of resistance against the Phylloxera being given at $\frac{18}{20}$, and seems also to do fairly well in calcareous soils. This vine has been introduced in our Islands in 1919, along with other American and Hybrid-American vines

There are other thirteen species of American vines viz: *Vitis candicans* Engelm., *V. cinerea* Engelm., *V. monticola* Buckley, *V. californica* Benth., *V. caribaea* D. C., *V. coriacea* Sputtleworth., *V. cordifolia* Michaux., *V. arizonica* Engelm., *V. rubra* Michaux., *V. bicolor* Leconte., *V. Lincecomii* Buckley., *V. aestivalis* Michaux. and *V. riparia* Michaux.; but with the exception of the last two the others have little interest for the vine grower. *V. aestivalis*, which is nearly allied to *V. bicolor* and to *V. Lincecomii*, is the summer grape of the central and eastern states, and has given origin to many varieties which are largely cultivated in the United States both as table grapes and for the production of wine. The principal varieties are Jacques, Herbemont, Cunningham, Black July and Elsinburg. Jacques is also extensively cultivated in Italy and Sicily, sometimes as stock for European vines, but chiefly as a direct producer. It is stated to be a hybrid with the European vine, and its grape is small, rather deficient in juice, but intensely coloured, and is fairly resistant to Phylloxera, although very liable to vine-blight. The resistance of *V. aestivalis* is given at $\frac{16}{20}$, and that of its hybrids or varieties at about $\frac{12}{20}$.

On the other hand *Vitis riparia*, the river-grape, native of Ohio and other alluvial regions along the Mississippi and Missouri, and most of its varieties, require a rich alluvial soil, and are very susceptible to the presence of lime, hence *prima facie* they cannot thrive well in our soils, although they have a very vigorous

habit of growth and are very resisting to Phylloxera, and would afford excellent stock for most European vines. The river-grape is now extensively used as stock in Italy, and especially in France, where about $\frac{2}{3}$ of the total area under vineyards has been replanted on Riparia-stock, its resistance to Phylloxera being indexed at $\frac{1.8}{2.0}$. This vine, crossed with European vines, has given origin to important hybrids, now often grown as direct producers, such as Noah, Clinton, Taylor, Vialla, Marion, Elvira, Black Pearl, Oporto and Franklin, but unfortunately for us most of them partake of their parent's dislike for calcareous soils.

The vine-mildew, the vine-blight and the Phylloxera vastatrix, which have wrought so much havoc in the vineyards of Europe, are of American origin, and were introduced at different times into Europe from North American. It is owing to them that the cultivation of the European vine could never make much headway in North America, and since their importation into the Old World, European viticulture has become both difficult and hazardous. The vine-grower has been confronted again and again by problems of the utmost gravity, and at certain times matters looked so serious, and the danger and the loss so widespread, that the best viticulturists lost all hope of ever again seeing viticulture resume its old place in the national economy. The use of sulphur and of Bordeaux mixture enabled the vine grower to wage a fairly successful war against the two fungous diseases above mentioned, but with the advent and diffusion of Phylloxera it was feared that the vineyards of France and of Europe will cease to exist in less than a quarter of a century. Scientific research again came to the rescue, and the remedy against the disease was found in those same American vines on whose roots the Phylloxera had travelled to Europe.

However, the present system of cultivation by which the European vine is grown on American or hybrid American stock, if it ensures the continuity of existence of the precious European varieties which are so gloriously associated with the several districts where they are grown, it certainly entails no little trouble and expense in the initial installation as well as in the subsequent upkeep of the reconstituted vineyards. Hence when the first heat in quest of American or hybrid American stock of sufficient vigour and good resisting qualities had abated, and vine growers were busily replanting their vineyards on stock of approved quality, the energies of hybridists in Europe and America were directed to the obtention of hybrids between the European and the American vines, which while possessing the required degree of resistance against the *Phylloxera* and possibly against the cryptogamic diseases, were capable of yielding a produce of sufficiently good quality either for table use or for the manufacture of wine, to replace that of the European vine. These hybrids are the so-called "direct producers", and their popularity increases from year to year, although they are still very far from the high standard of excellence to which the European vines have attained. However their use will permit a return to the simple old methods of cultivation, when the vine was propagated directly from cuttings and was as free from mildew and blight as it was from the *Phylloxera*. The ideal hybrid direct producer should unite comparative immunity from, or great resistance to the diseases above mentioned, to an abundant production of grapes of good quality for the table or for the press, and in our case should also be able to thrive well in a soil with a large percentage of lime and to bear well our warm and dry climate. Unfortunately all the direct producers so far obtained are deficient in one or more of these desirable qualities, but the unbounded resources of

nature have been so far hardly tapped, and sooner or later the untiring activity of hybridists will not fail to produce a good number of disease-proof and worthy successors of the famous vines of Europe

PROPAGATION. The vine is propagated by seed, by cuttings, by layers, and by grafting or budding on other vines.

Propagation by seed is only recommendable for the purpose of raising new sorts of improved quality or of obtaining hybrids having the power to resist the attacks of the many diseases to which the European vine is so liable. In the case of *Vitis Berlandieri*, *V. cinerea*, *V. cordifolia* and others which are difficult to grow from cuttings, they are generally propagated by seed. However, the propagation of the European vine on a small scale by sowing some seed reserved from the best table or wine grapes, should be recommended to the attention of gardeners, as one or two improved sorts are almost sure to be found even in a small batch of seedlings. The seeds may be sown in March or April, and the seedlings are planted out in winter when they are two or three years old. In about three years more they will be strong enough to fruit, and those whose fruit fails to give satisfaction may be grafted in the following winter. The seed should be selected from well-ripened fruit, and when collected may be kept in a paper packet, or better, stratified in a pot with sand or dry garden soil until required for sowing.

The vine is very generally propagated by cuttings, and the large development of its cultivation may be ascribed chiefly to this easy method of propagation. The European vine will strike well from cuttings of any quality and of any age, but the method generally followed by our vine growers is so good that it can hardly be improved upon. This method which is of ancient origin, and is also followed largely in most

vine-growing countries, consists in selecting canes of new wood, from 30 c.m. to 1 metre in length or more, having a bit of old wood at the base, so that at this end the cutting is shaped like a hammer, hence its old name of malleolus (It.=magliolo). A cutting taken at its point of insertion with the old wood, and therefore having a thickened base with several nodes closely set together, is just as good and perhaps better, and therefore is never discarded by the planter. In any case the cutting should have well ripened wood for a considerable part of its length, so that the uppermost bud which is left above the ground and is destined to produce the stem of the new vine may be situated on healthy, ripened wood. The time for making these cuttings (Maltese = zargun, pron. = zarjoon) coincides with the pruning season, that is from the time that the soil is well soaked with rain in November until February, and they are generally selected and put aside by the pruners during that operation, and then tied up in bundles of 100 canes, and sold to the planters at a price varying from 1s. to 1s. 8d. per bundle. The bundles are buried half way down in a trench, whence they are taken up one by one as required for planting. This precaution is necessary in order to keep the cuttings in good condition, otherwise if allowed to remain exposed for a few days they may become too dry, and many of them will then fail to strike. Planting is done at any time from November to February, provided that the soil and subsoil have been moistened by the autumnal rains. Cuttings planted along the walls of fields or in gardens, are laid down along a narrow trench, about 25 c.m. deep, keeping one or two buds above the ground. In a vineyard the cuttings are planted in trenches about $1\frac{1}{2}$ metres long, 50 c.m. wide, and 50 c.m. deep, laying down one cutting at each end of the trench. A small basketful of manure is spread evenly in the

trench and lightly covered with earth, the cuttings are laid down taking care that they are not in direct contact with the manure, and the trench is filled in with earth leaving the untrimmed end of the cutting well above ground. It is the practice with many planters to apply the manure above the cutting, that is the cutting is laid down in the usual way along the bottom of the trench and covered lightly with soil, the manure is then spread over the soil, and the trench filled up with earth to the brim. Others again, do not apply any manure to the cutting until it is well rooted and properly established as a vine, that is when it is three or four years old, and has nearly reached bearing condition. Notwithstanding the old practice to plant very long cuttings, it is not at all necessary that cuttings should have more than two or three nodes under ground, and may be planted straight down without bending them in a reclined position. They need not be planted deeper than 20 c.m. in rich and moist soils, or deeper than 30 c.m. in dry soils, but it is important not to allow them to retain more than one or two buds or nodes above ground.

When the whole area is planted the end of the cutting is trimmed neatly back to a healthy bud just above the surface of the ground, a circular trough is scooped around the trimmed cutting to keep it well clear of the soil, and a small stick or the end of the same cutting which has been trimmed off, is stuck in the ground close to the bud to mark the site and avoid possible injury during tillage. In any case the operation of planting should be preceded always by a thorough preparation of the soil, which is trenched to a depth of about 50 c.m. This is done early in summer and is followed immediately by the construction of trenches for the reception of the cuttings. The trenches are best constructed in summer or towards its close, so that the deep layers of the soil may have time to be acted

upon by the sun and the atmosphere, with the consequence that their physical and chemical qualities are improved and the young vine stands a better chance to make a good start. Another advantage resulting from this arrangement consists in the fact that the soil of the trench is sooner moistened by the first rains, and therefore planting can be started quite early in the season, and in fact as soon as the pruning season has commenced and cuttings have become available.

The distance at which the trenches should be constructed must vary with the nature of the soil. In good rich soils the trenches should not be less than one metre and a half in length, with the same distance from one trench to another in the same row, and again the same distance from one row to another, so that each vine may have for itself an area of 150 c.m. square or $2\frac{1}{4}$ square metres, thus giving 4,444 vines to the hectare, or 4,200 if allowance is made for sites occupied by walls etc. On soils of poor quality the distances are generally less, the trenches often not exceeding one metre in length, with the same distance from one trench to another in the same row, although the distance from one row to another is rarely less than one metre and a half. In this case the number of vines to the hectare would be 6,666, but this figure is hardly ever reached, as usually on such soils there are areas where the rock is too close to the surface to permit an even construction of trenches without entailing a heavy expenditure in cutting the rock, levelling etc.

From what has been said it is clear that the usual custom is to plant the cuttings directly in their final quarters. Of course, the vine can be transplanted in winter with little trouble and with perfect safety, but cuttings root so easily and require so little attention when properly planted, that the planting of cuttings in nursery beds to be transplanted to their final quarters

after a year or two is not looked upon with favour by our growers. However, in certain cases this method has its advantages and would be recommendable. Thus certain sorts of European vines do not strike from cuttings so easily as others, and in the case of new or rare sorts it may be desirable to utilise all the cuttings available, even small bits with two or three buds, or the upper part of the canes which have been pruned off, or the stronger side-twigs of the canes (It.=femminelle) which are usually cleaned off in pruning. All these odds and ends are useless for direct planting, but will not fail to strike root and yield good plants if planted in well prepared beds and properly watered during spring and summer. Moreover the cuttings of those American vines or American hybrids which strike root with difficulty if planted in the ordinary way, will fail much less often if they receive nursery treatment, and they can be grafted in the nursery before removal to their final destination.

Vine cuttings may also consist of one bud, and this method is commonly employed in northern countries where the vine is usually grown under glass. Such cuttings may consist of a node with about 1 c.m. of the wood above and below the bud, and the node is also notched half way through, on the side opposite to the bud, to promote the formation of an abundant callus and the emission of roots. The notch may be made wedge-shaped by cutting off a rectangular bit of wood, or may be made square-shaped by notching the wood at about half a centimetre above and below the node, thus removing a bit of wood about 1 c.m. long and leaving two angles, one above and the other below the bud. These cuttings are planted in sand, with the bud directed upwards but covered with about 2 c.m. of sand or soil, and are placed under glass. They may be prepared also by cutting the nodes with about 1 c.m.

of the wood above the bud and 2 to 3 c.m. below it, and are dibbled in sand with their bud directed upwards and covered to a depth of about 2 c.m., either singly in small pots or a few together in pans, and placed under glass. Such cuttings made early in March will strike roots here in the open air, if kept fairly moist and in the shade of trees. But this method of preparation is hardly recommendable except to the amateur, or in case that it is desired to propagate a rare sort of which few cuttings are available.

The vine is frequently propagated by layers. These may be of three types: (a) the *Winter Layer*, (b) the *Spring or Summer Layer*, and (c) the *Chinese Layer*.

The Winter Layer is the method usually followed by our vine growers to fill up gaps in the vineyard, and according to this method (It.=propaggine, M.=purpajn) the vine may be layered wholly or in part. In the first case (It.=provanatura) as many canes as may be required are allowed to remain on the vine, and a deep trench is excavated from the base of the stem or root-stock in the direction taken by the principal stem of the vine, with secondary trenches of the same depth in the direction of the several canes which have been retained. The stem is layered deeply along the principal trench and the several canes are distributed along the secondary trenches and buried deeply leaving a good terminal bud situated on healthy wood at the end of each trench, just above the ground. Some well rotted manure should be spread along the trench, especially close to the junction between the old and the new wood where roots are more likely to form, but no manure should be in direct contact with the layer. Where the vine is only partly layered, a trench is excavated on the spot where there is a gap in the vineyard, and a long cane preferably of new wood, selected from the nearest vine, is layered deeply in the same manner. This method of filling up gaps in the

vineyard presents the advantage that the layer is in a condition to fruit from the first year, while a cutting planted in the ordinary way will not be able to fruit before the fourth or fifth year. But whether the vine is layered wholly or partly a considerable portion of old wood is necessarily buried in the soil where it may favour the development of root-rot and of other parasitic fungi of the root system, particularly on lands which are not thoroughly drained.

The *Spring* or *Summer Layer* (It.=margotta. M.=tarkida) is made from March to June or July. As a rule the layer is made in pots or other convenient receptacle, and consists of a long cane of new wood which is bent down into the pot half filled with good garden soil properly manured. The pot is then completely filled up with soil, and the layer is tied up to a stick, or a stone is placed on the pot to prevent the layer from coming up again by its own elasticity or getting displaced by the action of the wind. Layers made in April or May, during active growth, will root in about fifteen days, but will flag somewhat if severed from the mother plant before five or six weeks. An ideal layer should consist of a long cane of well ripened wood, the junction with the old wood with its thickly set nodes being placed at the lowest part of the bend beneath the soil, and the end of the layer should have at least one good bud well above the soil. However, any branch or cane will root well if kept well moist, and even the new wood which is yet green will not fail to root if layered in June or July. This method of propagation is in favour with gardeners who grow vines in pots for sale, as the rooted layers with their bunches of ripening grapes find ready purchasers, and when planted in their final quarters establish themselves at once, and if properly cared for will continue to bear fruit. The parsley-leaved vine (*Vitis vinifera* var. *Laciniosa* Lin.)

and the vine Chasselas Cioutat which are old acquaintances in our gardens, are chiefly propagated in this manner, the rooted layers being sold in July with their pretty bunches of small round white grapes already half ripe.

The *Chinese Layer* consists of a cane of new wood which is entirely buried a few centimetres below the surface of the ground, in a horizontal position or slightly inclined downwards towards the tip. This operation is best done in March, just when the buds are beginning to swell, or a few days before, and is kept well moist to favour the emission of roots along with the development of the buds. Most of the buds under ground will grow into shoots and many fibrous rootlets are formed from the base of each shoot, so that in the following autumn or winter when the shoots are taken up to be planted elsewhere it will be found that every shoot has developed into a nice plant (It. = barbatella). This is however only a haphazard way of practising the Chinese layer. A more satisfactory method requiring perhaps a little more trouble consists in excavating a furrow 10 to 12 c.m. deep, in April or May when the buds are already pushing vigorously, the cane which it is proposed to layer is extended along the furrow, and pegged down by wooden pegs made of bifurcated twigs which are always at hand or are easily obtained from the heap of dry prunings. The layer is allowed to remain uncovered for two or three days, until all the growing shoots have taken an upward direction, and then the soil is filled in, and watered, keeping the soil well moist for several weeks until all the nodes are well rooted. In the following autumn or winter the layer is taken up, and the rooted plants are separated from each other by a cut close to the node.

The Chinese method of layering is useful for the propagation of those sorts which do not strike readily

from cuttings, and although it is hardly ever practised by our gardeners it deserves to be more widely known, as it furnishes excellent rooted plants for planting in the vineyard, or for filling up gaps, and their use instead of cuttings will certainly reduce by at least one year the time required by the vine to reach bearing condition.

By selecting for cuttings, layers or scions, canes only from those vines which have fruited regularly and abundantly, and have produced fine bunches of grapes, it is possible to bring about an improvement in the type of the vine which it is intended to propagate, and this method of selection is often adopted with very good results by the best viticulturists on the continent. Therefore those canes which have produced a number of fine bunches, and are usually pruned off in the following winter, make very desirable cuttings or layers, and should be preferred to all others as they are sure to develop into fruitful vines.

PROPAGATION BY GRAFTING. The vine is so easily propagated by cuttings or layers that grafting was rarely resorted to by the European vine-growers, except when it was desired to transform a mixed plantation into one of uniform quality, or to change the nature or quality of a long established vine without having to lose more than one year's crop. In this Island we were still until lately in this happy condition, but the spread of *Phylloxera* has changed all that, and nowadays grafting is the basis on which the old vineyards are being reconstituted, and therefore forms a really integral and highly important part of modern viticulture. Reference is made only to *grafting*, as the operation of *budding* is rarely performed on the vine, although the vine can be budded almost as well as other plants. Budding may be of two types *green or herbaceous budding* and *dry or woody budding*. The first may be performed from May to June or July, and consists in the

removal of a ring or shield with a healthy bud from which the leaf and the side twig have been cut off about 8 or 10 days before, and the said ring or shield is inserted according to the ordinary method of budding, on the green cane of the stock or subject. In the Salgues method of green budding the shield is taken up with some of the young cellular tissue to which the bark is attached, and is inserted on the subject, properly tied, and shaded off for some time by a leaf or a cone of paper tied above it. Woody budding is still less used than the preceding, and is performed in March or April, making use of dormant buds to be inserted on the subject whose sap is already in movement, and the shield or bud is neatly cut off in a lozenge or boat-shape and inserted on the subject on which a cross cut has been made on a clean and even part of the stem and the bark turned up just enough to allow the insertion of the bud ; or the bud may be taken up with about half the entire thickness of the wood and inserted on the subject from which an equivalent portion of its wood has been neatly removed (inlaid budding).

The various methods of *grafting* are also classified into two groups. (a) *Ordinary woody or dormant grafting*, and (b) *green or herbaceous grafting*. Old established vines are usually grafted at ground level, or if the stem is too thick, grafting may be done on two or more of the larger branches. In both cases the operation should be performed towards the close of February or early in March, only a few days before the buds begin to push, as then the risk of failure will be greatly reduced ; and the method adopted consists usually of cleft-grafting, in which the subject is cleft partially (radially) or wholly (diametrically) according as it is the object of the operator to insert one or two scions. The scions are selected of well ripened wood of the last year's growth, with two or three good buds at short intervals, and

should be about 10 c.m. long. Grafting of the stem or large branches above ground necessarily entails the use of grafting wax, with which all exposed tissues should be besmeared to prevent drying, but more often our gardeners make use of tin or zinc funnels or other likely receptacle at hand, into which they introduce the graft on which the ligature has been properly adjusted, and fill up with soil which is watered occasionally to keep it moist and cool. Grafts made at ground level, are tied in the usual way, and then simply heaped up with soil, leaving exposed only the uppermost bud. The tools used in this grafting are the same in general use for the grafting of other fruit trees, and are kept scrupulously bright and clean to prevent any possible contamination of the exposed tissues of the stock or of the scion where they are meant to unite, as that would be attended by a serious danger of failure.

Grafting a thick stem at ground level is sometimes modified with the object of ensuring success, by the use of a long scion which also acts as a cutting, to the lower part of which a heel is left attached and is embedded deeply in the soil at the foot of old stem, that part of the scion to be inserted in the cleft of the stock being cut neatly like a knife blade to fit the cleft. This scion-cutting of course will form roots at its heel which will keep it well alive until there is complete union between the graft and the stock. The heel may be cut off in the following winter, or may be allowed to remain.

Grafting on American stock or on American hybrids has now become an indispensable operation as a preventive against the *Phylloxera*, and this grafting is usually performed on quite young stock, or even on cuttings. This interesting operation has become the corner of modern viticulture in all countries wherever the *Vine-Phylloxera* has made its appearance, and for our purpose the following summary description will be found sufficient.

In continental Europe the production of large quantities of grafted vines for planting new orchards or for replanting those vineyards which have been destroyed by the *Phylloxera* is entrusted to well equipped establishments who are in a position to produce annually, at cheap rates, hundreds of thousands, or millions of young vines of approved quality grafted on selected stock having the desired degree of resistance against the *Phylloxera* and, wherever necessary, able to tolerate a soil containing a considerable percentage of lime. However there is no reason why what could be done on a large scale by a specialised establishment could not be done on a small scale by the private grower, with the same satisfactory results, although perhaps at a slight increase of cost.

For this purpose the first object of the grower should be to have at hand a sufficient number of mother-plants of American vines or hybrids to supply all the stock required for grafting. His choice of mother-plants will be regulated by the nature of the soil of the proposed vineyard and also by the quality of the vine which he intends to grow, as it is a generally accepted principle that certain European vines grow better on one American or hybrid American stock than on another. The choice should be restricted to one or two reliable sorts, with perhaps one or two others for trial. The mother-plants are of course grown directly from cuttings or layers, planted either singly or in small groups of two or three together, at a distance of two metres apart and two or three metres from one row to another, and they should be trained to a tripod made of three stout poles, and encouraged to attain full development, in order to yield a good supply of cuttings of suitable size for propagation. The tiny shoots should be pinched off, as the cuttings which they yield are too short or too slender to be useful, and at the same time the energy which would

be expended on their formation would go to increase the production of good cuttings. It should be noted, however, that cuttings exceeding 1 c.m. in thickness are undesirable, so that in order not to have canes of excessive thickness with too much pith, it is advisable to allow or favour the growth of numerous shoots, which will also result in a larger yield of cuttings. The number of mother-plants to be grown, of course depends on the extent of the vineyard, but as a well grown mother-plant will yield from 30 to 50 cuttings, a small reserve of 10 to 20 mother-plants will be sufficient to provide cuttings to fill up the gaps which may take place from year to year in a vineyard of about two hectares.

The cuttings intended as stock for grafting may be taken at any time from November to February, and should be long from 20 to 30 c.m., and are carefully disbudded, that is all their buds with the exception of the uppermost are cut off cleanly to prevent the formation of suckers from the stock of the grafted plant. They are then planted either in their final quarters, where they may be grafted in the following winter, or in nursery beds where they will receive better treatment, and will furnish grafted and well rooted plants in two years, of the type and strength most desirable for planting out in the vineyard. In the nursery bed the cuttings are planted in a straight or perpendicular position, in soil which has been deeply tilled or trenched, and manured, and are stuck at a depth of 20 to 30 c.m. with the uppermost bud at ground level or slightly above it, many good growers preferring to cover up the uppermost bud with soil which is ridged up over the bud to a height of about 5 c.m. The cuttings are best planted in alternate double or treble rows, 20 c.m. from one row to another. The distance between the double or treble row and the next should be from 40 to 50 c.m. to allow easy access for the necessary cultural operations. The cuttings

should be watered in summer, at first frequently and then more sparingly, and in the following autumn they may be taken up, grafted, tied up in bundles of 20 to 25, packed up in boxes with moss, sand or saw dust, leaving the grafted end well exposed, and submitted to a gentle heat in a glass house, or even in a well lighted apartment, gradually raising the temperature until the graft has developed into a shoot of 5 to 10 c.m. in the meantime keeping the rooted cuttings well moist by occasional sprinklings of water. The temperature is brought down again gradually to that of the external air, and after a few days of rest the young plants with their graft now well united to the stock may be planted out in their final quarters, or better replanted in the nursery at a great distance apart for another year, to become stronger. If a heated glass house or apartment for forcing the grafted plants is not available, the young stock is grafted on the spot in the nursery, the operation being performed very early in spring, a few days before the buds begin to swell. Grafting in the nurseries is always attended with difficulties as the operator cannot make use of the various tools and mechanical devices now available for this operation easily, quickly and on a large scale.

Whether grafting is done at the table on the plants taken up from the nursery bed, or on the spot that is in the nursery, without lifting the plants, grafting is generally performed according to the English method of cleft-grafting, tongue-grafting or whip-grafting. The stock is cut off by a clean cut in a slanting direction at an angle of 16° to 18° , equivalent to an inclination of 28° to 32° , on a smooth portion of the stem just below the shoot which has developed from the terminal bud of the original cutting. With the grafting knife a small notch is made across the upper part of the cut, on the wood between the bark and the pith, to a depth of about 1 c.m. The scion consists of a node having

a sound bud, cut and notched in a manner to fit perfectly with the cut and notch of the stock. It is desirable that cut of the scion or node be made in such a manner as to ensure that the grafted bud or node may have the same position and direction on the stock as that of the node with the terminal bud or shoot which has been removed as the first stage of the operation. The stock and the scion are fitted together as perfectly as possible, and the tongues are applied carefully and evenly into their notches, but without exercising any undue pressure, as any contusion may be fatal to the success of the operation. The graft is then tied firmly with raffia or twine and even besmeared with grafting wax to prevent drying, or in the case of plants grafted in the nursery bed the graft is tied firmly and simply heaped up with earth, covering the scion or node to a depth of about 5 cm. The above is the method of grafting generally adopted in the large establishments of France and Italy. In these establishments grafting is made invariably at the table, the particular inclination given to the cut being easily obtained by the use of the so called Richter's rings, which consist of a short metal tube cut obliquely at the required angle and fixed horizontally on a pedestal which is screwed to the table. Feyzelmeyer's machine, and other grafting machines are also largely in use, and with a little skill in their handling the operator is enabled to proceed with the operation of grafting at a quick rate.

It is desirable that both the stock and the scion be of the same thickness, so that the bark of the scion may fit exactly with that of the stock all round the graft; but should the stock be thicker than the scion, it is enough if the bark of the scion be made to fit exactly with that of the stock on one side only, although of course the chances of success are thereby reduced.

The "Champin" graft which was much talked of some years ago is a slight modification of the ordinary method, in which the notches are made deeper, from 2 to 3 c.m., and the corresponding tongues are of course of the same length. This method offers a larger area of contact between the stock and the scion and therefore success is better assured, but it requires a greater practice on the part of the operator and the long tongues are more easily contused or injured in the act of insertion or when the graft is ligatured.

In the simple English graft the stock and the scion or node are cut in the same slanting direction, but no notch is made, the stock and the scion being adjusted together and tied firmly. However, owing to the absence of a tongue the scion may get displaced by the slightest movement, and union is therefore precarious. To meet this difficulty it was suggested to make use of bits of copper or aluminium wire, or even of bits of wood-like toothpricks which are inserted into the pith of the stock and of the scion to keep them well together; but this form of the English graft has met with little favour and is now hardly in use anywhere.

It is now the general custom in large establishments to propagate the European vine early in autumn on a large scale by grafting on cuttings of American vines, submitting the grafted cuttings to an elevated temperature in a glass house, by which the cuttings are forced to form some rootlets and at the same time the grafted scion or bud is forced to push and thereby union or *knitting* is effected between the stock and the scion. The cuttings should be long 25 to 35 c.m., without any heel. They are carefully disbudded to prevent the formation of suckers on the stock of the future vine, and are grafted on the table with the tongue or whip-graft as above described. Then they are tied together in bundles of 20 or 25, and packed carefully in an upward position in

open wooden boxes with moist moss and sand or saw dust, and are well covered on top with straw or other dry foliage to keep off the light. The boxes are arranged systematically in a glass house which is heated to 28° – 30° C., and are sprayed frequently to keep up a constant moisture. In about a week or ten days the lower end of the cutting will have formed a callus, and the same happens about the union between the stock and the scion, and the bud of the scion begins to swell and to push out the young shoot, which is a proof that the graft has been a success. The boxes are then taken out in a glass house or room with a lower temperature, and the covering of straw is taken off to admit light and air, spraying the boxes occasionally to keep up a proper degree of moisture. In this way the callus at the base of the cutting begins to form some rootlets and the young shoot takes a healthy green colour, remaining short, with leaves closely set together instead of becoming etiolated with a thin and long stem and sickly foliage. In the meantime the temperature is gradually brought down to the same degree as that of the external air and in about 10 days this second part of the process is completed, and after a few days of rest during which the boxes are also sprayed occasionally to prevent a too quick defoliation with the consequent check to the vital processes, the bundles are taken out of the boxes with care, and being yet too weak to be planted in their final quarters in the vineyard, they are planted out in the nursery in the same way as ordinary cuttings where they are given proper attention for one or two years, and any rootlets which may develop on the scion are carefully removed to keep up the full value of the American rootstock and to prevent the *liberation* or *enfranchisement* of the scion.

A variation of this method suitable for small growers, consists in grafting canes early in March, without

detaching them from the mother plant, and then layering them in pots, leaving the scion or graft just above the soil, and removing all the buds below the graft as stated in the case of grafted cuttings. In this way very strong grafted plants can be obtained, which may be planted out in the course of autumn.

The Cadillac graft, which on the recommendation of the writer, is now being frequently employed in Malta and Gozo for the reconstitution on American stock of vineyards in districts infected with the *Phylloxera*, is in reality a side-graft made at convenient depth below ground. The stem of the European vine is exposed to a depth of 30 to 40 c.m., and at this point the debris of the bark on one side of the stem is scraped off in order to have a neat surface ; a clean cut is made downwards and inwards by means of a chisel and mallet on this side of the stem, and a scion 30 to 40 c.m. long of an American or hybrid-American vine suitable for that particular type of soil, is inserted and properly adjusted on one side of the cleft, as in ordinary cleft-grafting. The scion may be tied by two or three twists of twine, and the earth filled in, leaving the terminal bud of the scion well above the ground. The graft usually grows with vigour in the first summer, and may be grafted at ground level in the following spring, with an European scion. In this way the vineyard is renewed on American stock, without any loss of time or crop to the grower, the original American scion forming its own roots and becoming an independent vine, while the old European rootstock succumbs to the *Phylloxera*, or is cut down in the following year when the Cadillac graft has already commenced to bear fruit. The Cadillac graft is best performed in February or early in March, and the operation may be improved upon by using as scion a cutting of American stock ready grafted on top with a scion of European variety by the usual whip-and-tongue graft. The chisel used in this operation

should be wide enough (3 or 4 c.m.) to suit also stems of some thickness, and its edge should be knife-like, instead of bevelled.

GREEN-GRAFTING is a comparatively modern process which is commonly practised in Hungary and to some extent also in Italy. Of course its application for the propagation of the vine on a large scale is hardly admissible, but it is recommendable in certain cases, viz : (1) To fill up gaps in the vineyard by layering, when on a cane of the nearest vine is inserted a scion of an American vine, and as soon as the scion has grown to the desired length for layering, is in its turn grafted with a scion of the same European vine on which it is growing, and thus the cane which will be layered in autumn or winter will have the interred part formed of American wood and therefore resistant to *Phylloxera*. (2) To obtain grafted cuttings which may be planted directly in the vineyard, or grown as grafted plants in the nursery. In this case the canes of an American vine having reached the necessary length to make a good cutting are grafted with scions taken from the European vine which it is desired to propagate. The grafted canes are then used as cuttings, the interred part being made of American stock, and are disbudded as in the case of ordinary grafted cuttings. (3) To graft the young growing shoots which are thrown up by a cane which has been layered according to the so-called Chinese method. In this case the grafted shoots can be used as rooted and grafted plants for direct planting in the vineyard, in the following autumn. (4) To propagate a rare sort of which it may not be possible to obtain scions for autumn or winter grafting. (5) To graft a vine on a pergola or wall, with various sorts of grapes, as an object of curiosity.

The best time for green grafting is from April to the end of July; towards the middle of April the weather is usually already warm enough to insure success and in

July the lignification of the scions will not have proceeded too far to prevent a prompt union or knitting with the stock. The growing end of a twig is selected as a scion, which should have two buds, the plumule or extremity of the shoot is cut off about 1 c.m. above the upper bud, the two leaves are neatly cut off across the leaf-stalk half way between the leaf and the shoot, and the lower node with about 1 c.m. of the shoot below it, is fashioned into a short wedge about 1 c.m. long, which is inserted in a cleft made on the cut end of the stock, which should be of the same age and thickness as the scion, the insertion of the scion being made so that its lower bud may be just above the upper bud of the stock. The grafting knife used in the operation should be quite clean and bright, and indeed in Hungary the operators often go to the length of gilding or platinizing their knife-blades to ensure a thoroughly clean cut. The graft is tied with thick woollen thread, covering all the exposed parts of the graft, and the ligature is removed as soon as the scion has resumed its development and grown by about 2 c.m. carefully removing all the side growth of the stock, so that all the energy may be concentrated on the growth of the scion. The cleft on the stock is made preferably just above a tendril, which is cut across and affords the means for a more solid ligature, and the whole operation is done as quickly as possible so that the exposed tissues which are to unite or knit together may have no time to dry. The operation is completed by tying a vine leaf around the graft and scion to shade off the sun for the first week or ten days until union is well effected and the scion has resumed its growth. The above is the typical Hungarian green grafting, and is that which gives the best results, but other forms of green grafting are known, the saddle-graft being a mere modification of the preceding, in which the scion is cleft instead of the stock and this is formed into a wedge, thus reversing the procedure of the Hungarian graft.

Green grafting may be performed also following the method of the English whip or tongue graft, but the operation is so delicate that it cannot be recommended except to very skilled operators. In the method of green grafting by copulation or approximation the scion has also two buds, of which the lower is cut across the node on one side in a slanting direction thus giving an elongated oval section which is applied to a similar section made on the side of one of the upper nodes along the green stem of the subject, which is trimmed back to about 4 c.m. above this node.

The influence of the stock on the scion, and that of the scion on the stock, as well as that of the graft on plant itself and on the quantity and quality of the produce, has given occasion to long and lively debates, but the result of experience may be summed up as follows :

1). The stock imparts some of its vigour and resistance to the scion, however without any alteration in the specific quality of either the stock or the scion, hence given equal conditions a vine grafted on a vigorous stock is more vigorous than one growing on own roots.

2). The scion of a weak variety or species is a source of weakness to the stock on which it is grafted, that is the stock loses some of its natural vigour and resistance if grafted with a weak species or variety, and viceversa acquires in vigour or resistance if grafted with a species or variety more vigorous and resistant than itself. In practice the influence of the scion on the stock is usually small and negligible, but is always present to some extent, and accordingly an American or hybrid American vine which dislikes a calcareous soil may be grafted with advantage on European stock, and this stock becomes more vigorous and is stated to offer some resistance to Phylloxera, whereas it would easily succumb if ungrafted.

3). The graft improves the production and the quality of the produce, in varying degree according to the nature and quality of the stock. It is found in practice that European vines which were little productive and produced fruit of inferior quality, grafted with another variety of European vine or even with the same variety invariably show an improvement in the quantity and quality of their produce. It is generally admitted that European vines grafted on American stock show a marked increase of production as compared with ungrafted European vines growing under the same conditions. There is no deterioration of quality, and on the contrary an amelioration of the quality of the produce is often reported, and therefore the increase of production is not attended by any proportional diminution of the saccharine and aromatic contents of the grape.

4). This improvement is more marked on calcareous soils, and certain types of American stock such as *Vitis Berlandieri* and its hybrids, exercise in this respect a greater influence than others.

PLANTATION AND CULTIVATION. The vine as already stated will thrive well in a great variety of soils, provided that the subsoil is free from stagnant humidity. On terraced ground along the slope of hills, whatever may be the exposition, and on broken rocky ground, the development of the vine and its production will be moderate, but the quality of the produce both for table use or for the wine press will be highly satisfactory. On such ground, particularly with red or dark soils, the flavour of the grapes will be richer and their saccharine contents much higher, the wine obtained will be a finer produce, highly alcoholic and of good keeping quality. Such districts are the veritable realms of Bacchus. On the other hand, the heavy alluvial soils of the plain, ordinarily well manured, will produce an enormous development of canes and foliage, and a heavy yield of

large bunches, but the grapes will be lacking in flavour and too watery, and will contain too much nitrogenous material instead of sugar, so that they will be perhaps fairly satisfactory for table use, if they happen to be table varieties, but decidedly inferior for the press. Their produce in liquor will be abundant but lacking in alcohol and aroma, and of bad keeping quality, being more liable to alteration and deterioration than to improvement, and therefore must be consumed at once. On white or whitish soils, which are not so well heated by the sun as the red and dark soils and are moreover deficient in iron contents, the vine acquires a moderate development with a rather sickly habit and the grapes mature late and are generally lacking in sugar. On stiff clayey soils which dry up in summer and become water-logged in winter, the vine is liable to be burned up in summer, and in years of drought often succumbs for want of moisture, and in wet springs it is liable to suffer from an attack of root-rot or of eel-worms at the roots, which sometimes develop early in May at the time when the vine is in bloom and spread over patches of considerable extent with fatal results in a few days. Moreover on such soils the grapes are deficient in flavour and sugar, and are generally too acid and astringent, and the wine obtained from them will be poor in alcohol and aroma, and harsh or rough in quality, though perhaps of fairly good keeping quality on account of the excess of acids and tannin. Even vines of superior quality such as Pinot noir, if grown on these heavy soils will yield a wine of poor quality, requiring the addition of sugar during fermentation, and its native mild and mellow flavour will be replaced by a roughness and a dry after-taste which is difficult of amendment.

As a preliminary preparation the soil must be trenched to a depth of 50 c.m. or more, and at the same time should be manured in order to enable the grower

to obtain full profit from the land by the cultivation of certain field crops which do not interfere with the growth of the vines. This operation of deep trenching is expensive but cannot be dispensed with, or even postponed till the first or second year after planting, without prejudice to the vigour and early development of the young vines. On rocky ground this trenching is necessarily omitted, but then the omission is made up by the larger dimensions of the trenches excavated for planting. This work is usually done in summer or early in autumn, and is immediately followed by the excavation of trenches for the planting of cuttings as already mentioned, or if the grower is going to make use of rooted plants (*barbatelle*) holes are excavated 40 c.m. deep, and as much in diameter, and the soil allowed to be acted upon by the sun and then moistened by the early rains before proceeding to plant. Of course when the soil has been deeply trenched and manured it will not be necessary to manure again the plants or the cuttings during planting.

In a specialized vineyard the distance at which the vines are planted must vary with the nature of the soil and with the more or less vigorous habit of growth of the sort of vine which is grown, as well as with the method of training which it is proposed to give to the vine. On good soils and for vigorous sorts of vines, the distance may be one metre and a half from vine to vine in the same row, and two metres between the rows. For poorer soils the distance may be reduced to one metre from one vine to another, and to one metre and a half, and in some cases even to one metre, between the rows. The quincuncial method of planting, in which the spaces between the vines instead of being squares or rectangles are equilateral triangles, which is often recommendable for other fruit trees, offers no advantages in the case of the vine and only contributes to make the proper tillage of the soil more difficult.

Planting is done at any time from November with the first shedding of the foliage soon after the first rains, to the end of February, but the sooner the better as the soil will have time to settle well around the cutting or on the roots of the young plant, and success is better assured. Rooted cuttings or young vines planted early in autumn when the temperature is still above 15° C. generally display at once some activity in their root system, and therefore being already semi-established at the resumption of vegetation in spring, they push with greater vigour, and are less liable to failure in dry springs. Cuttings planted early form their callus before winter, and therefore the emission of roots precedes the development of the shoot, whereas with late planting the buds begin to push before the formation of the callus and the emission of roots, so that the risk of failure is much greater. Layers or plants grown in pots can be transferred to the ground at any time, as then the root system is not interfered with at all, but of course will require watering if the transfer is made in summer. On the other hand, it is not possible to transplant a vine during active growth, as any injury to the root system is resented at once, even if the plant is taken up with a good ball of earth.

The vine whether a plant or a cutting, should not be planted deeper than 20 to 30 or 35 c.m. Even in our light soils and in dry situations this depth should not be exceeded, and in fairly rich and moist soils a depth of 20 to 25 c.m. is quite sufficient. Planting is often made at a depth of 50 c.m. to 1 metre, but this practice presents no advantages, and is altogether mistaken. Cuttings planted too deeply often fail to strike root, as the lower part or heel, which is the best part of the cutting rots away through want of aeration, particularly in wet winters, and in any case a vine planted too deeply grows slowly and may not be in a condition to bear fruit

before five to seven years, whereas cuttings planted at a proper depth will bear fruit when the vine is three or four years old. Vines, and indeed all fruit trees, whose roots are comparatively close to the surface are invariably more productive, and their produce is of better quality and more sugary, as the superficial roots living in the upper strata of the soil mellowed and improved by cultivation as well as by the beneficial action of the sun and of the atmosphere, are better nourished than the deep root system whose function is chiefly to draw upon the reserve of moisture in the subsoil. It is therefore only necessary to plant deep enough so that the upper main roots are not injured by tools during the ordinary operations of tillage. A vine provided with only one or two whorls of roots at a depth of 20 to 30 c.m. grows more vigorously and is probably more resistant to drought than a vine with several whorls of half-developed roots at various depths.

Uniformity of produce is a very important consideration for the wine manufacturer, and therefore the vineyard however extensive should not consist of more than two or three choice sorts of vines. The planter should select those sorts which are known to give the best results in his district. The best sort of vine should constitute the bulk of the plantation, and another good sort or perhaps two, may be planted in separate portions of the vineyard, and the produce is only blended together in the required proportion during the manufacturing process. If other sorts have crept into the vineyard owing to some mistake in the selection of plants or cuttings at the time of planting, they should be grafted in order to secure a thorough uniformity of quality which is always better paid for by the purchaser.

In the extensive methods of viticulture as still practised in some countries, particularly in various districts of Italy, the vine is associated with other trees,

such as the elm, the maple, the lime, the poplar, the willow, the ash and even the oak, and now more frequently with fruit trees such as the mulberry, the cherry, the fig, the peach, the pear, the apple, the olive, the walnut, the almond, etc. the trees being planted at distances varying from 3 to 5 metres or more according to the quality of trees and the size to which they grow, the vines being planted at the same time as the trees. No doubt this very ancient method of growing the vine is exceedingly picturesque and far from being irrational, as the vine has full scope to exercise its climbing habit, and is trained in various ways but chiefly in festoons extending from tree to tree. These so called *arborescens* or *viti arborescens* are of course somewhat difficult to treat for mildew or blight, but otherwise they are said to produce as good wines as other vines, and they are generally heavy croppers. Not all trees seem to be equally suitable for this method of cultivation of the vine, the maple and the elm are said to be the best, and among fruit trees the best are the apricot, the cherry, the plum, the peach grown on plum stock, the pomegranate, the apple and the pear. The mulberry and the fig are less satisfactory. The vine does not agree well with either the almond, the olive or the walnut, but vines grown among prickly pears in this Island seem to do fairly well if the soil is at all suitable.

The vine married to the elm-tree has been sung by Virgil, and this association of the vine with other trees, particularly with fruit trees, though it may not be so remunerative as the specialized vineyard is so suited to the means of the small grower, and also to the requirements of a large estate, that there is no probability that it will ever become so obsolete, as to be completely superseded by other methods. However, for such a dry climate as that of the Maltese Islands, where the soil is also generally too shallow to permit the development of

the roots of the vine along with those of other trees, this method is only recommendable in exceptional cases. Here the vine is sometimes grown with the prickly-pear or with the fig-tree, or more rarely with stone-fruit trees in a mixed plantation along the walls of fields or gardens, or with the pomegranate and the apple along the walls or water-courses of irrigated lands under vegetables, and is allowed to climb over the trees but is not given any particular training. But on irrigated or partly irrigated lands, and where the soil is deep enough, there is no reason why the vine should not be associated with the fruit trees which are usually planted along the boundaries or water-courses of such lands, and submitted to a rational system of pruning and training which would increase its production, and thus set a good example to be followed where it could be done with advantage. The vine may be associated with the olive-tree as a subsidiary cultivation, the land being planted at the same time with olive-trees and vines, and these are removed or die off gradually as the olive-trees attain full size and take complete possession of the soil. Vines growing among full-sized olive-trees cannot be expected to be very productive, and the grapes will be small but very sugary and therefore desirable for the wine press. Beautiful bunches of good table grapes can be grown on watered lands, provided that the vines are allowed their due share of sun and air.

The association of the vine with vegetables or even with certain field crops should not present serious objections if the plantation is properly managed. The vine will benefit by the manure and tillage necessary for these cultivations, but unirrigated field produce maturing after the middle of April, should be kept away from the vines, otherwise the moisture of the soil may become exhausted too early in the season to allow a satisfactory development of the grape.

The vine-covered pergola is commonly used to shade off courtyards, terraces, and the walks of gardens and orange groves. The vine is also trained to cover the trellis-work or fence which is put up to flank walks or garden enclosures. For this purpose white varieties of the European vine are usually preferred, being more vigorous and hardy, but some black varieties such as *mignuna seuda* and *gelleuza seuda* are also used with very good results. Very good vines for pergolas in rather shaded situations are furnished by the American or hybrid American direct producers, but with our gardeners the most popular vine for the pergola is the sort known by the name of *Insolja tal Ghirghenti* which is well known for its extreme vigour and great productiveness, as well as for the long keeping quality of its beautiful oval golden yellow grape, which keeps on the vine in excellent condition often till Christmas. Vines trained on pergolas or on walls are allowed or encouraged to attain full development, and the distance at which they are planted apart depends on their expected growth, but it is always advisable to plant more vines than there is room for, in order to have the pergola well covered and in full bearing as early as possible, and then they may be thinned out gradually to allow more room for the remainder.

For the first two years the cultivation of the vine is simple enough. The ground is kept clear of weeds in winter, and hoed twice or three times around the young vine, keeping the plant well in sight to avoid injuring it. In spring the soil is tilled deeply and finely for the last time, and properly levelled to maintain the moisture of the soil and to keep up the vigour of the growing plant. If necessary, the foliage may be sprayed twice or thrice with Bordeaux mixture as a preventive against *Peronospora*, which if it attacks the plant will check its development by killing the foliage and interfering with the

ripening of the young wood. Cuttings will fruit in the 4th or 5th year after planting, and of course plants (*barbatelle*) will fruit earlier, but the training or pruning of the plants should commence from the first winter following that in which they are planted. In the first winter the shoot produced by the young plant is shortened to two buds and the same is done in the next winter. In the third year the plant is usually strong enough to be definitely trained and submitted to the system of pruning which it is proposed to adopt. In the first two years crops of potatoes, peas and winter vegetables may be grown among the vines, provided that the ground is left clear and finely tilled after April, so that the growth of the vines may proceed without any interference.

After summer the first tillage of the vineyard is done as soon as the fruit has been cut, and should consist mainly in making deep circular troughs or basins around the stem, with the object to facilitate the absorption of rain by the soil around the main roots of the vine. These circular troughs are allowed to remain all the winter, being readjusted after each weeding or tillage, and are moreover necessary for the removal of the upper rootlets which may develop from the stem with the first rains, and being too close to the surface are liable to dry up early in summer and draw upon the energy of the vine instead of contributing to its upkeep. After this early autumn digging the soil is again digged or stirred lightly at least once during winter, in December or January, or better twice more, the second hoeing being done early in December and the third at the close of January or in February. In April the soil is tilled for the last time, this tillage being done by a heavy hoe at a depth of 15 to 20 c.m., the basins above mentioned are digged off and the soil is properly levelled for the summer. Should there be a heavy shower of rain in

April or May, it will be necessary to break up lightly and reduce to powder the surface crust or cake which is formed, but no deep work is necessary.

It is advisable to manure the vineyard every third or fourth year. The operation is best associated with trenching to a depth of 15 to 20 c.m. early in winter as soon as the pruning is completed, and the manure is distributed evenly at the bottom of the trench and there it is digged in by a pickaxe, in the ordinary way. Well-rotted manure from the farmyard or the cowshed is the best for this purpose, and is applied at the usual rate of 400 to 500 hectolitres to the hectare, which works out roughly at $\frac{1}{2}$ to 1 basketful per vine according to the development of the plants and the distances at which they are planted. On rocky ground where the land cannot be trenched, the manure is applied as a surface dressing and in smaller quantity, but then the vineyard should have this surface dressing in alternate years. Surface dressings of manure are practically useless in the case of vines growing on good soils, but a dressing of wood-ashes given early in winter just before a hoeing, or a long with the manure during trenching, improves the vigour of the vines and the quality of their produce. Another method of manuring the vineyard which is often adopted by the growers owing to the difficulty of trenching land thickly covered by the vines, consists in digging square holes, between the rows and alternately with the vines, half a metre wide and 40 to 50 c.m. deep, and burying half a basketful to one basketful of manure in each hole.

Whatever method is adopted for manuring the vineyard, it should be remembered that the excessive use of organic manure will produce grapes of inferior quality for the wine-press, and therefore vines the yield of which is destined for fermentation should be manured sparingly, making up for any deficiency of potash and phosphates by the use of wood ashes and chemical manures such as

superphosphates, chloride of potash etc. Where manuring is not done by trenching, the ashes may be applied in small quantities, but every other year, being spread over the surface of the ground at the rate of 1 to 2 kilog. per are, in autumn or winter, just before hoeing. The superphosphates are best supplied in spring being distributed in the same manner as the ashes at the rate of 100 to 150 kilos per hectare. This phosphatic manure may be spread on the ground just before the deep hoeing of spring, and digged in at once, or may be applied with the same good results in autumn or winter, but should not come in contact with organic or farmyard manure should this be applied at the same time as the other.

PRUNING AND TRIMMING. The vine must be pruned every year, and trimming is also an essential part of every year's work. A vine which has not been pruned falls out of production, loses its vigour, and soon become decrepit. Trimming is performed on the plant in active growth and its object is to economise the vigour of the plant, throwing it entirely on the improvement of the bunches and on the formation of healthy wood for next year's crop; therefore the operation of trimming is a preparation for pruning and also a continuation of it. Training, sometimes referred to as pruning, is the shape given to the plant by judicious pruning and trimming, and is of course very variable, according to the type of the vine and the method of cultivation. In reality pruning consists of three types, (a) short pruning, (b) long pruning and (c) a combination of both.

I. *Short pruning* is suitable only for special sorts of vines of medium or poor vigour, the canes of which are usually furnished with true flower buds or fruit buds close to the old wood, and therefore if pruned to four or two buds, and even to one bud, will not fail to fruit.

A. In the system of short pruning pure and simple, as practised in certain districts of Calabria, Sicily, Greece,

etc (Italian=sistema a capitozza), the vine is trained on a single stem to a height of about 25 to 40 c m. and afterwards the fruiting canes situated on wood of the preceding year's growth are shortened to one bud, and sometimes to two buds. If only one bud has been retained, or if only one cane has developed from the spur, the cane is again shortened to one or two buds in the following winter, but if two canes have developed from the same spur the upper one is cut off altogether, and the lower one is shortened to one or two buds, and so on, so that when pruned the vine has the appearance of a pollarded willow. The number of spurs allowed to each vine varies with its strength, from one to as many as six or more.

B. A variation or rather an improvement of this short pruning is the so called shrub training (It.=sistema ad alberello, or ceppo basso. Fr.=gobelet), which in its turn offers the following subdivisions.

a). The single-spurred method which is largely followed in France, Italy, Sicily, Sardegna and also in Spain. The vine is trained to a height of 20 to 40 c.m. or more, and is then allowed to bear only one spur of two to four buds. Sometimes two spurs of the same length are retained, both spurs being fruit-bearers or mother-bearers, and no special spur is allowed for the production of wood for the next year's crop. This method is suitable for soils of poor quality, where the vine must be restricted to the smallest possible development, and cannot be permitted an alternate growth of wood, but the lowest cane which has developed on the spur or mother-bearer is retained as the spur for the following year.

b). The double-spurred method, which obtains in certain districts of Southern Italy. According to this method the vine in the 3rd year is allowed to develop two canes, which in the following winter are headed back

to four or five buds, and henceforth these two spurs will constitute the two branches of the vine. Each of these two branches is allowed to develop two canes, and these are pruned back to two buds, so that the typical vine has always two branches having on each two spurs with two buds. These two buds are, or are intended to be, fruit buds, and at pruning time the cane which develops from the upper bud is cut off, and that which is formed from the lower bud is in its turn shortened to two buds, and so on.

c). The vase-shaped method (It.=alberello, alberello a vaso. Fr.=gobelet). This method is of ancient origin, and with slight local variations is followed for most specialised vineyards in France, Spain, Italy, Sicily and Greece, and in some of its modifications it is associated with long pruning, one or two canes being pruned long to increase the production of the plant, as practised in Sicily, particularly in the districts of Marsala and Palermo, as well as in Tuscany. The method of Professor Ottavi and that known as the umbrella shape, are mere local modifications, and are more successful with certain sorts of vines than with others.

The typical vase-shaped vine has a stem from 20 to 50 c.m. high, with a minimum of three to a maximum of ten divergent branches, as much as possible radiating from the same level, each of the branches bearing a single spur pruned to one or two good buds. In the first years of its life the young stem is secured to a short prop to grow straight, but afterwards no propping is necessary. In France as well as in Sicily, the stem of the vase-shaped vine is hardly more than 20 c.m. high at the point of bifurcation into branches, and is often less, sometimes the branches commencing quite close to the surface of the ground.

The pruning of the typical vase-shape, and indeed in all cases of short pruning to a spur of one to four buds, should be performed in two epochs. In the first epoch,

from November to January, all the superfluous canes are cut off neatly so that the scar may heal and close over in a short time ; but the canes which are to furnish the spurs are left untouched or only just trimmed at the end. In the second epoch, from February to the first ten days of March, the canes which were left untouched in the first operation are pruned back to two good buds, but are never allowed to retain more than four buds, the cane being cut across the next node or bud above the upper bud of the spur, so that this upper bud may not be exposed to injury by having the pit of the internode laid open just above it. This delay in performing the second part of the operation is necessary in order to give full time to the lower buds which are to be retained on the spur to mature properly and develop into flower or fruit buds, otherwise they may remain immature and in the following spring will push into vigorous shoots but will produce little or no fruit. Owing to inattention to this detail the two budded spurs retained on the vines in our local method of mixed pruning usually develop into very strong shoots, which is indeed the primary object for which the spur is retained, but rarely produce any fruit except with certain vines, such as *Insolja tal Ghirghenti*, which matures its wood and its buds quite early in the season, and is therefore not affected by this consideration. The various methods of espalier or contrespalier, in which the vines are first trained to the required height and shape, but the pruning proper on the established vines is always short, the mother bearers being all short spurs of two to four buds, belong really to the short-pruning type.

B. Long pruning is the type necessarily adopted for vines trained on pergolas or trellis, and for the vines trained on trees (alberate) as grown in many districts of Italy. Long pruning is also advisable for vines trained over the stone walls of our fields and gardens, and is

sometimes associated with short pruning for the purpose of increasing the production of grapes where the vines are strong enough to bear the extra strain without exhaustion, as in the method of Prof. Ottavi, and in the Casalese method. A cane may be said to be pruned long when at least five good buds are retained, and it is long pruning pure and simple when no short spurs are retained for fruit, but only for the reconstitution of the vine or of a fruiting branch, as a detail of training.

Generally speaking the fruiting canes are those produced from wood of the preceding year's growth, and canes arising from old wood being sterile, should be removed, or if required for reconstructing the vine may be headed back to two buds. For vines trained on pergolas, trees, walls, or in any other way, this occasional association of short pruning is often very recommendable and even unavoidable, but as already hinted it is a training operation rather than pruning proper.

The French method of growing vines spread over the ground (*chaintres* or *chaines trainantes*), and a similar method which is practised on a considerable scale along the Italian riviera from Genoa to Spezia, belong to the long pruning type, the ground doing the office of a pergola, and the canes bearing bunches of grapes being raised off the ground on short bifurcated prongs without any ligature. Some of our older vineyards, as at Bahria, are trained in this way, the old stems being allowed to spread over the ground sometimes for two or three metres, and short pruning is resorted to only when it is necessary to renew an old branch which has become too exhausted. This system is by no means irrational, and an abundant crop of grapes of good quality is generally obtained, if proper care is taken to prop up the mother-bearers as soon as the bunches become heavy and begin to touch the ground, in order to avoid sunburn or other injury to the growing grape.

C. Methods of long pruning systematically associated with short pruning. These methods are probably the best for the specialised vineyard, and being the most rational are suitable for all sorts of vines and for soils of any quality. The methods may be generally described as a mixed type of pruning, in which the mother-bearer is renewed every year, and the biological function of the plants is thoroughly specialised, one part of the vine being destined only for the fruit and the other for the production of healthy wood for next year's crop. The type of these methods is the system of pruning evolved or perfected by Dr. G. Guyot and bearing his name. The methods of mixed pruning are of very ancient date, and the annual renewal of the mother-bearer, as well as the specialisation of the functions of the vine, are not a modern invention. What Dr. Guyot has done was to bring the type to a high standard of perfection, and indeed the true Guyot system is rarely followed, owing chiefly to the attentions which it requires and also for other considerations, but in its modified forms it is largely followed in most vine-growing countries. The following is a brief description of the Guyot system. The land is trenched manured and levelled, and divided into square sections of equal size by narrow walks which give easy access to all parts of the vineyard. Cuttings or plants are planted at a depth of 25 cm. and at a distance of one metre apart, with the same distance between the rows. Therefore according to this system one hectare should contain 10,000 vines but for the small space about half a metre which is taken up by the narrow walks. In the first two years the young vines are pruned back to two buds. In the third year, having favoured the formation of a strong cane, by assiduously nipping off all other shoots, and tied it to a prop or a reed to preserve it from harm, in winter it is bent down to a horizontal position at 20 to 30 cm. above the ground, trimmed back to 60 cm. or 1 metre, and its

extremity tied to a small prop, in the meantime fastening the base of the stem to a strong pole about $1\frac{1}{2}$ metres high. In the following summer this horizontal cane will yield some fruit, and will push two or more strong shoots from the bend above the base of the stem. Two of these strong shoots are reserved and tied to the pole, all others not bearing fruit being rigorously nipped off as soon as they appear. In winter the cane which has fruited is cut off, and the uppermost of the two canes which were reserved is brought down to the horizontal position as a fruiting cane and secured to a small prop as before; the other cane is headed back to two buds, which in the following summer produce two other strong shoots, and the process is repeated year after year in the same manner. It is obvious that in this system the vines are planted too close together, as particularly in our climate a greater distance is always desirable, even on the poorest soils. A modification of the Guyot system is the so called *archetto romagnolo*, in which the cane instead of being extendent horizontally is turned in a circle and secured to the same stout pole which sustains the base of the plant. In the spiral method or corkscrew method recommended by Champin the cane is twisted round the same support and secured to it along with the two shoots which in due course spring out from the spur on the stem.

The double Guyot system, for which the vines are of course planted at greater distances, is a simple modification of the preceding, the vine being allowed to have two fruiting canes or mother-bearers, which are bent horizontally, in opposite directions, and only five or six good buds are retained on each. Two spurs are also retained instead of one, although one spur with three buds is often sufficient, the two upper shoots being retained as fruiting canes, and the lower one being in its turn retained as a spur and headed back to three buds. Many

modifications or improvements of the double Guyot system have been recommended at different times, the best known and often practised being the Balzari system which is a double or triple Guyot system, suitable both for vineyards in the plain and for those planted along the slopes of hills, and the Sylvos and the Cazenave-Marcon systems, which are in reality multiple Guyot systems, the last being favourably received in France.

Instead of describing these and other modifications of the Guyot system, it is worth while to say something of our local method of pruning the specialised vineyard, which presents the great advantage that it requires no outlay in the installation and maintenance of permanent propping or indeed of any support whatever. In our method the permanent stem of the vine is never more than 15 c.m. above the ground, and often quite close to the surface, and the pruning is carried out rigorously on the Guyot model, although the method with hardly any variation has been practised for ages by our vine-growers, who perform this pruning with the utmost care, being fully acquainted with the importance of each part of the operation. This method is so suitable for our soil and climate, and gives always such good results in the specialised vineyard, that no one of the more modern methods is likely to supersede it. In fact the "alberello" of Prof. Ottavi, the umbrella-shape, and the Ravaz method which were adopted on a rather ambitious scale by a few of our more progressive viticulturists, have been all dropped after a few years of trial in favour of our time-honoured method.

In their anxiety for an early return, the growers are prone to retain a fruiting cane in the third year, when the vine is not strong enough to bear the strain, particularly on poor or dry soils. They also frequently retain a weakly fruiting cane in its full length of 50 c.m. or more, only just trimming it at the extremity instead of

heading it back to stronger wood with well formed buds, so that the weak buds at the trimmed end are often sterile, and their development represents a waste of energy for a plant which can ill spare it. Another technical defect consists in the way in which most growers make the cut on the spur and on the fruiting cane. These are cut generally just over the uppermost bud which has been retained, with the result that the bud is weakened by the exposure of the pith just above its node. The cut should be made at least half way between the bud which is retained and that which is severed, or better across the bud next to that which is retained, cutting off the bud without setting open the pith canal below it. The thickened node end will also give a firm hold to a ligature without any inconvenience to the growing wood, should it be necessary to tie together two canes in order prop them up when they are in fruit. When the vines are full grown, they are often allowed to develop some wood, in order to have room for two or more spurs and several canes or mother bearers, if there is room for their development, or if the vines have been originally planted too far apart, as the tillage in our vineyards is almost always done by hand, the stems stretched on the ground cause little inconvenience if any. The mother bearer which has fruited is always cut off close to the old wood, so that no unsightly stumps or heels are left to delay the healing process, except in the case that the mother-bearer is required for layering to replace a missing vine in the immediate neighbourhood.

TRIMMING OR SUMMER PRUNING. The operations of trimming (It.=scacchiatura, rimondatura, cimatura, etc.) are performed on the vine in the green or growing condition, that is from April to June or later, and are usually divided into three or at least two stages. The first trimming is done in April, and consists in nipping off or breaking off with the fingers those shoots which

are pushing on the stem or in places where they are not required, and multiple shoots springing from the same bud are reduced to one, reserving the upper one which is always the strongest. The first stage is sometimes merged into the second, which is performed in the first half of May, and consists in the removal of a second crop of superfluous shoots which follows the first, and in shortening the fruit shoots to two or three leaves above the uppermost bunch of flowers. The third trimming is done early in June and consists in a third removal of superfluous shoots and in shortening those fruit shoots which were not sufficiently developed to be trimmed or stopped in May. This shortening or stopping of the fruit shoots is particularly necessary in the case of the upper two fruit shoots which are formed on the mother-bearer, as they have a tendency to start growing at a very quick rate, and take up all the energy which should go to the formation of the grape. The uppermost shoot is therefore allowed to develop unhindered only when a long cane is required to furnish a good layer for next winter, to replace a missing or sickly vine close by, or to fill up an empty space in the rows of vines, on lands free from *Phylloxera*. At the second and third stages of trimming the fruiting shoots are secured to the pergola or to their supports, otherwise they may hang down and break off when a breeze is blowing. Vines, trained on pergolas should be trimmed with moderation, removing the useless and ill-placed shoots, and shortening only the weaker fruiting shoots, sparing the more vigorous, if well placed, to be retained as mother-bearers for next year. It is also necessary to exercise circumspection in the trimming of the specialised vineyard planted on good soils, where the vines are growing vigorously. On such vines the bunches will shank considerably if there is any delay in trimming, that is if part of the vigour of the vine is not diverted from the formation of foliage to the formation of fruit ;

and on the other hand immoderate trimming may result in a fatal loss of equilibrium between the root system and the aerial activities of the plant. In these cases it is therefore advisable to commence trimming early and to continue it frequently but moderately almost until the close of June.

The third trimming is best done at the time when the flowers of the vine are about to bloom, in order to assist the vine to set the flowers and to prevent shanking, and at the same time the vigour of the plant will be diverted to the bunch and the grapes will develop more quickly. In this connexion it may be pointed out that the drastic trimming performed by some viticulturists who stop the fruiting shoots generally to one leaf, and only occasionally to two leaves, above the bunch, cannot be repeated year after year without serious injury to the vine, and although the grapes may at first make very quick progress, their quality cannot be of the best, owing to the want of sufficient green parts for the elaboration of the biochemical processes. On the other hand a vine untrimmed is more liable to attacks of mildew and blight, and the grapes are generally of poor quality both for the table and the wine-press.

The operation of ringing is best performed on the green wood below the bunch just before the blooming period, with the object to obtain bunches of finer appearance. Thinning of the grapes is done in June, to allow the berries to grow to their full size, without pressing upon each other, but both operations are suitable to the small market grower who grows grapes for the table, and are neither necessary nor recommendable as part of the routine work of an extensive vineyard.

VINES GROWN IN THE MALTESE ISLANDS.

The cultivated varieties of the European vine are very numerous, every country having a certain number of local origin, and with very few exceptions the large majority of these varieties are chance seedlings, only a few having been obtained as a direct result of the gardener's art or through a process of artificial hybridization and selection. Yet few fruit trees answer so kindly to careful methods of hybridization and selection. Certain sorts, chiefly wine grapes, have been submitted to a process of selection by continental growers, by selecting cuttings only from plants which excel for high production and for the quality of their fruit, and by continuing this selection over a long period, strains have been obtained which are remarkable for their fertility and for the quality of the fruit as compared with the original type.

Unfortunately there is hardly another class of fruit trees the nomenclature of which is so confused so that it is often a hopeless task to try to extricate the synonymy, that is the names under which the same sort of European vine is cultivated in various countries, or even in various districts of the same country. A few sorts are known everywhere by the same name or by mere linguistic or dialectic variations, but the great majority have special names for each region, and as the appearance or quality of the fruit generally varies somewhat from place to place, it is often difficult to ascertain whether it is the same sort or a distinct variety. Again, many widely different sorts are often known by the same name in various countries or even in the same country or region, and this is another serious obstacle to a correct determination. In the case of American or hybrid-American vines, whether grown as grafting stock or as direct producers, the difficulties above mentioned do not exist, all sorts being correctly named everywhere, or at least

their name has not undergone such profound changes as to preclude their identification.

In the following descriptive list of vines cultivated in these Islands, each sort is described under its local Maltese name, wherever there is such a name in general usage, and in the case of imported sorts the name given is that under which they have been imported or are known, and where identification has been possible the name is followed by its synonyms.

1. AGLIANICO NERO, AGLIANICO, AGLIANICONE, AGLIANO, ELLENICO, sometimes called in Maltese *Isued ta Napti* or simply *Isued tal Imbid*. This vine, long known and cultivated sparingly here and there, was introduced again by Mr. Gollcher from Gragnano in the neighbourhood of Naples. It is largely grown all over Southern Italy for the production of the "Aglianico" table wine. The vine is fairly vigorous and fairly productive, requiring short or half-long pruning. The leaves are small grass-green, soft, smooth on the upper surface, cottony on the lower surface, indistinctly lobed, with a short thin and green leaf-stalk. The bunches are middling, conical, long, and loose. The berries are middling, round, bluish black, heavily covered with bloom, with a thick rind. The pulp is fleshy, juicy, without flavour and somewhat acid or astringent. Should be mixed with white grapes in about equal proportions, otherwise the wine will be too rough and dry.

2. ALICANTE HENRI BOUSCHET. This is a cross obtained by Henri Bouschet in 1885 from *Alicante* or *Grenache* and *Petit Bouschet*. It was introduced in the vineyards at Xaghra (Gozo) by a local vine-grower Lazzaro Attard about 1908. The vine is vigorous and productive, to be grown on dry and stony lands, and requires half-long pruning. The leaves are middling, shaded reddish on the upper surface, and very hairy on

the lower surface. The bunches are middling long-stalked, winged, and usually loose or even shanked. The berries are round, middling or small, black, heavily covered with bloom. The juice is red, and without a special flavour. It is a good wine grape, producing a wine intensely coloured and alcoholic.

3. *Auista bajda* (It.=Agostenga, Uva luce, Prié blanc of Aosta, called also vert de Madère etc.). This vine is probably native of Upper Italy, and is very vigorous and productive; has very long shoots or canes and should be grown preferably for the pergola. Its canes are dark reddish, and flowers late. The leaves are medium or small, smooth on the upper surface slightly hairy on the lower surface, and are almost always trilobed. The bunches are of medium size, often winged, conical, compact. The berries are middling, round or roundish, greenish white, becoming light yellow on the sunny side. Pulp soft, juicy, sugary, well flavoured. Matures in August, but sometimes about mid-July or earlier. It is one of the earliest grapes, if not the earliest, being sometimes exhibited ripe in the show at Boschetto on the 29th June. It is chiefly a table grape.

4. *Auista seuda*. (It.=Agostina, San Lorenzo, Agostenga nera). This vine is native of Southern Italy, and is common in the neighbourhood of Naples, but is rare in our vineyards, probably owing to its low production. The leaves are 3 to 5 lobed, long, rough and very hairy on the under surface, with a short reddish leaf-stalk. The bunches are long, cylindrical, winged, bluish black, with a thick rind, and a fleshy, sweet pulp. It is a table grape of fairly good quality. It is a distinct sort, and not a mere variation of *Auista Bajda*.

5. *Barbera*, corrupted into *Barbria* in Maltese. This is an ancient Piedmontese vine, recently introduced in these Islands. The vine is vigorous, very productive

and agrees well with most soils. The leaves are broad, five-lobed, usually assuming a purplish tint along the margin long before autumn, slightly hairy or cottony on the under surface. The bunch is long-stalked, fairly large of a conical shape, and loose or even shanked. The berries are oval or a dark violet black colour, well covered with bloom, becoming transparent a few days before they begin to show colour. This is an excellent vine for the production of highly coloured table wines of good quality, which keep well and improve with age.

6. *Bezzula bijda* (It.=Pizzutello di Gattinara or Uva lunga). This vine is native of Upper Italy, and is of medium vigour, but fairly productive, with large light green foliage, of roundish shape, imperfectly five-lobed. The bunches are small or medium in size, branched or winged. The berries are very large, elliptical, elongated, often slightly curved, with a very thin adherent rind. The colour is greenish waxy white or yellowish. The pulp is firm, but tender, juicy and moderately sweet. The seeds are small, generally one or two. Matures at Mid-August, and does not keep long. This is one of the finest grapes for the table, with a mild aromatic flavour, and is very suitable for ampelotherapeutic treatment, but is rather scarce, probably owing to its capricious production.

7. *BEZZULA RATBA*. (It.=*mennavacca bianca*, *mennavacca*, or *visparola*). This vine is rather frequent in the vineyards of Dingli and Rabato, also at Fiddien and Zebbieh, being frequently confused with *Insolja ta Gerusalem* or *Bermestia*, and less frequently with *Insolja hadra tal-ibjar*. The plant is very vigorous and highly productive, but the berries are much subject to rot; requires half-long or long pruning. The leaves are large, deep green, smooth on both sides, deeply divided into five lobes. The bunches are large conical, winged, more or less loose and shanked. The berries are large,

oval and elongated, with a thin rind, at first waxy white and then yellow or even golden yellow. The pulp is fleshy, sweet, with a delicate flavour. It is a fine table grape, suitable for pergolas, where the fruit being well ventilated keeps better.

8. BEZZULA SEUDA. This is very probably the *Mennavacca nera* of South Italy. It has nothing to do with *Ghageb tar-Rdum* or *Tuila Seuda tar-Rdum* which is a local vine of transcendent beauty. It is rare in our vineyards owing to its low productivity. The berries are very large and long, with a leathery rind, well covered with bloom. The bunches are large, but usually very shanky. It is grown to a small extent at Imtahleb and Bahria.

9. BEZZUL IL BAKRA. This vine is a local seedling long cultivated at Lippia, Ghain Tuffieha and Gneina. The plant is vigorous with a spreading habit, requiring half-long pruning, and is fairly productive. The leaves are broad, light green, deeply five-lobed, with acute mucronate teeth, tipped yellow or brown, smooth on the upper surface, somewhat cottony and with abundant tufts of hairs along the nerves on the lower surface with a short reddish leaf-stalk, about half the length of the blade. The bunches are long, conical, rarely winged, loose but not shanked, with a reddish brown and somewhat flattened peduncle. The berries are very large, elliptical, much elongated, all of the same size, waxy translucent yellow, with a slight bloom, often marbled and spotted rust close to the stalk. The flesh is soft, very juicy and sweet, with a delicate flavour. The rind is thick and tough, and the seeds are large and plump, greenish brown. It is a very fine table grape of good quality and attractive appearance, and keeps fairly well.

10. BUTTUNI DI GALLU. It. = *pizzutello*, *pizzutello di Roma*, *uva cornetta*, *ditella*, *uva galletta*, *corniola*.

Fr.=*cornichon*, *cornichon blanc*). This is an ancient Italian vine known to the Romans by the name *Dactylis*. It is fairly vigorous and is still planted in the courtyards of old-fashioned country residences, but it is very liable to mildew. It has rather small five-lobed leaves of a light green colour, golden greenish yellow when young, with a reddish petiole or leaf-stalk. The canes are rather short, and the bunches are long, conical, winged, and shanked, with a reddish green stalk. The berries are very long and curved, varying in size and shape. The rind is thick, pale yellow and covered with a thick bloom. The pulp is firm but tender, and of good flavour, usually with only one seed. Keeps well for a long time, and was formerly much more grown for the table than at present, being a good vine for pergolas.

11. BUTTUNI DI GALLU ISUED, sometimes called by mistake *Bezzu'a Seuda*. (It = *galletta nera*, *corniola nera*). This is a distinct subvariety of the preceding, grown at Lia, Attard and Rabato, and now rarely met with. The berry is shorter than in the preceding variety, less markedly curved, and the colour is a violet or reddish black, with much bloom. It is as liable to mildew as the white sort, and is less productive.

12. CABERNET FRANC or CARMENET. (It.=*Cabernet grigio* or *Bretona*). This is a recent introduction in our vineyards, sometimes called *Insolja francisa irkika jeu griza*. The vine is vigorous and highly productive, with stout erect canes, and requires short or half-long pruning. The leaves are rather small, trilobed, dull green and rugose on the upper surface, light green and hairy on the under surface, with a long, thin, reddish-violet leaf-stalk. The bunches are rather small, long, winged, conical and rather compact. The berries are small, round and of unequal size, bluish-black, well covered with bloom. The pulp is soft and watery, sweet and slightly astringent. This is one of the best French

wine grapes, and is also extensively cultivated throughout Italy.

13. CAGNORALI or CAGNOVALI. (Fr.=Morastel). Is common in France and Sardegnia, and has been recently introduced in these Islands. Thrives well in almost any soil, and is vigorous, with a dwarf vegetation and short internodes, requiring short pruning. The leaves are small, rugose and tough, irregularly five-lobed, with very acute segments and a long slender reddish leaf-stalk. The bunches are large, broadly conical, winged and very compact. The berries are round, black, well covered with bloom, not liable to rot. The flesh is soft, sweet and juicy. It is a very good wine grape, recommendable for dry soils and exposed situations, and is very productive, yielding a wine of medium or inferior quality and therefore requiring the addition of other sorts of grapes to improve it.

14. CALABRISA BAJDA or SERKUSAN ABJAD, probably *Calabrese bianca* of Sicily and Calabria. This vine is now little grown but is still met with at Dingli and Rabato, and is often mistaken for the local seedling *Insolja hadra tal Ibjar*, the bunch and grape being very similar, but the rind is not so tough and the juice has not the same rich muscat flavour. The plant has a spreading habit and is fairly productive, requiring long pruning, but the grape is liable to rot off easily. The leaves are broad, pentagonal, indistinctly lobed, light green or yellowish green, smooth on both surfaces, or slightly rugose, doubly toothed, with a short reddish leaf-stalk and sometimes with reddish nerves. The bunch is large, similar to that of *Insolja hadra tal Ibjar* but more compact, with berries of the same size, shape, and colour, but not so richly flavoured and much more liable to rot. This is a table grape of middling quality, often confused with one or other sort of *Nuccellata*.

15. CALDARETTA, probably a corruption of *Claretta* or *Clairette noir*, which is a synonym of *Mourvèdre* or *Murvedro*, a Spanish vine largely cultivated in France since the VI Century, and now grown largely also in Italy. It is cultivated to some extent in Gozo at Nadur, and also at Bahria, Imtahleb and Melleha in Malta, where it is sometimes known also by the name of *Catlan isued* or *Spanjol*. The vine is fairly vigorous and productive, and requires short pruning to produce fine fruit. The leaves are middling, very downy on the lower surface. The bunch is large, conical, winged and compact. The berries are roundish or oval, often compressed by mutual pressure, with a thick black rind well covered with greyish bloom. The pulp is very juicy, rather sweet, and of simple flavour. It is a fairly good wine grape.

16. CANAJOLO NERO or CANAJOLO TOSCANO or UVA CANAJOLA. This vine is largely grown in Tuscany, and has been introduced here in 1854 at San Antonio and Boschetto. It is now cultivated almost exclusively at Ghar Lapsi where it was introduced by Dr. Gaetano Gauci from Carmignano, near Florence. The vine is fairly vigorous, very hard-wooded, and if grown on clayey soils and pruned long or half-long it is well productive. The leaves are deep green, five-lobed, slightly rough and rugose on the upper surface, very cottony on the lower surface, with a long pink coloured leaf-stalk. The bunches are middling or small, conical, long and loose, but may be quite compact. The berries are oval, with a thin but tough rind of a violet red colour. The pulp is juicy, soft, sweetish and acidulous. It makes a good table wine, but gives better results mixed with other grapes.

17. CATARRATTO BIANCO COMUNE. This is a well known and ancient Sicilian vine, from which the famous Marsala wines are chiefly produced, with but little ad-

mixture of other grapes such as the Damaschina or Mayorquin. This vine originally imported by the late Signor Urzi Basile at Dingli has been re-introduced in the Ghain Zhuber vineyards, towards 1907, and appears to be identical with a vine grown at Nadur, Gozo, under the name of *ta Preina il Bajda*. The vine is fairly vigorous and very productive, thrives well in all soils, but prefers the dry and sunny hillside, and requires short or half-long pruning. The leaves are middling, indistinctly three-lobed, rarely five-lobed, often deep green and rugose on the upper surface, very light green on the under surface, somewhat hairy along the nerves. The bunches are large, cylindrical, long, winged or doubly winged, usually very compact, rarely loose. The berries are round, middling, often deformed by mutual pressure, yellow or amber, greenish white if shaded, slightly covered with bloom. The pulp is sweet, slightly acid, juicy, with a simple flavour. This is one of the very best grapes for the production of dessert wines, and is justly accounted as the premier wine grape of Sicily. The well known variety *Catarratto mintellato* or *Carri-cante*, is also cultivated at Dingli, where it was imported by Signor Urzi Basile.

18. CATLANA OR CATLANA SEUDA (It = *Grénache*, *Granaccia*, *Alicante*, *Carignan rosso*, *Aragonese*, etc.). This is a Spanish vine suitable for dry hill-sides, with an erect habit, and strong straight canes, with short internodes. Requires short pruning. The leaves are small, soft, imperfectly lobed, light green and smooth on the upper surface, yellowish or whitish green and somewhat hairy on the under surface, acutely toothed with reddish or brown teeth. The leaf-stalk is rather short and thick, reddish or streaked reddish. The bunches are middling in size, winged, broad, compact. The berries are middling or small, nearly spherical, black, well covered with bloom, and drop off easily. The rind is thick and tough,

highly coloured. The pulp is juicy, melting and sweet, with a fine aroma. This is an excellent wine grape for the production of table wines and also of dessert wines, but is fast disappearing from our vineyards on account of its erratic production.

19. CATLANA BAJDA, sometimes by mistake *Catlan*. The name is sometimes also applied by mistake to *Mignuna bajda* or *Folle blanche*, but the vine usually known as *catlana bajda* is the ancient Sicilian vine known as *Tiro* or *Tiro bianco* or *Sapa* or *Tripiannu*, and is a valuable table grape common in the province of Catania. The vine is vigorous and highly productive, with a spreading habit, and canes with long internodes, preferring long pruning. The leaves are large, roundish, five-lobed, smooth and dark green on the upper surface, cottony and whitish on the under surface, with a thick and hairy leaf-stalk. The bunches are large, conical, winged and usually compact. The berries are roundish or slightly oval, clear greenish yellow, becoming light yellow or amber, with rusty dots on the sunny side. The pulp is fleshy and thick, sweet, with a very delicate flavour. This is a very good table grape, but does not keep well, and is also mixed with other grapes for the press.

20. CORTESE or CORTESE BIANCA. This is another recent introduction from Italy. The vine is very vigorous and well productive, having also a marked resistance against cryptogamic diseases. The leaves are quite smooth, light green in colour and five-lobed, whitish and almost smooth on the under surface, with a thin reddish-green leaf-stalk. The bunches are large and long, often irregular, and generally winged. The berries are round, large and unequal in size, golden yellow, with a more or less rusty appearance on the sunny side. The pulp is rather firm, very juicy, sweet, with an agreeable slightly acid and saltish taste. It is a

good wine grape, used largely in Italy to correct other wines.

21. DAMASCHINA BAJDA. (It.=*damaschina di Marsala*, *Arratalau bianco di Sardegna*, *Mayorquin* or *Damas blanc* of Southern France). This vine, said to derive its origin from the Island of Majorca, is very vigorous, with long trailing canes, and is very productive. Requires long pruning, and is very subject to mildew and blight. The leaves are large, regularly five-lobed, broadly and acutely toothed, tomentose or cottony on the lower surface. The bunches are very large and much branched, conical and loose. The berries are large, roundish or oval, greenish yellow with abundant bloom. The pulp is juicy with a simple or watery flavour, with few seeds or with no seeds at all. This a wine grape to be grown in dry but deep and rich soils, and is also a fine table grape. It is not common in our vineyards and is often confused with other grapes.

22. DAMASCHINA SEUDA or MAROCCHIN. (*Ribier du Maroc*, *Gros Ribier*, *Gros Maroc*, *Black Morocco*, *Ribier*, *Maroccain noir*, *Damas noir*, *Damas gros*). This is a recent introduction, but is now frequently met with in the gardens of amateurs. The vine is very vigorous, with a spreading and erect habit. The canes are hard-wooded, long, erect, with short internodes, and prominent buds. The leaves are middling, thin, dark green and smooth on the upper surface, slightly hairy on the lower surface, deeply lobed and acutely toothed. The leaf-stalk is as long as the blade, thin, tinted reddish pink, and swollen and arched at its insertion on the stem. The bunches are large, oblong-shaped, branched, compact or somewhat loose. The berries are large, obtusely elliptical or oval, deep purplish black, and heavily covered with bloom. The rind is thick and tough. The pulp is firm and somewhat crisp, juicy, with a sweetish and pleasant flavour. Requires half-long pruning, and a

warm and dry situation. It is a fine table grape, but rather capricious as regards production.

23. **DIELJA TAL GOUM**, so called at Nadur probably from the nickname of its original grower. This vine seems to be identical with *Giustulisa bianca* of Syracuse and Mount Etna. The plant is very vigorous, with reddish canes and a somewhat erect habit; the leaves are five lobed, cottony on the lower surface, with a fairly long leaf-stalk of a reddish colour. The bunches are large and elongated, usually winged, and more or less loose. The berries are middling or large, round, greenish yellow, golden yellow on the sunny side. The pulp is juicy, sweet with a good flavour. It is a wine grape.

24. **DIELJA TAL KSARI**. (Fr.=Chasselas Cioutat). This vine has been long known to our gardeners, and is more ornamental than useful, but is grown in pots on accounts of the pretty appearance of its foliage and fruit. It is a miniature vine of vigorous habit, with long, straggling canes, and finely dissected foliage of a lively green. The bunches are small, but long and winged, rather loose but not shanked. The berries are small, round, of a waxy white transparent colour. They mature very early and keep long on the plant. The flesh is watery, sugary, sweetish, but devoid of flavour.

25. **DODRELABI**, also known as *Gros Colman*, *Gros Colmar*, *Gros Kölner*, *Occhio di bue*, sometimes called *Ghain il bakra* by our gardeners. This is a Caucasian variety and is a table grape of fine appearance. The vine is vigorous and productive, suitable both for the pergola and for the vineyard, and may be submitted to half-long or long pruning according to circumstances. It is found at Curmi, Luca, Attard, Tarxen and Boschetto, but is still scarce. The leaves are large, broad, soft but tough, imperfectly lobed or almost round, rugose and dull green on the upper surface, hairy or cottony on the under surface, with a short and thick petiole. The

bunches are large, winged and often double and irregular. The berries are large or very large, round or rather flattened at the poles, intensely black and shining, but covered with a thick whitish bloom. The pulp is firm and thick, dark green, very juicy and fairly sweet.

26. FIANO BIANCO or LATINA BIANCA, sometimes called *Fannu* in Maltese, and is a recent introduction in our vineyards. The vine is fairly vigorous, but more often makes weakly growth, and is very productive. Requires a sunny situation on a moist soil and should be pruned short or medium. The leaves are light green, and whitish green on the under surface, smooth on both surfaces, five-lobed or nearly entire, and have a long leaf-stalk. The bunch is fine, broadly pyramidal, winged, usually with a flattened peduncle, and rather compact. The berries are roundish, with a thick shining yellow rind. The pulp is soft and watery, sweet and aromatic. It is a wine grape, producing spirituous wines of good keeping quality.

27. FRAPPATO NERO DI VITTORIA. This vine is largely grown in Sicily in the province of Syracuse, for the production of red table wines. It is grown in Gozo under the name of *ta Preina* or *Senda*. It thrives best on the hillsides and requires half-long pruning. It is vigorous and productive, with an erect habit of growth and deep reddish canes with prominent buds. The leaf is middling, more or less deeply cut into five lobes, very thick, of a very dark green colour and perfectly smooth on the upper surface, with a cottony lower surface, and a long leaf-stalk often tinted reddish. The bunch is long, cylindrical, with one or more wings, usually compact. The berries are round, reddish black, or black at perfect maturity, covered with an abundant bluish bloom. The pulp is white or pinkish, very juicy, sweet, slightly acid, with a good flavour. The famous red table wines of Vittoria or Syracuse are the product of this grape.

This vine is also much grown at Dingli where it was imported by the late Signor Urzi Basile, and is known there by mistaken name of *Nerello mascalese di Giarre*, which is another Sicilian vine.

28. FRESA or FREISA CHERI or SPANNA MONFER-RINA. This is another recent introduction from Italy, and seems to do well here. The vine is very productive, and fairly resistant against cryptogamic diseases. Thrives well even in soils of inferior quality, and in exposed situations. May be pruned long or half-long. The leaves are small and tough, trilobed or entire, light green, and smooth on both surfaces, with a long, thin, green leaf-stalk. The bunch is long, cylindrical, winged, compact but sometimes slightly shanked. The berries are fairly large, roundish, with a soft and glutinous pulp, rather acid and astringent. The rind is tough, reddish violet, covered with an ashy bloom. It is a wine grape for table wines.

29. GELLEUZA, GELLEUZA SEUDA. (Probably a seedling of the Italian *mammolo*, *mammolo nero*, or *manmola*). This vine is now extensively cultivated in many vineyards, being one of our best wine grapes, possessing also two valuable qualities of great vigour and great fertility. The vine has a spreading habit and should be pruned long or half-long. The leaves are five-lobed, with long pointed segments, rough or rugose on the upper surface, with cottony under surface, especially along the nerves which are often coloured pink. The leaf-stalk is thick, greenish pink, of medium length. The bunch is large, nearly conical, or irregular, compact and often winged. The berries are roundish or slightly oval, with a tough rind, deep purplish black, thickly covered with bloom. The pulp is thick but soft, juicy, sweet and fragrant, with an agreeable acidity.

30. GELLEUZA HOXNA TAL MADLIENA. This vine is a recent seedling of *Gelleuza seuda*, and is grown at

Madliena in the neighbourhood of Dingli, whence it is fast spreading to other parts of the Island. The vine is very vigorous and very productive, requiring half-long or long pruning, and is very recommendable both as a table grape and as a wine grape. Heavy yields are the rule. The leaves are middling or small, practically round and lobeless, or with broad and short lobes, very dark green and smooth on the upper surface, hairy along the nerves on the under surface, with thick, long, violet-red leaf-stalks, streaked darker. The bunches are usually of enormous size, irregular, winged or doubly winged, with a stout greenish stalk, rather compact. The berries are large or very large, round and black, with a very heavy bluish bloom, sometimes of unequal size. Both the bunch and the berry are finer than those of Gelleuza seuda, matures slowly and late, and is usually fit for the press on or after the middle of September.

31. GELLEUZA TUILA. This vine is cultivated at Uied Hazrun near Dingli and has some points of resemblance with Black Cyprus, particularly in its very aromatic flavour, but it is clearly a local seedling. It is vigorous and productive requiring half-long or long pruning. The leaves are middling or small, deeply five-lobed, deep green, slightly hairy along the nerves on the lower surface, with obtuse mucronate teeth. The leaf-stalk is short, thin, and violet red. The bunches are middling, rather compact, and conical, often winged. The berries are middling variable in shape and size, round, roundish or oval, almost black, with a bluish bloom. The rind is thin, but tough. The flesh is soft, greenish, very juicy and sweet, with a delightful aroma, and a slight astringency. The seeds are small, broad, with a slender and acute chalaze. This is a good table grape, and is also excellent for the press, imparting a special aroma to the wine.

32. GHENEB TAT-TOROC. (*Darkaja noire, Persia or Herlani*). This oriedtal vine was first grown in the Mahommedan Cemetery at the Marsa, hence its name *tat-toroc*, where it was introduced towards 1895. This vine is very vigorous and fairly productive, with long stout canes having very swollen nodes, and requires half-long or long pruning. The leaves are very large, broad, five-lobed, slightly hairy on the under surface. The bunches are large or very large, irregular, winged, rather loose. The berries are very large, olive-shaped, bluntly oval, often irregular in shape and size, violet-black, well covered with bloom. The flesh is rather firm, juicy, sweet with a mild flavour. It is a very fine table grape, and rather slow to come to fruit, but is afterwards a regular bearer. Requires a deep soil and a sunny situation.

33. GORBIN or GORBINA or CORBIN, (It.=*corbina* or *corbinella*). This vine is largely grown in Gozo, but is also well known in the vineyards of Melleha, Fiddien, Zebbieh, Ghain Tuffieha, Bahria, etc. It is middling in vigour, with spreading habit, requiring half-long pruning. The leaves are middling, deep green, thin and soft, somewhat hairy on the lower surface, with 3 to 5 deep lobes, acutely toothed, and a long, thin deep red leaf-stalk. The bunch is long, pyramidal, winged, rather compact. The berries are small, round or roundish, deep black-blue, with a heavy whitish bloom. The pulp is soft and very juicy, sweet and acidulous. This is a well known wine grape, producing highly coloured wines, weakly alcoholic, but foamy and dry, of rather inferior keeping quality.

34. GORBINA BAJDA. This vine is cultivated rather extensively at Xaghra and Nadur, and has nothing in common with *Gorbin* or *Gorbina*. It is probably a local seedling nicknamed *gorbina bajda* on account of the size and beauty of the bunch. It is very vigorous, with a

spreading habit, and is very productive, requiring half-long or long pruning. The leaves are very large, dark green, indistinctly five-lobed, somewhat hairy on the under surface, with a rather short leaf-stalk, streaked reddish. The bunch is very large, long, conical, often winged, and very compact. The berries are middling or large, round, yellowish white, with a heavy bloom, often with a ruddy or golden sheen towards the sun. The rind is thick and tough. The juice is abundant and sugary, with a simple flavour. It is an excellent wine grape, producing a light wine of a golden colour, and is largely used to mix with black grapes to give fineness to the product.

35. GRINJOLA or GRINJOLIN TAL BIZBIEZIJA or G. TA MALTA. This vine is cultivated at Bizbiezija, Fiddien and elsewhere. It is quite distinct from *Grinjolin* which is also cultivated at Fiddien, Imtahleb, Bahria, etc. The plant is vigorous and productive requiring half-long or long pruning. Agrees with all types of soils, but prefers a dry and sunny situation. The leaves are middling or large, broad, deep green, smooth on both surfaces, imperfectly five-lobed, with very acute and mucronate teeth often irregular or curved, and with a slender reddish leaf-stalk less than half the length of the blade. The bunches are large long, loose or full, but never compact, sometimes winged. The berries are middling, usually obovate, that is broader at the stalk, but sometimes oval or even roundish, bluish black, with a heavy bloom. The rind is thin, partly adherent to the flesh, highly coloured. The flesh is firm, juicy, with a few reddish veins, sweet and with an agreeable flavour, faintly aromatic. It is probably a local variety, and makes excellent wine, and is also a good table grape.

36. GRINJOLIN. (It. = *grignolino* or *verbolino* or *rossello*). This Italian wine grape is still grown in the neighbourhood of Rabato and Dingli, but its cultivation

was always restricted. The vine is vigorous and well productive, requiring half-long or short pruning. The leaves are broad and thick, with 3 to 5 lobes, rugose on the upper surface, and somewhat cottony on the lower surface. The bunch is pyramidal and winged, usually compact. The berries are roundish, of medium size, with a rusty reddish or pink rind, well covered with bloom. The pulp is thick but soft, juicy and well flavoured. It is a good wine grape, producing a wine of rubby red colour, and of fairly good quality.

37. INGLIZ, ABJAD INGLIZ or INSOLJA INGLIZA. This vine which is cultivated rather extensively at Bizbiezija and Fiddien, as well as at l'Ghassari where it has been grown for the last fifty years, appears to be identical with *Van der Laan*, *Laan hatif*, *Scotch White* or *Blacksmith's White Cluser*. The vine is vigorous and very productive, requiring half-long pruning. The leaves are large or very large, rounded, imperfectly five-lobed, often without lobes, deep green and somewhat rough on the upper surface, smooth on the lower surface, doubly toothed, with acute teeth. The leaf-stalk is slender and reddish, variable in length, may be as long as the blade or less than one-third of its length. The bunch is very large, pyramidal or irregular, winged, full but not compact. The berries are middling, roundish or oval, of a uniform dull yellowish white, heavily covered with bloom. They are also of uniform size, without any admixture of small ones. The flesh is soft, juicy, sweet, with a delicate flavour. It is a fine table grape, and is also mixed with other grapes for the press.

38. INSOLJA FRANCIZA. (Fr. = *Chasselas Gros Coulard*, *C. Coulard*, *Duc de Malakoff*, *Perle Blanche*, etc.). This vine is well known in our vineyards, although it is probably a comparatively recent introduction. It is chiefly grown for the manufacture of wine, but it is also an excellent table grape. It is fairly vigorous and well

productive, preferring short or half-long pruning. The leaves are large, soft, slightly and irregularly five-lobed, obtusely toothed, light green and smooth on the upper surface, with a cobweb of hairs on the lower surface, and with a long, thin, reddish leaf-stalk. The bunches are fairly large, broad and irregular, sometime winged, rather compact and often loose, but never shanked. The berries are fairly large, round, waxy white, later becoming transparent and of a golden yellow colour. The flesh is rather soft, juicy, sweet, with a saline flavour and highly aromatic. The name *I. francisa* is also given by mistake to various other sorts of round or oval-berried white grapes.

39. INSOLJA FRANCIZA TAL IMBID. (Fr.=*Gros blanc de la Moselle*). Probably introduced during the rule of the Order of St. John, its cultivation has remained restricted to Dingli, Fiddien, Imtahleb and Bahria. The vine is very vigorous and very productive, with long canes requiring half-long or long pruning. The leaves are large or middling, light green and rugose on the upper surface, with hardly any angle or with overlapping lobes, and with abundant tufts of hairs on the lower surface. The form is pentagonal with five lobes, obtusely toothed, and the leaf-stalk is short, streaked pink. The bunch is very large, cylindrical, winged, compact or somewhat loose, but not shanked, with a short thick yellowish peduncle. The berries are roundish, oval or elliptical, very variable in size in the same bunch, of a greenish yellow colour, with a good bloom, and mottled or marbled rust. The flesh is soft, very juicy, very sweet and aromatic. It is justly appreciated in France for the production of Moselle wines, and yields here light white wines of good keeping quality. Deserves to be more widely cultivated.

40. INSOLJA FRANCISA TAX-XIAMPANJA or IX-XIAMPANJA. This misleading denomination is given to the

French vine *Oillade blanche* or *Gross Clairette* or *Gallet blanc* of Southern France, the *Ulliade bianca* of Italian authors. It has been long cultivated at Dingli and Rabato, and probably has been introduced during the rule of the Order of St. John. The vine is vigorous and very productive, requiring long pruning. The leaves are middling or small, pentagonal, light green, smooth on both surfaces, or with a few hairs at the angles of the nerves on the lower surface, 3 to 5 lobed, with broad short lobes. The leaf-stalk is very short and thin, green, reddish at the base. The bunches are large pyramidal or conical winged, rather compact. Berries roundish or oval, middling, greenish yellow to brownish yellow, marbled with rust. The rind is thin, and the flesh is soft and watery, sweetish, with a simple flavour. It is in reality a table grape, but is also mixed with other grapes for the press.

41. INSOLJA GHAUDXIA or I. TA GHAUDX. This is probably the Italian *Sanginella bianca* or *Mangiatoria* or *Sancinella*, and is chiefly grown in Gozo, but is met with also in the vineyards of Malta. The vine is very vigorous and productive, requiring short or half-long pruning. The leaves are large and broad, five-lobed, acutely toothed, deep green and smooth on the upper surface, very hairy along the nerves on the lower surface. The bunches are large, irregular and compact. The berries are large, oval or elliptical, long, with a thick bright greenish yellow or rosy yellow rind. The pulp is rather firm and crisp, sweet, with a fine flavour. This is an exclusively table sort, and in Southern Italy is extensively grown for export.

42. INSOLJA HADRA. (It.= *Vermentino*, *Malvasia grossa*). This is an excellent grape for white wines, but is not much grown, although it is not a recent introduction. The vine is very vigorous, and fairly productive, with spreading habit and long trailing shoots, requiring

half-long or long pruning. The leaves are tough, five-lobed, quite flat and rough on the upper surface, cobweby on the lower surface, with reddish nerves, and with a long leaf-stalk, green, shaded red. The bunches are large or very large, conical, winged, compact. The berries are large, round or roundish or slightly oval, greenish yellow, with a tough and thick rind, well covered with bloom. The pulp is fleshy, sweet and juicy. It is also a table grape of good quality.

43. *INSOLJA HADRA TA L'IBJAR*. This vine is a seedling chiefly grown at L'Ibjar near Dingli. It is vigorous and productive requiring half-long pruning. The leaves are large, deeply three-lobed or five-lobed, rather light green and smooth on the upper surface, somewhat hairy along the nerves on the under surface, with long pointed teeth. The leaf-stalk is short, thin, reddish, and the nerves are reddish almost for their whole length. The bunches are large, conical, often winged, loose, but not shanked. The berries are large, elliptical, greenish yellow, turning to ocre yellow or golden yellow towards the sun, with a white bloom. There are no undersized or unripe berries. The rind is thick and leathery; the pulp is fleshy and firm close to the rind, but soft and watery around the seeds. The juice is abundant, very sweet and aromatic, with a muscat flavour, and with some astringency communicated by the thick rind. It is a fine table grape, late keeping, and is also mixed with other grapes and made into wine.

44. *INSOLJA TA RUMA*. (It. = *Trebbiano bianco comune*, *Trebbiano fiorentino*). This vine has been long known in our Island for trailing on pergolas, and is often simply called *Insolja* or *Insolja bajda*. It is a refined Italian vine of ancient origin, and is chiefly grown for the table. It is vigorous and fairly productive, requiring half-long or long pruning. The leaves are large, usually deeply lobed, with small acute teeth, bright green on the

upper surface, and somewhat cottony on the lower surface, with a leaf-stalk just shorter than the blade of the leaf. The bunch is broad at the base, conical, long, rather compact, sometimes loose, but not shanked. The berries are round or roundish, yellowish white, often with a golden sheen, with short pedicels. The pulp is juicy, sweet, soft, with a fine aroma and a slight acidity.

45. INSOLJA HAMRANIA or DIELJA TAL MUSCI. (It.=*Roussan*, *Procanico*, *Trebbiano della fiamma*, *Trebbiano di Firenze* or simply *Trebbiano*). This excellent vine is closely allied to the preceding, of which it may be a well marked variety. It has been long known in our vineyards, but is nowhere common, although it is more frequently seen in the markets than the preceding. It is an ancient vine of vigorous and erect habit, with long stout canes of reddish grey, and is very productive. It is excellent for pergolas in sunny situations, preferring long pruning. The leaves are large, soft, 3 to 5 lobed, rugose on the upper surface, with long segments, hairy on the under surface, with a long stalk streaked pink. The bunches are of good size and very beautiful, long, winged, loose and sometimes shanked. The berries are fairly large, round, with a thick rind of a rosy amber yellow, turning to lively pink, and only slightly covered with bloom. When fully ripe the rosy tint becomes deeper and loses its bloom, assuming a bright translucent flame colour. The pulp is soft, sweet, acidulous, slightly perfumed. It is a good table grape, but is also useful for the manufacture of wines, especially of dessert wines of fine quality.

46. INSOLJA HELUA or I. TAL PONTA or I. TFUH. (It.=*Malvasia di Lipari*). This excellent and productive vine is unfortunately little grown, although it has first class qualities both as a table grape and for the press. It has a tall spreading habit, and requires long or half-long pruning. It is suitable for pergolas in dry

sunny situations. The leaves are large, tough, almost smooth and shining green on the upper surface, with five long lobes. The leaf-stalk is of medium length, rather thick, generally coloured pink, and flattened at the point of insertion on the blade of the leaf. The bunches are long, conical, winged, usually compact, but may be loose or even shanked. The berries are round or roundish, pointed, shining pale yellow or golden yellow. The pulp is rather firm, very sweet and highly perfumed. It yields a dessert wine of superior quality, but is usually mixed up with other grapes to improve their quality. It is also an excellent table grape, and is suitable for drying.

47. *INSOLJA HELUA IRKIKI* or *I. HELUA TA MALTA*. This is very probably an ancient local vine, of middling vigour, but with spreading habit and very productive. The leaves are middling, five-lobed, acutely toothed, light green, slightly hairy on the lower surface, with a long thin partly reddish leaf-stalk. The bunches are rather small, but numerous. They are long and loose, but sometimes fairly compact. The berries are small, elliptical and elongated, with a slight bloom, and are of a warm golden yellow, shading to flame colour when perfectly ripe. The rind is thick and rather astringent. The pulp is soft and juicy, excessively sweet and highly perfumed. It is a good wine grape, suitable for mixing with other wine grapes to improve their quality.

48. *INSOLJA HONNA, I. MORRA* or *I. MALTIA*. This is an ancient local vine and is still frequently met with in most vineyards, but is gradually giving place to other less valuable vines, which produce a larger number of canes and therefore stand a better chance of being propagated. This vine is fairly vigorous on good soils, but on dry soils it makes weak growth and should be pruned rather short. It is always highly productive and resists cryptogamic diseases fairly well. The leaves are large, deeply cut, five-lobed, light green and smooth on both

surfaces. The bunches are large and long, more or less shanked, and winged. The berries are large, elliptical, elongated, of a warm golden yellow colour, with little or no bloom. The rind is thin but tough, astringent and slightly bitterish. The pulp is soft, very juicy, sweet and well perfumed. Some berries remain small and seedless, but mature with the others. It is a fine grape for the table and keeps well, but it is essentially a wine grape of the finest type, and should be more grown for the production of dessert wines.

49. INSOLJA JIEBSA, sometimes called *Mignuna francisa* or *Ghain l'Ass*. (Fr.=*Mamelon* or *Chrisselas Le Mamelon*). This is a French vine and is cultivated here and there in gardens as a table grape, but is very subject to mildew and rots off easily when ripe. However the plant is vigorous and productive, requiring half-long pruning. The leaves are large, smooth on both surfaces, with long upper lobes, and obtusely toothed. The bunch is large or very large, irregular or somewhat abruptly pyramidal. The berries are large roundish or slightly oval, with thick stalks. The rind is thick and tough, yellowish white, with an abundant bloom. The pulp is fleshy and firm, somewhat crisp, sweet and juicy.

50. INSOLJA MALTIA IRKIKKA or I. SAFRA. This is probably one of the half-wild sorts of grapes cultivated in ancient days. The vine has a spreading habit and thrives well in all situations. It is fairly productive in good years and is very resistant to drought. The leaves are small or middling, very deeply cut into three or five roundish lobes, smooth on the upper surface, somewhat hairy along the nerves on the lower surface, with a long pinkish petiole. The bunch is middling or small, loose and long. The berries are middling or small, oval, of uneven size, deep golden yellow, often with only one seed, many berries remaining quite small and seedless.

The rind is thin, tough and astringent, and the pulp is watery, very sweet, and slightly aromatic. This would be a good wine grape, but is now discarded owing to its irregular production.

51. INSOLJA MARSUSA HAMRANIA OR INSOLJA TAL IMBID. (It. = *Erbaluce bianca*, *Erbalus*, *Ambra*). This vine was probably introduced in 1854. It is very vigorous with a spreading and trailing habit, and is very productive requiring half-long pruning. The leaves are five-lobed, deep green and smooth on the upper surface, somewhat hairy on the lower surface, with a short and thick leaf-stalk. The bunches are long, cylindrical, and very compact. The berries are middling, round or sometimes slightly oval, more or less compressed by mutual pressure. The colour is amber yellow, turning to golden reddish yellow or flame colour at perfect maturity. The rind is thick and tough ; with a simple flavour. It is a fine vine for pergolas, but the grapes are also good for the press producing a deep golden yellow wine of good keeping quality.

52. INSOLJA NAPULIUNA. (Fr. = *Chasselas dorè de Fontainebleau* or *Ch. Thoméry*). This is a recent introduction from France, but has not met with much favour, the berries being very liable to the depredations of birds and insects. The vine is vigorous and very productive, requiring long or half-long pruning. The leaves are large, light green, five-lobed, with a thin reddish leaf-stalk, almost identical with those of *Ch. Gros Coulard*. The bunches are conical, long, winged, rather compact. The berries are middling, round, transparent, greenish yellow, and then golden yellow. The flesh is soft, juicy, very sweet, with a fine flavour. It is one of the best table grapes of France.

53. INSOLJA SEUDA TA GHAIN TUFFIEHA. This is a local shedling grown rather extensively at Ghain Tuf-

fieħa, and also at Melleħa. The vine is very vigorous and well productive, and requires long or half-long pruning. The leaves are middling or large imperfectly five-lobed, and of regular form, smooth on both surface, deep green on the upper surface, with a long slender, green leaf-stalk. The bunches are large, conical, winged, loose but not shanked, with a short, thick and green stalk. The berries are large or very large, oval, often elongated, with many small roundish or oval berries, which mature with the rest. The rind is thin, but tough, deeply coloured purplish black, with a fair amount of bloom, the pulp is greenish white, fleshy and rather firm, but juicy sweet and faintly aromatic, with purplish veins underneath the rind and close to the stalk. The seeds are two to four, middling, pointed, yellowish. It is a good table grape, and also produces wine of fine colour, and fairly good keeping quality.

54. INSOLJA SEUDA TA L'IMBID. This vine is little grown in Malta, but is fairly common in Gozo, and may be a local modification of the French *Gamay* or *Beaujolais*. It has an erect habit with rather short canes, having short internodes, and requires short or half-long pruning. The leaves are of oval form, almost entire or imperfectly 3 to 5 lobed, light green, slightly hairy on the lower surface. The bunches are middling or small, but numerous, conical, more or less compact. The berries are small, roundish or slightly oval, deep violet black well covered with greyish white bloom. The pulp is fleshy, rather thick, juicy, very sweet, with a fine aroma. This is a wine grape of excellent quality, but rather too liable to mildew and blight.

55. INSOLJA SEUDA TA STONCA. This is a local seedling which originated in the vineyards "ta Stonca" at Uied Liemu. The vine is very vigorous and very productive, requiring half-long or long pruning. The leaves are middling, with a very open angle, very deeply

cut into five lobes, with long narrow lobes, doubly toothed, with acute mucronate teeth tipped yellow or brown. They are deep green, smooth or slightly rugose on the upper surface, cottony on the lower surface, with a thin reddish leaf-stalk variable in length, sometimes half the length of the blade and sometimes as long as the blade or longer. The bunches are large, rounded or obtusely conical, rarely winged, somewhat loose, with a slender peduncle. The berries are large, roundish or oval, purplish black, heavily covered with bloom, occasionally with a few undersized seedless berries. The rind is very tough, highly coloured, with little astringency. The flesh is white, firm, juicy, fairly sweet, with a simple flavour, containing two to three large plump seeds of a greenish brown colour. It is a beautiful table grape, but is also mixed with other grapes for the press.

56. *INSOLJA TA BURNAHHALA*. This is a local seedling which originated towards 1870 at Burnahhala to the west of Kabato. The vine is very vigorous and highly productive, requiring half-long or long pruning. The leaves are large, soft and tender, five-lobed, hairy on the under surface, with a thick green leaf-stalk. The bunches are very large, conical or pyramidal, winged, rather compact. The berries are large, roundish or oval, pale yellow with a heavy waxy bloom, of most beautiful appearance. The rind is thin but tough. The pulp is fleshy and soft, fairly juicy and sweet, with a simple flavour. It is an excellent table grape, keeps well, and is rather poor for the press. The foliage is very liable to downy mildew.

57. *INSOLJA TA CHELUL*. This vine is highly esteemed in Gozo, but is little known in Malta. It was introduced by Canon Don Giuseppe Buttigieg, nicknamed "ta Chelul" from Nadur, and is one of the finest and best grapes of local origin. The vine is very vigorous and is highly productive; requires short or half-long

pruning. The leaves are large, smooth, almost entire or very imperfectly lobed, with a long petiole tinted red or pink. The bunches are large or very large, pyramidal or conical, winged, full, without being compact. The berries are large or very large, round or roundish, at first greenish white, and then waxy white, with abundant bloom, becoming golden yellow at perfect maturity. The pulp is white or greenish white, melting, sweet and of good flavour. It is extensively cultivated at Nadur and elsewhere in Gozo, chiefly as a table variety, producing also wine of fairly good quality.

58. INSOLJA TA GENNARU OR GENNARUA. This is another local seedling much planted in Gozo for the production of white and light coloured wines. The vine is vigorous and very productive, requiring half-long pruning. The leaves are large, imperfectly lobed, slightly hairy on the lower surface. The bunches are fairly large and numerous, conical, winged, rather compact. The berries are middling or small, round, waxy white, passing to golden yellow, spotted with rust, and covered with a fine bloom. The pulp is soft, juicy and sugary. It is a good wine grape, maturing early, and if allowed to dry in the shade for a day or two before it is crushed, the keeping quality of the wine is improved.

59. INSOLJA TA GERUSALEM. This name is usually applied to the Italian vine *Bermestia* or *Brumestia* or *Brumastra* or *Prunesta*, and is now sometimes applied also to *Lattuaria* which is another vine of comparatively recent introduction. It has nothing to do with *Gerosolimitana bianca* of Sicily or *Moscatellone* of Italy, which is the Muscat of Alexandria or Salamanna. The *Insolja ta Gerusalem* or *Bermestia* is very vigorous and highly productive, with long reddish canes, deeply grooved, and with long internodes requiring long or half-long pruning. The leaves are five-lobed, roundish, smooth on both surfaces, with a long, green leaf-stalk. The bunches

are very long and usually shanked, rarely winged, with a long thick green peduncle. The berries are oval and elongated, shaped like an olive, well covered with bloom, of an ashy white colour, passing to pale yellow. The pulp is fleshy and thick, fairly sweet, with a faint aroma. It is a table grape of very good keeping qualities, and probably our *Insolja tal Ghirghenti* is a chance seedling of this variety.

60. *INSOLJA TA GNIE N FIERES*. This vine originated at Gnie N Fieres (Rabato) and is a splendid table grape of good keeping qualities. The plant is vigorous and very productive, requiring half-long or long pruning. The leaves are middling or small, slightly divided into 3 or 5 lobes, doubly toothed, light green and smooth on both surfaces with a very short slender white leaf-stalk, vinous red for its lower half close to the stem. The bunches are very large, often winged, conical and long, loose but not shanked. The berries are very large, oval, without admixture of small ones, greenish yellow to waxy yellow, well covered with bloom, shaded gold and marbled rust towards the sun. The flesh is rather firm, but juicy, sweet, with a delicate flavour. It is an excellent table grape, and is also mixed with other grapes for the press.

61. *INSOLJA TAL GHASSARI*. This vine is cultivated at Ghassari (Fiddien) and is a recent local seedling, which fruited for the first time toward 1895. The leaves are middling, round, hardly lobed, with a close angle, and small obtuse teeth, light green and blistered or rugose on the upper surface, with only a few hairs at the angles of the nerves on the lower surface, and with a short reddish leaf-stalk. The bunches are large or very large, winged, pyramidal or irregular, loose, with a thick greenish stalk. The berries are middling, round, roundish or slightly oval, greenish yellow to golden yellow on the sunny side, with a good bloom, and with many small

seedless berries which mature with the rest. The flesh is rather firm, juicy, sweet with a simple flavour. It is a promising wine-grape.

62. *INSOLJA TAL GHIRGHENTI* or *GHIRGHENTINA*. This well known local vine has originated at Ghirghenti and is probably derived from *Bermestia* or *Insolja ta Gerusalem*, and is now extensively cultivated in most vineyards on account of its resistant qualities, very high production and great vigour, but when well ripe is also good for the press and gives satisfactory results if mixed with other grapes. It has a spreading habit with very long canes and is therefore one of the best vines for pergolas, but may be trained in any way adapting itself well to short, half-long or long pruning according to circumstances. The leaves are fairly large, deep green, smooth on both surfaces, but often slightly hairy along the nerves on the lower surface, divided into five long lobes, of which the middle one is very long and lozenge-shaped, with a pinkish midrib and a long reddish pink leaf-stalk. The bunches are conical, long, winged, quite loose or shanked ; with a long, thick stalk which becomes very brittle when the grapes are ripe. The berries are large, oval or elliptical, of uniform size and shape, with a thin but very tough rind, of a bright golden yellow colour when well ripe, only slightly covered with bloom. The pulp is fleshy, juicy, and when well ripe very sweet and delicately perfumed. It is our best grape for late keeping, being also a table grape of great beauty.

63. *INSOLJA TAL GNEINA*. This vine has been cultivated for many years at Gneina, has points in common with *Trebbiano* or *Insolja ta Ruma*, but is evidently a local seedling. The vine is very vigorous and well productive, requiring half-long pruning. The leaves are large, not unlike those of *Trebbiano*. The bunches are large or very large, pyramidal, winged or doubly winged, somewhat loose. The berries are large round, with a

fine bloom, straw-coloured at perfect maturity, often dotted with rust on the sunny side. The pulp is soft and watery, sweet and delicately flavoured. It is a table grape, but is also mixed with other grapes and made into wine.

64. INSOLJA TAN-NADUR, locally known by the name of *Insolja tat-Ticciu*. This is the *Albana bianca* of *Syracuse*, and has a vigorous habit with long canes, suitable for pergolas, requiring half-long or long pruning. The leaves are large rugose and blistered, deep green, five-lobed, with short lobes, very cottony on the lower surface, and with a short thick green leaf-stalk. The bunch is fairly large, with a short thick stalk, conical and winged, rather loose or even shanked. The berries are large, oval, golden yellow at full maturity, with a thick rind and a fleshy pulp of good flavour. It is a fairly good table grape.

65. INSOLJA TA SKALLIA. (It. = *Inzolia*, *Insolia imperiale*, *I. di Candia*, *I. bianca*). This is an ancient vine and is extensively grown in Sicily and Calabria as well as in the East. In these Islands it is met with in most places but is nowhere common and never grown in specialized vineyards. It is a good table grape, but is especially an excellent wine grape, very recommendable on account of its vigorous habit, fair production, and the good wine produced from it. Requires half-long pruning. The leaves are deeply cut and five-lobed, light green and smooth on the upper surface, slightly hairy on the under surface, with a slender reddish brown leaf-stalk. The bunches are large, long and broad, winged and more or less shanked. The berries are oblong or elliptical with a thick rind well covered with bloom, of a pale yellow or golden yellow colour. The pulp is firm but juicy and sugary.

66. INSOLJA TORCA or INSOLJA TAZ-ZBIB, sometimes called *Insolja ta Gerusalem* by mistake. (It. = *Lattuaria*,

Lattuario bianco, Uva turca, Turchino, Passolaro zuccherino). The vine is very vigorous with an erect habit and is well productive with fairly long canes, but with short internodes, requiring medium or short pruning. The leaves are fairly large, 3 to 5 lobed, with obtuse segments, smooth and bright green on the upper surface, slightly cottony and pale on the lower surface, with a thick, short, leaf-stalk. The bunches are cylindrical and winged, rather compact, but may be loose or even shanked. The berries are large roundish or oval, with a thin but tough rind of a bright greenish yellow colour. The pulp is soft, juicy, sugary, and aromatic. Matures early, and is usually mixed up with other grapes for the press, but it is essentially a table grape.

67. *INSOLJA TUILA HAMRANIA*. This is one of our oldest vines and is met with in most vineyards, but is nowhere grown extensively. The plant is fairly vigorous and productive, requiring short or half-long pruning. The leaves are large, deep green, deeply five-lobed, smooth on both surfaces, with acute lobes and long mucronate teeth. The leaf-stalk is as long as the blade, reddish green. The bunches are middling or small, but numerous, conical or irregular, fairly compact, but often more or less loose. The berries are middling, elliptical, all of the same size and shape, rich golden yellow shaded rose or flame colour, with hardly any bloom. The rind is fairly thick and astringent, and slightly bitterish. The flesh is soft, melting, very juicy and sugary and well perfumed. It is a table grape, but is generally mixed with other grapes for light coloured wines.

68. *ISUED TAL BEIKA*. This vine is so called from the nickname of a farmer from Nadur in whose field it originated as a seedling. It is now largely grown in Gozo on account of its high production and other qualities. This vine has points in common with the Sicilian *Perricone* or *Quarnaccia*, and is very vigorous, with stout

shoots, requiring short or half-long pruning. The leaves are large, flat, roundish, imperfectly or irregularly lobed, with a short thin leaf-stalk, reddish close to the stem. The bunches are large, conical, bent on one side, very compact. The berries are middling or small, round, with a thick and tough rind, violet black, thickly covered with bloom. The pulp is thick, juicy, rather sugary. Produces a good table wine, deeply coloured red, fiery, strongly alcoholic, and of good keeping qualities, which in colour and flavour strongly resembles the commendaria wine of Cyprus.

69. ISUED TAL HAUUIEF. This is a comparatively recent sort, which originated as a chance seedling towards 1885 at Melleha in a field called "tal Hauuief". The vine is very vigorous and highly productive, with long spreading and trailing shoots, and requires rather long pruning. The leaves are large, mostly five-lobed, deep green, hairy on the under surface, with a long thick reddish leaf-stalk. The bunches are large, irregular or pyramidal, winged, and quite compact. The berries are large, round of a reddish black colour. The pulp is soft, juicy and sweet. It is largely grown as a wine grape, but is also a table grape of seductive appearance and fairly good quality.

70. ISUED TAL MAIMAZ. This is a seedling from Bahria and is cultivated also at Imtahleb and Dingli. The vine is vigorous and very productive requiring half-long or long pruning. The leaves are round, deeply five-lobed, somewhat rugose on the upper surface with some hairs along the nerves on the lower surface. The leaf-stalk is thick and very short, reddish along its lower half. The bunches are middling or small, very compact. The berries are round or roundish, middling, violet-black, with a heavy bloom. The rind is tough. The flesh is greenish, juicy, fairly sweet, with a faint aroma. It is a wine grape of middling quality.

71. LAGRIMA or LACKIMA, *Lacrima di Napoli*, *Lachryma Christi*, *Negro Amaro*, etc. (Maltese=*Għeneb ta Urzi*, so called from Signor Urzi who first introduced it in his vineyards at Dingli). The name *Lacrima* is given in Southern Italy to various sorts of grapes, black or white, and Urzi's vineyards contained a mixture of these sorts collectively known as *Lacrima* or *Għeneb ta Urzi*. The following description applies to the real *Lacrima*, the best of its group as a wine grape. The vine is rather weak and not very productive, does best on rather moist and deep clayey soils, and requires short or half-long pruning. The leaves are very deeply divided into five lobes, deep green, light green on the lower surface, where it is slightly hairy along the nerves. The bunches are long irregular, more or less shanked. The berries are oval, of unequal size, violet or reddish violet, with an abundant white bloom, and drop off easily if the bunch is shaken at maturity. The pulp is fleshy, juicy, very sweet and fragrant. This is suitable for the production of fine table wines, but has met with little favour on account of its rather low production.

72. L'IMTARFA. This vine, originally introduced from Marfa (Malta), has been long grown in the vineyards all over Gozo and is an old local sort. The vine is vigorous and highly productive, with spreading and trailing shoots and requires long or half-long pruning. The leaves are middling with three or five lobes, somewhat hairy on the under surface. The bunches are large, long, winged and loose. The berries are rather small, roundish or oval, straw-coloured when perfectly ripe. The pulp is soft, juicy and very sugary. It is chiefly grown as a wine grape.

73. MADELEINE ROYALE, MADELEINE IMPERIALE, MADDALENA REALE, sometimes called in Maltese=*Francisa imperiali*. It appears that this French vine has been introduced in the Boschetto Gardens towards 1860, but

it has never spread notwithstanding its valuable qualities. The vine has a quick and large development ; with large five-lobed leaves, having a closed petiolar sinus ; dark green on the upper surface, heavily covered with a cottony web on the under surface. The bunches are fairly large, long, conical, winged, rather loose. The berries are roundish or round, fairly large, whitish green and pellucid, with a slight bloom. The rind is thin but tough, the seeds are few and small, and the pulp is soft, watery, sweet, with a fine and delicate flavour. It is a table grape of good quality, and very early, usually maturing well by the end of July. The vine is productive, and should be more grown on account of its earliness and fine flavour.

74. MARSUSA or MARSUSA BAJDA. (It.= *Albana*, *Albana bianca*, *A. gentile*, *A. di Toscana*, *Biancame*). This ancient vine is very vigorous and is suitable for trailing on pergolas and trees, requiring rather long pruning. The leaves are broad and rounded, deep green, five-lobed, with the upper surface often blistered or rugose, with a dense cobweb of hairs on the lower surface, and with a reddish leaf-stalk and midrib. The bunch is conical, and usually winged, generally compact, but may be slightly loose. The berries are of medium size, round, slightly covered with bloom, becoming yellow or golden yellow at maturity, sometimes blotched or marbled with rust. The pulp is soft, sweet and juicy. Matures rather early and yields a wine of good quality and of a golden yellow colour. It is a very good wine grape for these Islands, and is also a good sort for the table. Other forms of this vine, having smaller leaves smooth on both surfaces, and bearing less compact bunches, are also cultivated.

75. MARSUSA SEUDA, (It.= *Albana nera*, *Albanina*). This vine is only grown here and there ; and is generally confused with *gelluza seuda*. The plant is very

vigorous and fairly productive. The leaves are very broad, rugose, five-lobed, cottony on the under surface, and on its long petiole, which is reddish on its under side. The bunches are large, conical, winged, generally somewhat loose. The berries are round or slightly oval, of medium size, and of a deep violet colour, with a thick greyish bloom. The pulp is juicy, soft, colourless, sweet and slightly aromatic. Produces an excellent wine of good keeping qualities, and of a deep ruby red colour, with a fine aroma. It is also a good table sort. Does well on clayey soils, but unfortunately is not a steady bearer.

76. MARSUSA SEUDA TAN-NAHAL or simply TAN-NAHAL. This vine has been long cultivated in Gozo, especially at Nadur and Xghara. It has some characters in common with the *Black Malvasia of Candia*, but it is clearly an ancient local seedling, and is very productive. Requires long or half-long pruning. The leaves are broad five-lobed, downy on the lower surface, with a slender greenish leaf-stalk. The bunches are large or very large, conical and long, compact, and usually winged. The berries are middling, round, black, with a heavy bloom. The pulp is very juicy and sweet, with a faint aroma. It is very early, maturing early in August, and on that account it is exposed to the depredations of wasps and bees, hence its name. It is a wine grape, yielding a product well coloured and of a mellow flavour.

77. MARSUSA TAN-NEBBIET. This is quite a recent seedling which originated at *l'Ghassari (Fiddien)*. The vine is very vigorous and very productive, requiring long or half-long pruning. The leaves are small, often asymmetrical, rounded, trilobed or imperfectly lobed, with very acute mucronate teeth, tipped yellow, deep green and somewhat rugose on the upper surface, smooth on the lower surface, with a slender reddish leaf-stalk. The bunches are very large, conical, winged, compact, with a slender and tenacious leaf-stalk. The berries are very

large, oval or roundish, yellowish green to waxy yellow, dotted and marbled rust, with little bloom, and with many small seedless berries maturing with the rest. The rind is thin and tender, and the flesh is melting, juicy, sweet, with a very delicate flavour. It is a fine table grape, and one of the earliest, well deserving of propagation.

78. MELLIEHIJA or TAL MELLIEHA. This is a local seedling which originated at Melleha about 25 years ago, and is now largely grown at Melleha, Ghain Tuffieha, Uardia and Gneina, and is also often grown for trailing on pergolas. The vine is very vigorous, with long trailing canes of a reddish brown colour, with long internodes, and requires half-long or long pruning. The leaves are large, deep green, almost entire or hardly lobed, with large and very acute teeth, perfectly smooth on both surfaces, with a stiff reddish pink petiole almost as long as the blade, and with reddish nerves on the lower surface of the blade and often also on the upper surface. The bunches are generally very large, long, winged or doubly winged, rather loose, and often somewhat shanked. The berries are of the largest size, as large as those of *Ghageb tar Rdum*, elliptical, deep purplish black, with a fine bluish bloom. The pulp is greenish, and rather soft, juicy, sugary, with a fine aromatic flavour. Matures late. It is a most beautiful table grape, suitable for pergolas, and keeps well. It is also mixed with other grapes for the press.

79. MIGNUNA BAJDA, often called *Catlana*. (Fr. = *Folle blanche*, *Gros Plan*, *Fol*, *Fou*). This well known vine has a vigorous semi-erect habit, with long stout canes, and is very productive. It has broad leaves, with 3 to 5 lobes, obtusely toothed, dark green, with a thick cobweb on the lower surface, and with a thick reddish leaf-stalk, green and swollen at both ends. Requires short or half-long pruning. The bunches are small or medium in size, conical, usually compact, with a short

and strong stalk. The berries are oval or elliptical, greenish yellow or even golden yellow, spotted rust on the sunny side. The pulp is firm but juicy, sweet and slightly acidulous. This grape is usually consumed here as a table grape, but is an excellent wine grape, largely grown in France for the manufacture of cognac.

80. MIGNUNA BAJDA TAL CANNIZZATI, sometimes miscalled *Catlana*. (It.=*Luglienga*, *Lugliatica*, *Lugliatica bianca*, *Lignan bianco*, *Agliana*. Fr.=*Madeleine blanche* or *Joanin charnu*). This vine is very vigorous, with a spreading habit, and is well productive. Should be pruned long or half-long. The leaves are middling, bright green, 3 to 5 lobed with acute segments, somewhat cottony on the under surface, with a long and thick leaf-stalk. The bunches are large, irregular, winged and compact. The berries are roundish or ovate, with the thicker end close to the stalk, greenish yellow, transparent, with a golden sheen, and a thin delicate rind adherent to the pulp. The flesh is firm and somewhat crisp, softer in the centre, sweet and well perfumed. Matures in July and August, and is an excellent table grape formerly much planted for pergolas, and still in favour although rather too liable to attacks of oidium and downy mildew.

81. MIGNUNA BAJDA TAR-RABAT. This ancient vine is in all probability a local seedling. The bunch and grape are very much like those of the Sardinian *Albumannu* or *Bianco grande* but the foliage, habit and vegetation are quite distinct. There is also some resemblance to the *Verdicchio bianco* or *Verdone bianco* of Bologna and Central Italy, but both the bunch and the berry are larger, and the pulp is firmer. The name *mignuna bajda* is given to other types of white grapes, but in the district of Rabat (Malta) where this vine is more frequently met with, the name is generally applied exclusively to this variety. The vine is fairly vigorous, with a bushy habit

and moderate expansion, having short canes of an ashy greyish brown, with short internodes and prominent cottony buds. It is fairly productive, and requires short or half-long pruning and a sunny and dry situation. The leaves are large and broad, rather downy on the lower surface, with a thick leaf stalk. The bunches are very large, broadly conical and winged, compact or somewhat loose. The berries are very large, round, or compressed where they touch each other, with a thick rind, light greenish yellow to amber, with abundant bloom, and often blotched with rust or dotted on the sunny side. The pulp is very firm and crisp, juicy, sweet and aromatic, with small seeds. It is an excellent table grape, maturing early and fairly long keeping, and is also mixed with other grapes for the press.

82. MIGNUNA SEUDA. (*Frankenthal, Black Ham-burgh, Nero di Italia, Rother Maltheser*). This is a well known vine cultivated on pergolas and in the vineyard, and is a beautiful table grape of fairly good quality. The vine is vigorous, often with fasciated twigs, and is a regular bearer. The leaves are large, trilobed, thick, of a light green colour, with a rugose upper surface, the lower surface being greenish white and almost smooth, with a long green leaf-stalk, streaked with purple. The bunches are large, winged, irregular, compact. The berries are large or very large, round or sometimes roundish, with a thin rind which is coloured reddish, usually turning to dark violet purple, but often remaining partly green towards the stalk. The pulp is fleshy, firm, watery, sweet, with a faint flavour. The subvariety known as *Mignuna tal Lixx* or *Dielja tal Lixx* from the nickname of the grower, is a chance seedling raised recently in a garden at Rabato (Notabile), producing bunches like those just described but with finer and larger berries more deeply coloured, and is very productive. Both are magnificent table grapes, deservedly popular.

83. MIGNUNA TAL PELLEGRIN or MIGNUNA TAL BOZoz. This is a chance seedling of recent origin, found and propagated at *Rdum il Pellegrin* near *Fomm-ir-rieh*. The vine is very vigorous and highly productive, requiring half-long pruning. The leaves are large five-lobed, slightly hairy on the under surface, with a long, thick, slightly reddish leaf-stalk. The bunches are large or very large, pyramidal or irregular, winged or doubly winged, generally compact. The berries are large, round, dark violet black, thickly covered with greyish bloom. The pulp is fleshy, rather soft and melting at the centre, without being watery. It is greenish or greenish white, sweet, with a fine fragrance. This is a table grape of good quality and very attractive appearance, hence its name *tal bozoz*, that is worthy to be placed in a show glass bell.

84. MIGNUNA TAUUALIA TAL CANNIZZATI. (It. = *Pergolese, Roggia, Groja, Rodia, Uva di Natale*). This vine was formerly much grown for pergolas and terraces in country-houses, but is now almost entirely discarded owing to its being much liable to mildew. The plant is very vigorous and highly productive, often producing a smaller second crop of bunches which mature in November or later. Requires half-long or long pruning. The leaves are fairly large with three or five indistinct lobes, and therefore almost round, light green and smooth on the upper surface with a bluish metallic sheen, and slightly hairy along the nerves on the lower surface, with a yellowish green and rather short leaf-stalk. The bunches are large or very large, generally with double wings, long and loose. The berries are large, elliptical, but sometimes oval or even roundish in the same bunch, varying in colour from pink or reddish to reddish purple or violet-black, darker on the side of the sun, with a thick leathery rind, and a firm or crisp pulp, which is sweet with a pleasant acidulous flavour.

85. MORETTO or NORETTO or LAMBRUSCA D'ALESSANDRIA (D'ITALIA). This vine has been recently introduced in these Islands, and has a half-wild character, with a dwarf but vigorous habit, and requires short pruning. The leaves are rather small and nearly round or indistinctly lobed, rugose on the upper surface, slightly cottony on the lower surface, with a short and thick leaf-stalk. The bunch is fairly large, conical and rather loose; and the berries are small, round, intensely black, shining, without bloom, with a thin rind, soft pulp and acidulous juice. It is a good vine for the production of ordinary red table wines.

86. MOSCATO DI CANELLI. (M.=*muscatell tal Italia*). This is an introduction from Upper Italy, where it is grown for the production of the famous wines of Cannelli and Asti. It has been long grown in Gozo as well as in Malta, and has been imported again recently. The leaves are fairly large, 3 to 5 lobed, slightly rugose on the upper surface and smooth on lower surface, with whitish nerves and a short and stout leaf-stalk, streaked pink or reddish. The bunches are long, cylindrical, but may be short and rather compact, and are sometimes irregular, loose and even shanked. The berries are round, usually of a good size, greenish yellow or amber, becoming later partly ruddy and spotted with rust, but mostly transparent. The pulp is rather firm, juicy, sweet, and highly perfumed with a marked muscat flavour. This is an excellent vine for making sparkling and dessert wines, and yields also very good grapes for the table. The typical form (*Moscato bianco*) has been long grown in Gozo under the name of *muscatell* or *miscatell*.

87. MUSCATELL, MUSCATELL VERU or M. TAL ILMA ZAHAR. (It.=*Moscato fior d'Arancio*, Fr.=*Muscat de Jesus*, M. *fleur d'Oranger*, Tokay *musqué*). This is a popular grape much appreciated on the market. The vine is vigorous and very productive, requiring short or

half-long pruning. The leaves are middling, with 3 to 5 short lobes, dark green and smooth on the upper surface, smooth on the lower surface, with a long, rough, leaf-stalk. The bunches are middling, pyramidal or conical, winged, and usually very much shanked. The berries are large, roundish or oval, of unequal size, with a thin rind, at first greenish yellow and then golden yellow. The pulp is soft, juicy, excessively sweet and highly perfumed, having the special bitterish aroma of orange-flower water. It is an excellent table grape, and fetches a good price. It is also mixed with other grapes to improve the flavour of the wine.

88. MUSCATELL ISUED. (It = *Moscatello nero*, *Moscato nero*, E. = *Black Frotignan*). This vine has been long grown in our gardens, but is by no means common. It has a vigorous erect habit, and requires half-long pruning. The leaves are five-lobed, light green and somewhat rugose on the upper surface, smooth on the lower surface, with a short and thick leaf-stalk. The bunches are large, winged or doubly winged, loose, sometimes shanked. The berries are round or roundish, purplish red or dark violet, large or medium in size, with many small seedless berries which may or may not come to maturity. The rind is thick and well covered with bloom. The pulp is firm juicy, very sweet and highly perfumed. This is essentially a table grape, but may be mixed with other grapes for the press to improve their aroma.

89. MUSCATELL ISUED TA AMBURGO. (It. = *Moscatello di Amburgo*, Fr. = *Hambourg musqué*, E. = *Black Muscat of Alexandria*, *Muscat Hamburgh*). Introduced in 1900 and again in 1912, and is a good vine for amateurs. The vine is fairly vigorous, with long straggling canes, and requires medium or long pruning. The leaves are middling, usually five-lobed, with acute segments, smooth on both surfaces, with a rosy leaf-stalk. The bunches

are fairly large and long, but always very much shanked. The berries are oval or elliptical, with many small or undersized ones, and of a purplish or dark violet colour, well covered with bloom. The pulp is soft, juicy, very sweet, with an exquisite perfume of muscat. It is an excellent table grape, but shanks too much to meet the favour of growers. It is said to resist *Phylloxera* better than any other European vine.

90. MUSCATELL ROSA or MUSCTELL AHMAR. (It. = *Moscato rosso*, Fr. = *Muscat rouge, doigt de deesse, M. rose*, E. = *Red Frontignan*). This vine is rarely seen now, but formerly was quite common. The plant is fairly vigorous and productive. The leaves are five-lobed, light green, smooth on both surfaces, with a long pinkish leaf-stalk. The bunches are long, usually much shanked, with many undersized and seedless berries, which however mature with the others. The berries are oval, elongated, yellowish pink and pinkish red on the sunny side, with a thin rind and hardly any bloom. The pulp is soft, juicy, very sweet and highly perfumed. It is a table grape of good quality, but rather poor appearance.

91. MUSCATELLUN ISUED, known in Gozo by the name of *Isued ta Cusaman*, is the *Moscattellone nero* of Girgenti and other parts of Sicily and Southern Italy. The vine is of middling vigour and requires short or half-long pruning, but is well productive. The leaves are middling or small, with 3 to 5 well-marked lobes, slightly hairy on the lower surface. The bunches are large, conical or cylindrical, winged, loose, with a long and slender stalk. The berries are large, round, of a shining violet black colour, with hardly any bloom. The pulp is firm, juicy, sweet, with a faint aroma. It is an excellent table grape, rather liable to blight and mildew, and is usually mixed with other grapes for the press.

92. MUSCATELL ISUED TAL GHASSARI. This is a distinct variety of Muscat, long cultivated at *l'Ghassari*.

(Fiddien). The plant is vigorous and very productive, The leaves are small, deeply 3 to 5 lobed, with rounded lobes and small obtuse teeth, light green and smooth on both surfaces, with a slender leaf-stalk of a vinous red colour. The bunches are middling or large, long, loose or shanked, with a long reddish stalk. The berries are large, oval, purplish black, well covered with bloom. The flesh is somewhat firm, juicy, very sweet and aromatic. It is a table grape, and is also pressed with other grapes to improve the flavour of the product and to give it fineness.

93. MUSCATELL TAL GHASAFAR. Is probably a local seedling of ancient origin, and is occasionally met with in the vineyards of Rabato, Dingli and Melleha. The vine is fairly vigorous and requires rather short pruning. The foliage is middling, deeply lobed, in other respects similar to that of *Insolja tal Ghirghenti*. The bunch is rather small, winged, loose, or shanked. The berries are middling, oval, golden yellow at maturity, with only a slight covering of bloom. The pulp is juicy, very sweet, and slightly aromatic. Matures early, and is liable to the depredations of birds, hence its name.

94. MUSCATELL TAN-NEBBIET. This vine, grown only in the neighbourhood of Rabato and Notabile, is another local seedling. The plant is very vigorous and very productive, with a spreading habit requiring half-long or long pruning. The foliage is middling, soft, deep green, rather hairy on the lower surface, and is imperfectly lobed. The bunches are numerous, large, very long, winged and compact. The berries are middling or small, round, yellowish green, becoming yellow or ruddy, and dotted with rust on the sunny side. The pulp is soft and juicy, fairly sweet and faintly perfumed. It is almost devoid of flavour, and notwithstanding its name it has nothing to do with the Muscats. It is a good and productive grape for the production of white

wine, requiring the addition of other white grapes to give body to the produce.

95. NEBBIETA TA UIED HAZRUN. This vine is a seedling which originated at Uied Hazrun near Imtahleb, and is now cultivated in that valley and also at Fiddien. The plant is very vigorous and very productive, with a spreading habit, requiring half-long or long pruning. The leaves are large, very broad, rounded or almost kidney-shaped, with a wide angle, thin but very tough, perfectly smooth on both surfaces, imperfectly 3 to 5 lobed, doubly toothed, with acute mucronate teeth tipped yellow, and often with a tooth in each of the angles on both sides of the central lobe. The leaf-stalk is very short, of a lively pink. The bunches are very large and long, usually doubly winged, always shanked, with a thick reddish stalk. The berries are very large, elliptical, with few undersized berries, all of the same shape. The colour is greenish pink to violet red, with little bloom. The rind is thin and tough, adherent to the pulp, which is light pink or greenish pink, rather firm, juicy, sweet, with a good flavour. This is a beautiful table grape of good quality and keeps well. The bunch has often the appearance of that of *Pergolese* (*Mignuna tauualia tal Cannizzati*), but is much larger, more shanked, with larger and longer berries, of a lighter colour.

96. NEBBIETA TA UIED LIEMU. (Seedling of Liemu Valley). This is a chance seedling which originated recently in the Liemu Valley, not far from Rabato. The vine is very vigorous and very productive, requiring half-long or long pruning. Thrives well on clayey soils. The leaves are large, rounded, with a narrow angular aperture, five-lobed, with broad short lobes and narrow angles, and broad teeth tipped yellow or brown. They are light green and rugose on the upper surface, very cottony on the lower surface, with a short leaf-stalk, more or less dark pink, about half the length of the

blade. The bunches are large, conical, winged, somewhat loose but not shanked, with a long yellowish brown peduncle. The berries are large, roundish or elliptical, waxy yellow, with little bloom, often flushed marbled or dotted rust, without any undersized or abortive berries. The rind is thick and tough, and the pulp is fleshy soft and juicy, very sweet, with an agreeable flavour. It is a fine table grape, and should prove a valuable sort for the press.

97. NEBBIOLO DI BAROLO, also called *Marchesana*, *Picotener*, *Spanna di Gattinara*, etc. This is a very recent introduction from Upper Italy. It is one of the most valuable Italian vines, and produces the celebrated wines of *Barolo* and *Gattinara*, but so far it has not given encouraging results outside its native district. The vine is vigorous with long canes, but is not very productive even in its native home. The grape seems also to lose in part its fine quality when grown outside its own region, but is always a wine grape of superior quality. Requires half-long or long pruning. The leaves are five-lobed, light green and smooth on the upper surface, somewhat cottony or hairy on the under surface, with a long hairy reddish leaf-stalk. The bunches are long, conical, winged, somewhat loose. The berries are rather small, roundish or oval, dull purplish red, with a thin rind. The pulp is soft, watery, sweet, with a fine aroma.

98. NIGRU GROSS. (It.= *Sangiovetto grosso*, *Sangiovetto dolce*, *Sangiovese*, *Prugnolo*). This remarkable Italian vine was probably introduced here during the rule of the Order of St. John, and is now grown extensively in most vineyards. The vine is very vigorous with a spreading habit, and thick long trailing canes. Requires long or half long pruning. The leaves are large, long, trilobed, with acute segments, dull green and smooth on the upper surface, somewhat hairy along the nerves on the lower surface, with a long and thick leaf-stalk,

streaked reddish. The bunches are large, long, conical, winged and loose or even shanked. The berries are very large, elliptical or oval, of a deep bluish violet, almost black, well covered with greyish bloom. The rind is thick and tough, deeply coloured. The pulp is soft, watery, very sweet, acidulous, slightly perfumed with a fine flavour. It is an excellent table grape, but is better known as a good wine grape, producing well coloured wines of good body, requiring the addition of other grapes to soften the acidity and improve the keeping qualities.

99. NIGRU GROSS SECOND, sometimes called *Serkusan imuahhar*, and miscalled *Bezzula senda*. (It.= *Olivella*, *Sciancinoso*, *Sanginoso*, *Cascola*). The vine is very vigorous and requires half-long or long pruning. The leaves are very large and thick, five-lobed, with reddish nerves, and a very hairy or cobweby under surface. The bunches are large, long and cylindrical, somewhat loose. The berries are middling in size, oval, and drop off easily at maturity, of a deep violet black colour, heavily covered with bloom. The pulp is soft, melting, sweet, astringent and somewhat acid. It is a good wine grape, but is subject to rot. This is an Italian vine grown here and there in the vineyards of Rabato and Zebbieh, Burnahhala and Bahria, but is not much valued as a wine grape.

100. NIGRUA. This vine is chiefly grown in Gozo, and has points in common with *Gellenza senda*, but is quite distinct and is either an old local variety or a form of the vine *Panzali* of Sardegna. The vine is vigorous and very productive, requiring half-long pruning. The leaves are dark green, three-lobed or five-lobed, cottony on the lower surface, with a reddish leaf-stalk. The bunches are large and numerous, loose, broad, and usually winged. The berries are large, round, black or bluish-black, with a heavy bloom. The pulp is soft and

juicy, sweet, with hardly any aroma. It is a wine grape of fairly good quality, and is also an attractive table grape.

101. NUCCELLATA. (It.= *Paradisa* or *Verdea*, *Verdicchio bianco*. Fr.= *Dorée d'Italie*). This vine was formerly a favourite for pergolas in country houses, and is still grown here and there in the vineyards as a good table grape. It has a very vigorous and spreading habit, with long stout canes, and requires half-long or long pruning. The leaves are large, five-lobed with long segments, slightly rugose and light green on the upper surface, cottony on the lower surface. The bunch is large, conical, long, rather loose. The berries are large, roundish or slightly oval, with a thick rind, greenish yellow, amber yellow on the sunny side. The pulp is firm and crisp, but soft around the seeds, juicy, sweet and delicately flavoured. Matures late and is a table grape of excellent quality, suitable for ampelotherapeutic treatment, and it is a pity that it has been supplanted by less valuable sorts.

102. NUCCELLATA Hoxna or Zakk in-Naghga HADRA. (It.= *Verdone di Bari* or *Verdone di Siena*). This vine is very vigorous, with a straggling habit, requiring half-long pruning. It is grown at Bahria and Imtahleb and also at Zebbieh and Imgiar, but is little in favour. The leaves are usually light green, soft, trilobed, with long lobes finely toothed, and with a short, thick, green leaf-stalk. The bunches are fairly large, conical, always with a small wing, compact or somewhat loose. The berries are large or very large, round or irregular, very uneven in size, yellowish green, with rusty spots and black dots, and with a golden sheen on the sunny side at perfect maturity. It is used as a table grape, but is really a wine grape of fairly good quality.

103. PASSULINA or PASSULINA SEUDA. (It.= *Passeretta*, *Passolina*, *Cornito*. E.= *Black Corinth*). This

vine has become rare in these Islands, but was formerly much more frequent in fields and gardens. The white Corinth grape (M. = *Passulina Bajda*) is still rarer. The vine is very vigorous, with long canes, and is highly productive, requiring long or half-long pruning. The leaves are rather small, elongated, 3 to 5 lobed, somewhat rough and deep green on the upper surface, cottony on the lower surface, with a long, thin, reddish, twisted leaf-stalk. The bunches are large, long, winged and conical, rather loose. The berries are very small, round, roundish, or discoidal, of a deep reddish violet colour, with thin and adherent stalks, and are seedless or rarely contain one seed. The pulp is soft and sugary, with a delicate flavour. These are the *black currants* of commerce, imported from Greece, but the grape as well as its white variety, is also good for the press, producing a wine of good quality and highly alcoholic.

104. PINOT BLANC, or P. GRIS, BURAT or FAUVET or PETIT GRIS, sometimes called by our gardeners *Dielja tax-Xiampanja*. This splendid vine was introduced in 1854, but unfortunately remained long neglected or forsaken at San Antonio Gardens. It is now being propagated on a fairly large scale. In vegetation and requirements it is similar to *Pinot noir*, but the bunch is larger, winged and very compact. The berries are small, round, yellowish or greyish green, with a heavy bloom, becoming greyish yellow with ruddy spots on the sunny side. The pulp is soft and juicy, with a colourless sweet juice of a delicate flavour. This is an ideal grape for the press, highly productive, and should be grown extensively for the production of table wines comparable in quality to the best white table wines of France. It is the principal grape entering into composition of Champagne.

105. PINOT NOIR, PINEAU, PINEAU FIN, NOIRIEN MORILLON, (often called by our gardeners *Dielja tal*

Ghemieri). This famous French vine is now well known to our vinegrowers, both in Malta and Gozo, especially since it has been so successfully cultivated on a fairly large scale at the *l'Ghemieri* (*Gomerino*) vineyards, but its introduction in Malta dates back to about 1890 or earlier. The vine is very vigorous, and is a fast grower, preferring clayey soils or reddish soils moderately moist. Requires half-long pruning. It is very productive, especially on moist soils where however the grapes become too much charged with astringency. The leaves are middling, roundish, deep green, imperfectly 3 to 5 lobed, hairy and greyish white on the lower surface, with a long green leaf-stalk tinted red, and grooved on the upper surface. The bunches are rather small or middling, cylindrical or conical, compact. The berries are middling or small, round or roundish, deep violet black, thickly covered with bloom, and are firmly adherent to the stalk. The rind is thin, highly coloured. The pulp is soft and juicy, very sugary, with a peculiar flavour. This is an excellent vine for the production of table wine of fine colour and good keeping quality, and is grown over large districts in France (Champagne) for the production of Burgundy, etc.

106. SALAMANNA. (It.=*Salamanna*, *Moscatellone*, *Moscato d'Alessandria*, *M. di Spagna*, *Zibibbo*, Fr.=*Panse musqué*, Sp.=*Moscadel Gordon Blanco*, E.=*Muscat of Alexandria*, etc.). This vine has existed for a long time in the vineyards at Rabato, Dingli and Imtaħleb, but has been introduced again lately by Count Dr. A. Caruana Gatto. The vine is very vigorous and spreading, with long stout canes, and is best grown on a pergola or a wall, requiring rather long pruning. The leaves are broad, thin, tough, with 3 to 5 lobes very acutely toothed, smooth on both surfaces, with a long and thick leaf-stalk often shaded reddish. The bunch is large, winged or ramified, long, more or less loose. The

berries are large, oval or elliptical, waxy yellow, well covered with bloom. The pulp is rather firm and fleshy, juicy, very sugary, with a pleasant muscat flavour. This is an ideal table grape, of fairly good keeping qualities.

107. SARDINISA or CANJAU. (It.= *Canonao* or *Girò*). This is a celebrated Sardinian vine, good for the production of table grapes as well as of fine dessert wines. It is met with in the vineyards of Melleha, Bahria, Burnahhala and Imtahleb, but it does not appear to be sufficiently productive. The vine is fairly vigorous, and requires short or half-long pruning. The leaves are large, deep green, trilobed, hairy or cottony on the under surface. The bunches are conical and fairly compact. The berries are middling, round or roundish, reddish violet or violet black, with a slight bloom. The pulp is soft juicy and sugary, with a fine aroma.

108. SERKUSAN or SIRACUSAN, now often called CALABRIS. (It.= *Calabrese*, *Calibrese nera*, *Calabrese d'Avola*). This vine is vigorous, but has a dwarf habit and requires rather short pruning. The leaf is small thin and soft, five-lobed, dark green on the upper surface, whitish green with much cobweb on the lower surface, and has a slender green petiole. The bunch is conical, usually winged and much shanked. The berries are of medium size or small, oval, elongated, with a thick and tough rind, dark purplish almost black, with an abundant greyish bloom. The pulp is soft, fairly sweet. It is a good wine grape, though not very productive, producing robust wines, deeply coloured, and of good keeping quality. It has been long grown and cultivated in the Island, and was re-introduced again from Sicily in 1919 by Fra Salvatore Astuto and others.

109. SERKUSANA TA GNIEF FIERES. This vine has been long grown at Gnief Fieres and is a local variety, notwithstanding its name. It is very vigorous and very productive, requiring half-long pruning. Its leaves are

middling, round or trilobed, with acute or mucronate teeth, deep green and rugose on the lower surface, and hairy on the lower surface, with a short and dark pink leaf-stalk. The bunches are large, winged, conical, fairly compact, with a slender yellowish stalk. The berries are middling, round, bluish black with a heavy bloom, strongly adherent to the stalk. The rind is very thick and tough, and the flesh is firm, juicy, fairly sweet, slightly astringent, with a simple flavour. It is a wine grape of the same type as the *Moretto* or *Lambrusca* of Italy, and produces a rough wine highly coloured.

110. SERKUZAN TAL IBJAR OR SIRACUSAN TAL IBJAR. This name is given to a vine cultivated sparingly in the neighbourhood of Dingli and is doubtless of local origin. It has nothing to do with *Serkuzan* or *Calabrese* which is a vine grape now grown extensively in various districts. It is probably a round berried form of *Mignuna tuila tal Cannizzati* or *Pergolese*. The vine is very vigorous and very productive, with a spreading habit, and requires long pruning. The leaves are broad, deeply lobed, acutely toothed, smooth on both surfaces, or with a few hairs along the nerves on the lower surface, and with a long slender reddish leaf-stalk. The bunches are large, long and conical, often winged, rather loose, but not shanked. The berries are middling, round, slightly depressed at the pistill end, with a thin rind firmly adherent to the flesh which is green and firm, juicy, with a simple flavour. The colour of the berry is generally dark violet red, with little bloom, but may be pink or greenish pink, with some small seedless berries which remain unripe. It is a table grape of middling quality, and has nothing to recommend it.

111. SEUDA TAL MOHA OR ISUED TAL MOHA. This is a recent seedling which originated in a field at Nadur belonging to a man nicknamed *Moha*, and fruited for the first time about 15 years ago. It was soon propagated

in several vineyards, owing to its heavy yield. The vine is very vigorous and very productive, requiring half-long pruning. The leaves are large, deep green, deeply lobed, rather hairy on the lower surface. The bunches are very large and long, winged, and usually very compact. The berries are fairly large, oval and intensely black, with a bluish bloom. The pulp is juicy, sweet and slightly astringent. It is praised as a good wine grape.

112. SOMARELLO or COLORE. This vine is sometimes called *Salamanna seuda* or *Seuda ta Skallia* or *Seuda irkika* or *Calabrisa irkika*. It has been long cultivated here and there in our vineyards but nowhere extensively, and has been introduced again recently. The vine is vigorous and very productive. Requires short or half-long pruning, and thrives best in dry and open situations. The leaves are soft, five-lobed, with acute segments, dull green and smooth on the upper surface, slightly hairy on the lower surface, with a short reddish leaf-stalk. The bunches are large, long, cylindrical, rather loose. The berries are middling or small, round or roundish, with a bright reddish black rind. The pulp is somewhat firm, but soft, sweet and slightly aromatic. This is a good wine grape, largely cultivated in Southern Italy.

113. TAL-LAHAM or ISUED TAL-LAHAM. This is a seedling which originated at l'Ghassari near Fiddien, where it has been long cultivated under this curious name. The vine is fairly vigorous and fairly productive requiring half-long or long pruning. The leaves are small, with a wide angle, imperfectly 3 to 5 lobed, with acute mucronate teeth, smooth on both surfaces, and with a slender greenish leaf-stalk of variable length often tinted brown pink along its lower half. The bunches are very large and long, often irregular, winged, loose, but sometimes compact, with a thin but tenacious stalk. The berries are roundish or slightly oval, middling or small, brownish

violet black, heavily covered with bloom. The flesh is soft, juicy, fairly sweet and faintly aromatic. It is a wine grape of middling quality.

114. **TUILA SEUDA TAR-RDUM** or **GHAGEB TAR-RDUM** This marvellous vine originated a few years ago at C. Dingli in a ravine not far from the sea. It is very vigorous and productive, requiring half-long or long pruning. The leaves are of a lively green, middling, roundish, hardly lobed, with the middle lobe broad, short and pointed; and the teeth are broad and mucronate. The leaves are smooth on both surfaces, or with a few hairs along the nerves. The leaf-stalk is thin and reddish, shorter than the blade, and the nerves originating from it are reddish up to their first ramification. The bunches are large or very large, winged or doubly winged, irregular in shape or obtuse, rather loose, and of most beautiful appearance. The berries are very large, being the largest in size so far known in these Islands, generally of the size of a large olive; their shape is an elongated oval, narrower at the stalk, and roundish at the other end. The stalk of the bunch is long and reddish green. The colour of the berry is purplish black or violet black, heavily covered with a bluish bloom. The rind is resistant but not thick: the pulp is greenish, fleshy and rather firm, fairly sweet and of a simple flavour. The juice is abundant and colourless. The seeds, often reduced to one, are small and long, with a pointed chalaza. A few berries remain undersized and seedless, but mature with the rest. This is a black table grape of surpassing beauty.

115. **ZAKK IN-NAGHĠA (MALTA)** or **MARSUSA TANNEBIET**. The vine is fairly vigorous and is well productive. Should be pruned long and requires sunny and dry situations to fruit well. It is in all probability a local seedling and has been long known in our vineyards at Uardia, Gneina, Ghain Tuffieħa and Fiddien, though

nowhere common. The leaves are small, five-lobed, with long segments, smooth on both surfaces, with a short whitish leaf-stalk. The bunch is long and conical, compact, well formed and of beautiful appearance. The berries are round, of uniform size, thickly set together and therefore often compressed, maturing all at the same time. The rind is golden yellow, shaded reddish. The pulp is firm and fleshy, rather aromatic, with a sweet, pleasant flavour. It is a good grape for the table, and is suitable for the production of fine dessert wines and of sparkling wines.

116. ZAKK IN-NAGHĠA HOXNA OR NUCCELLATA TONDA. (It. = *Verdea d'Arcetri*, *Verdea di Firenze*, *Vernaccia di Toscana*). The vine is vigorous and very productive, but is too liable to mildew. Requires long pruning, and a deep rich soil, in a sunny situation. The leaves are dark green, smooth on the upper surface, hairy on the lower surface, deeply and irregularly lobed. The bunch is large and broad, rather compact. The berries are large, round or roundish, often obtuse or discoidal, greenish yellow, dull and powdery, sometimes rusty yellow on the sunny side. The pulp is fleshy, juicy, sweet, with a delicate flavour and aroma. It is a table grape, but makes also good wine, either alone or mixed with other grapes.

117. ZAKK IN-NAGHĠA SEUDA. This ancient vine appears to be identical with the *Barbarossa* which is cultivated in Southern Italy, as well as in Sicily and Tuscany. It is rare in Malta, but frequent in Gozo. The vine is vigorous and well productive, requiring half-long or long pruning. The leaves are middling, somewhat downy on the lower surface, with a slender and reddish leaf-stalk. The bunches are middling, winged, and usually loose or even shanked. The berries are large, roundish or somewhat oval, of a purplish black or reddish black colour, covered with bloom. The pulp is

rather firm, but juicy and of a sweetish flavour, with a faint aroma. It is a table grape, but is also mixed with other grapes for the press.

118. ZAKK IN-NAGHĠA TA GHAUDEX OR DEMB IN-NAGHĠA. (It. = *Pallagrello bianco*, *Coda di Pecora*, *Falerano*). This ancient vine is still widely grown in Gozo, and is very vigorous and well productive, requiring half-long or long pruning. The leaves are small, five-lobed, thin or paper-like, smooth on both surfaces. The bunches are large and long, conical, winged, compact. The berries are rather small, round, of uniform size, greenish yellow tending to pink on the sunny side, well covered with bloom. The pulp is soft and juicy, very sweet and with a faint aroma. A black variety (*Zakk in-Naghġa seuda*) with rather loose bunches and reddish violet berries is also grown, but is far less productive. It is a wine grape of middling quality.

119. ŻEBBUGIJA, or DIELJA TA ŻAMMIT-GAUCI. This is a recent chance seedling raised by Mr. Żammit-Gauci at Casal Zebbug, and now grown at Ghodor near Zebbug and fast spreading elsewhere on account of its good qualities. The vine is very vigorous, with long bright reddish canes and rather short internodes, and requires half-long pruning. The leaves are large, bright green, deeply lobed, usually with reddish nerves and with a few hairs on the lower surface. The leaf-stalk is middling, reddish pink. The bunch is very large, pyramidal or irregular, winged or doubly winged, full, but not compact. The berries are large, roundish or oval, deep purplish black, with a slight bloom. The rind is thick and highly coloured. The pulp is greenish rather soft, juicy, very sweet, and with a very delicate aroma and a somewhat muscat flavour. The vine is resistant to mildew and highly productive, and its cultivation is recommendable both for the table and for the press.

120. ZINFANDEL. Introduced in 1920; received by Mr. Paul Borg from Mr. José Duarte de Oliviera of Oporto, Portugal. This is the original vine from which the ancient Port Wines were formerly produced in the Alto Douro. The vine is very vigorous and fairly productive. The leaves are middling, imperfectly five-lobed, more often entire, doubly toothed, with large teeth often curved inwards, with central lobe or tooth very long and acuminate, and with a large open angle at the sinus. The leaves are smooth on the upper surface, velvety along the nerves on the under surface, with a long slender petiole tinted reddish. The bunch is middling, pyramidal, loose, but not shanked, having a short green stalk, with green pedicels. The berries are middling, round, with many abortive small berries, a few of which mature with the others. The colour is purplish black, heavily covered with bloom. The rind is tough and thick, easily detachable from the pulp, which is greenish white, very soft, very juicy, sweet and with a mild aroma. The seeds are three or more, small, greenish, narrow and pointed. It is a famous wine grape, which has practically disappeared from its native home in Portugal, but is much cultivated in Australia.

In the foregoing descriptive list of 120 sorts of European grape-vines grown in the Maltese Islands, 36 are certainly local seedlings or varieties. There are also other sorts which could not be identified or described for lack of insufficient material, including several local sorts. Among the more recent introductions from Italy etc., which are not included in this list, I may mention the following: *Malaga*, *Malbeck*, *Montepulciano*, *Grappolungo*, *Riesling Italico* and *Semillon*, as wine grapes, and *Fresa da Mensa*, *Imperiale nero*, *Monarca del Vesuvio*, *Dattier de Beyrouth* and *Terra Promessa* as table grapes.

SELECTION OF VINES.

It is generally known that a wine grape which flourishes and yields a celebrated wine in one district, often fails to give satisfaction anywhere else. It is but too often the case even when the trial is made in districts of the same geological formation and of equal climatic conditions, and perhaps more than other fruits the original character of the vine as a wine producer is frequently an unsurmountable barrier to its successful cultivation away from its original home. No doubt the product obtained may be satisfactory in other respects, or even closely similar, but there is always something lacking in it which at once marks it out as a counterfeit. To this rule there are a few notable exceptions. The *Pinot noir* when properly handled yields as good a product in this Island as it does in France, but with a slightly higher degree of astringency. The same may be said of *Pinot blanc*, *Mammolo* and *Canajolo nero* of Tuscany, the *White Muscat* of Canelli etc. But most Italian growers who have tried to grow the *Nebbiolo*, that most noble of Italian vines, outside its region of *Gattinara* and *Barolo*, have failed signally, and it is not likely that we are going to be more successful with it in these Islands. The Hungarian vine *Furmint* has been introduced and cultivated in Italy and elsewhere, but its product cannot compare with the celebrated *Tokay* of Hungary. The *Cataratto bianco comune* of Marsala, although always a good vine, is here rather a shy bearer, and its product does not develop the peculiar flavour of Marsala. It is doubtful whether the celebrated Spanish vines such as *Pedro Ximenes* would produce here anything like a true sherry, although the cultivation of this vine has now spread over extensive areas in Algeria, and is well spoken of by the French growers. In fact on the whole it is doubtful whether the finer liqueur wines can be reproduced with all their valuable qualities outside

their native home, and it cannot be said that this is due to an imperfect knowledge of the ferments or of the processes connected with the manufacture and maturing.

With ordinary table wines the case is wholly different, and quite often these can be reproduced almost faithfully, thus the *Clarets*, *Burgundies*, *Santernes*, *Moselle*, *Etna*, *Capri*, *Lacrima*, *Chianti*, etc. are being reproduced more or less satisfactorily from the original vines cultivated far away from their original home.

Moreover, owing to the presence of the *Phylloxera* it is no longer safe to grow vines directly from cuttings, and it is necessary to resort invariably to grafting on resistant American stock. Hence, the suitability or otherwise of a certain variety to special types of soils, although by no means quite negligible, is now largely discounted and has not the same paramount importance as in the days when the vine was always propagated directly by cuttings or layers. The quality of the soil, therefore, is now a factor which should influence primarily the selection of the type of American vine used as stock, rather than that of the grape-bearing vine itself.

The best vines for the production of white wines in these Islands appear to be the following: *Marsusa* or *Albana bianca*, *Pinot blanc*, *Insolja hoxna* or *I. morra*, *Insolja Franciža*, *Insolja Franciža tal Imbid*, *Insolja hadra*, *Insolja hadra ta li bjar*, *Insolja helua*, *Insolja helua irkika*, *Insolja marsusa hamrania* or *Erbaluce*, *Catarratto bianco comune*, *Gorbina bajda* and *Moscato di Canelli*. For high production *Marsusa*, *Insolja marsusa hamrania*, *Gorbina bajda*, *Insolja Franciža tal Imbid* and *Insolja hadra* are easily first. *Insolja helua* or *Malvasia di Lipari*, *Insolja helua irkika*, *Insolja hoxna*, *Insolja hadra ta li bjar*, *Pinot blanc*, *Catarratto bianco comune* and *Moscato di Canelli* yield wines or dessert wines of superior quality, and may be pressed either apart or with

one or more of the preceding group to improve the body and flavour of the product.

For the production of red wines the following sorts will be found to give the best results in our climate: *Aglianico nero*, *Alicante Henri Bouschet*, *Barbera*, *Canajolo nero*, *Catiana seuda*, *Frappato nero di Vittoria*, *Gelleuza* or *Mammolo nero*, *Gelleuza tuila*, *Gorbin*, *Grinjola*, *Grinjolin*, *Isued tal Beika*, *Isued tal Hauuief*, *Nebbiolo*, *Nigru Gross*, *Pinot noir*, *Serkusan* and *Seuda tal Moħa*. Table wines of deep colour, good flavour and body, and good keeping quality, suitable for direct consumption, as well as for blending with other wines, are produced by *Pinot noir*, *Isued tal Beika*, *Frappato nero di Vittoria*, *Seuda tal Moħa*, and in certain years also *Barbera*, *Gelleuza* and *Serkusan*. *Nigru gros* or *Sangiovetto grosso*, *Gorbin*, *Aglianico nero* and *Isued tal Hauuief* yield an abundant but rough product if pressed alone, and require the addition of *Gelleuza*, and especially of *Gelleuza tuila*, of *Canajolo nero*, *Grinjola* and other sugary and slightly aromatic grapes. However, it is always advisable to specialize and grow only one or perhaps two sorts of wine grapes, with one or two other sorts to be grown to a less extent, for use as correctives, to secure a better and more palatable product.

As regards table grapes the following are desirable white sorts, viz: *Insolja ħamrania* or *Trebbiano della Fiamma*, *Beżżula bajda* or *Pizzutello di Gattinara*, *Insolja ta Chelul*, *Insolja ta Burnaħħala*, *Mignuna bajda tar-Rabat*, *Nuccellata*, *Salamanna* and *Muscatell*. *Insolja tal Ghirghenti* is probably our best white grape for late keeping, and *Auista Bajda* or *Agostenga* and *Mignuna bajda tal Cannizzati* or *Luglienga* are two very good early sorts.

Auista Seuda or *Agostenga nera* is a beautiful and good-flavoured grape, both early and long keeping.

Damaschina Seuda or *Gros Maroc*, *Dodrelabi*, *Darkaja* or *Gheneb tat-Toroc*, *Mignuna Seuda*, *M. Seuda lat-Lixx*, *M. tal Pellegrin*, *Nebbieta ta Uied Hażrun* and *Tuila Seuda tar-Rdum* are splendid black grapes for the table. *Nigru gros* and *Gellenza Seuda* are also justly appreciated for the table. *Muscatell Isued*, *M. Isued tal Ghassari*, *Grinjola* and *Muscatellun* have a rich Muscat flavour, and the *Black Muscat of Hamburg* is a delicious table grape which only lacks a fine appearance and a fuller bunch to give it a foremost place among table grapes.

AMERICAN AND HYBRID-AMERICAN VINES.

1. ANANAS OR NANAS. (E.=*Isabella grape*, *Strawberry-grape*, It.=*Isabella*, *Uva fragola*, *Ananas d'America*). This is the only American vine which has been introduced for some time in these Islands. It was introduced here towards 1860, and has met with some favour for gardens and pergolas owing to its being proof or almost proof against the attacks of mildew and blight. It is derived from *Vitis Labrusca* Linn.; and is very vigorous and in comparatively dry situations, resists fairly well to the action of calcarous soils, thriving in the shade almost as well as in full sunshine, and is always very productive. The canes are long, with long internodes, requiring half-long or long pruning. The leaves are small, roundish or imperfectly lobes, deep green and rough on the upper surface, greyish or silvery white on the lower surface owing to a thick formation of short hairs. The bunches are numerous, often three or four on the same twig. They are small, cylindrical, sometimes winged, and compact. The berries are middling, round or roundish, bluish black, with an abundant grey bloom. The pulp is soft and mucilaginous, juicy, sweet, with a powerful musky flavour. On moist clayey soils this vine, like other sorts derived from *V. Labrusca* is subject to chlorosis. It is said to offer only a weak

resistance against the Phylloxera, being killed by it almost as easily as the European vine.

2. VITTORIA. This is a seedling from Hybride Parde-Lacoste or Auxerrois-Rupestris, raised at Boschetto. The seed was sown in January 1911, and the plant fruited well for the first time in 1919. The vine is very vigorous and very resistant to drought. The canes are long and slender, of a reddish brown colour. The foliage is small roundish and pointed like that of a Riparia. The bunches are very numerous, long, rather loose, often winged. The berries are small, round, reddish or reddish violet, sweet, juicy, with a distinctly musky flavour. This vine is resistant to mildew and blight, but its degree of resistance to the Phylloxera is not yet ascertained.

The following hybrid "direct producers" have been introduced in the Government Nurseries at Boschetto (Malta) and Victoria (Gozo) in 1920, but it is too early to express an opinion about them.

Othello, Special French Hybrid, Hybrid Franc, Jouffreau, Seibel No. 1, No. 2 and No. 153, Castell No. 120, No. 13317 and No. 13320, Hybrid Cognac, and Auxerrois \times Rupestris.

AMERICAN VINES AND HYBRIDS FOR GRAFTING STOCK.

In June 1919 the presence of Phylloxera was ascertained in many vineyards in Gozo, particularly in the district between Ramla, Xaghra and Marsalforno, and from the extensive area over which the vines were found suffering from this pest, as well as from other considerations, the original infection must have dated at least five years before and probably more. At any rate, immediate action was taken to establish American vine-nurseries at Victoria (Gozo) and also at Boschetto (Malta), to be in readiness as soon as the infection spreads to the latter

Island. Steps were taken to propagate the plants of *Vitis Berlandieri* existing at San Antonio and Boschetto, which were raised from seed in 1910, and six well known hybrids suitable for grafting stock were introduced and planted in December 1919. These hybrids are Rupestris du Lot, Aramon-Rupestris Ganzin No. 1, Berlandieri-Riparia 34 Ecole of Foëz, Berlandieri-Riparia 157-11, Chasselas-Berlandieri 41B and Berlandieri-Riparia 420A. The first three were introduced tentatively in small quantities, Rupestris du Lot and Aramon-Rupestris Ganzin No. 1 being specially suitable for poor clayey soils, but the last three were imported in bulk being generally recognized as the best for very calcareous soils, and warm and dry climates.

Berlandieri-Riparia 157-11 of Couderc and Chasselas-Berlandieri 41B of Millardet and De Grasset are recommendable for fairly deep soils of whatever nature, and Berlandieri-Riparia 420A of Millardet and De Grasset is specially recommended for light, shallow and dry soils, such as are commonly met with along the slopes of hills in both Islands.

All hybrids of Berlandieri partake more or less of the only drawback presented by that most useful vine, that is they are somewhat slow to strike root from cuttings, and this defect is more marked in Chasselas-Berlandieri 41B and in Berlandieri-Riparia 420A, hence it is recommended to plant cuttings of these hybrids in nursery-beds where they can be tended more easily, and also watered if the weather is too dry in spring. The rooted cuttings can be taken up and grafted in the following winter or may be planted directly in their final quarters to be grafted in the following year.

There are at San Antonio several types of *Vitis Berlandieri* grown from seed sown in 1910, one or two producing abundantly the characteristic small bunches of

tiny black grapes and are useful for the supply of seed, and others growing near them flower abundantly but are male plants with aborted pistil and therefore no berries are formed or only occasionally, and the bunches dry up as soon as the flowering is over. These last have a more vigorous habit and are useful for the supply of cuttings and layers for grafting stock, particularly certain plants with large shining leaves and long thick canes. Indeed such are the transcendent merits of the species *V. Berlandieri* for our soils and climate on account of its great resistance to the Phylloxera, to prolonged periods of heat and drought, and to calcareous soils even of the worst description, that fuller details as to its qualities and peculiarities would be welcomed by the local grower.

It is a native of Texas and other hot and dry regions of N. America, and is an excellent graft-bearer for European vines, which on account of its sturdy habit even under the most adverse conditions are enabled to grow well in soils where the cultivation of the European vine on own roots would be otherwise impossible. Thus, it will grow well on the whitish and dry soils where the European vine on own roots would give but poor results, as well as on the stony soils and also on badly drained clayey lands where the European vines are liable to suffer from root trouble. Moreover the knitting of the graft is usually very perfect, without any appreciable difference in the diameter of the stem at the point of union between the stock and the scion. Another important consideration is the great vigour and high productivity of the European vine when grafted on *Berlandieri* stock, thus showing that there is close affinity between the two species. Therefore, *V. Berlandieri* is clearly marked as the most desirable graft-bearer for calcareous soils in warm and dry climates, and we resort to the use of its hybrids above mentioned solely on account of the difficulty often experienced in propagating it from cuttings.

V. Berlandieri is easily propagated in quantity by seed which is sown in March, in beds well prepared with rotted manure or in pans or boxes, and the seedlings are planted out separately in the following winter, and with a little attention generally reach grafting size at the end of the second year. Layers made in March-May root easily and furnish well-rooted plants by the following autumn. The Chinese layer is especially recommendable for propagating *V. Berlandieri*; the long canes are trimmed at the end to the first good bud, and are interred 3 to 5 c.m. deep, the buds on the exposed part of the cane between the stem and the interred buds to develop, and the shoots which spring and summer, and are cut off and planted out separately in winter.

However, cuttings of *V. Berlandieri* will strike fairly well, with only 25 to 40 per cent. of failures, if they are properly prepared and well cared for. The cuttings should be selected of well-ripened wood, and cut into lengths of 25 to 40 c.m., the lower part of the cane close to the old wood, with many nodes and short internodes being the best type of cutting and easier to root well. The lower end of the cutting should be cut neatly just below a node, in order to favour the quick formation of callus and the emission of roots. Cuttings taken from the upper parts of the cane, with few nodes and long internodes, should be "barked", that is a narrow strip of bark 2 to 3 c.m. long, is taken off with a sharp knife, on one side or on both sides of the cutting, just above the lowest node. These cuttings should be made in December, or as soon as the new wood is well matured and the vine is shedding its leaves; they should be properly cut and barked at once, without undue exposure to the air, and then they should be stratified, that is buried almost completely in moderately moist sandy soil, in a horizontal or in a slanting position to promote the formation of callus before they are planted out in February or early in March.

The cuttings are best planted in nursery beds in a cool situation, where they may be easily watered occasionally until they are well rooted. They may be planted quite close in triple rows 15 c. m. apart, and 10 c. m. from one cutting to the next in the same row, leaving a space of 20 to 25 c. m. between one group of rows and the next to facilitate cultivation. The cuttings are planted deeply, leaving only one or two buds above the ground. The practice of grafting the cuttings before planting,—using the whip-and-tongue graft,—is said to promote an easier formation of roots. In fact, the cuttings of *V. Berlandieri* as a rule develop their buds very early, and the early development of the buds exhausts the cutting before it can draw nourishment from the soil by its own roots.

There are now many forms of *V. Berlandieri* in cultivation, but unfortunately the most vigorous and therefore the most desirable as graft-bearers, are even less easy to strike from cuttings than the weaker forms. Among the best known forms are *Berlandieri* Rességuier No. 1, having shining elongated leaves with nearly parallel sides, and particularly B. Rességuier No. 2 with shining rounded leaves. Other good forms of great vigour are B. Mazade, B. Cristal, B. de Lafont, B. Viala, B. d'Angeac, B. Millardet, B. Daignère, etc., but a good seed-bed of *V. Berlandieri* is sure to furnish several seedlings more vigorous than the rest, which could be selected apart and propagated on a sufficient scale, if it is found that they answer to the required standard as regards their resistance to chlorosis and the ease with which they can be propagated by cuttings.

The best forms of *V. Berlandieri* for our soils and climate are those having a very vigorous habit, with thick canes, with large and thick leaves of almost fleshy texture, of a dark, glossy, almost metallic green on the upper surface, and of lighter shining green on the lower surface, having but a few supple hairs along the midrib

and nerves. Forms with very hairy or tomentose leaves, particularly if the upper surface has not the glossy or shining appearance already mentioned, even if otherwise quite vigorous, should be discarded, or at any rate should not be retained for propagation, as very likely they do not offer the same resistance to chlorosis as the other forms. In fact the only objection which can be brought against the propagation of *V. Berlandieri* on a large scale by seed for use as stock, consists in this habit of giving origin to numberless forms having varying degree of vigour and resistance.

DISEASES OF THE VINE.

The vine is subject to many diseases and pests which prey upon the leaves, the stem, the roots, the flowers, the fruit both when young and when it is ripening; but the worst three diseases which have caused far more injury and loss than all other diseases taken together, are the vine mildew, the vine blight and the vine-Phylloxera. These have been imported into Europe from America in comparatively recent times, and were therefore unknown to the ancients. The ravages which they have caused and are causing, and the recurrent expenses incurred in their treatment, are incalculable; but the use of chemicals has reduced to a considerable extent, and in some cases has kept well within bounds the ravages of vine blight and vine mildew, and the Phylloxera has been baffled by making use of the natural resisting qualities of the American vines. The vine has however many other pests and diseases, several of which

are of great economic importance, and a short review of the principal diseases and pests is necessary to enable the vine grower to recognize his enemies and to place him in a position to combat them with some measure of success. There are also certain diseased conditions of the vine which are not due to the action of parasites, but may derive their origin from adverse conditions of the soil or of the climate, and sometimes their real cause is still obscure.

NON-PARALITICAL DISEASES.

Chlorosis or *Yellows*. This is characterized by the yellowish aspect of the foliage and of the green parts of the vine, with the formation of small, deformed, and almost colourless leaves, which generally dry off in a few days or weeks. Afterwards, small, thin and rachitic shoots develop from the lower dormant buds on the stem, often several arising together from the same bud or point, and these soon share the same fate as the foliage. This disease may be due to cold, or to excessive or stagnant humidity in the soil, or it may be the result of a serious disturbance of vital processes brought about by parasitism. American vines, with the exception of *Vitis Berlandieri* and to a certain extent also of *V. rupestris*, planted in calcareous soils are particularly subject to a very persistent form of chlorosis to which they often succumb. Therefore American hybrids intended for grafting stock, as well as American hybrid "direct producers", must have a satisfactory coefficient of resistance against lime, otherwise they would be wholly unsuitable for planting in the calcareous soils of these Islands. Fortunately there are now many hybrids of *V. Berlandieri*, *V. rupestris*, etc, which are able to tolerate a soil with a high percentage of lime. Vines growing on moist calcareous soils are more easily affected by chlorosis than those growing on dry or well drained soils.

Except in the case of vines grafted on unsuitable American stock, ferrous sulphate or green vitriol gives the best results in the treatment of chlorosis from whatever cause. The stems and branches of the vine may be painted over in winter, in dry weather, with a solution containing 25 to 40 per cent. of ferrous sulphate dissolved in water. A weak solution containing $\frac{1}{2}$ to one per cent. of the same substance may be used for spraying the foliage in spring and early summer; and the crystals of green vitriol may be applied to the soil early in winter at the rate of 100 to 300 grammes for each vine.

Roncet. This a French term, the Italian equivalent being *arricciamento*. This strange disease is characterized by the formation of shoots having short internodes, arising in bundles of two or more shoots from the same bud, with short stalked, small, deformed foliage, acutely and irregularly toothed, and generally of a light green or yellowish colour. The bunches become greatly elongated and much shanked owing to the abortion of the flowers. The formation of new shoots in spring is more or less delayed, and in severe cases the shoots spring out in great numbers from all likely points of the stem and branches, but remain short and undeveloped, and the plant assumes a characteristic appearance (*cabouchage=cavolismo*), and blackish irregular spots are formed on all green tissues, showing that there is a grave alteration in the processes of nutrition. The nature of this disease is still unknown, but does not appear to be due to parasitism. Cuttings or scions taken from diseased plants perpetuate the evil, while on the other hand, the roots seem to be always healthy, and a healthy scion grafted on diseased stock develops into a healthy plant. This disease is rather frequent in our vineyards, but in its lighter forms it is generally overlooked, so that cuttings are taken from diseased plants and planted and of course in their turn develop into diseased plants.

Vines affected with this disease continue to bear fruit more or less for several years, but the production is irregular, the bunches are much shanked, and the grower at last is struck with the peculiar appearance of the foliage, and by the fact that the same vine always produces long, shanky bunches, with few grapes. The diseased condition known as perforation of the leaves is probably only a variation of *roncet*, in which the leaves instead of being very acutely toothed and irregular, became perforated or torn up irregularly over the whole surface, or are reduced almost only to the nerves with hardly any blade. There is no known remedy for this disease, but affected plants at least in the early stages, are often cured by grafting them with scions taken from a healthy plant.

Shanking. (It. = *colatura*). The bunch assumes an elongated and leggy form, with few berries, and often the berries are malformed, or are not of the same shape, size and colour, as in the typical healthy variety. Sometimes *shanking* is so far advanced that very few berries are left, and occasionally none at all, so that the bunch dries up altogether. This diseased condition may affect the bunch before the blooming of the flowers, so that these drop off unexpanded, or at the blooming period, but more often when the berries are setting or when they are about the size of a pin's head, although the disease may continue long afterwards, almost until the berries begin to show colour. This disease is frequently due to attacks of vine blight, and to early attacks of vine mildew, but may be due also to *roncet* and in the absence of these diseases it is ascribed to excessive vigour of the plant growing in moist or badly ventilated localities. This plethoric condition of the plant may be corrected by frequent trimmings, at the same time exposing the bunches to the full action of the sun until they are well formed and the berries have reached the

size of small peas. The action of bees and other insects which visit the flower, is said to cause the bunches to shank, but there is no positive proof of this, although these insects may break off a few of the delicate flowers of the vine here and there, in their busy flight. On the other hand *shanking* is often ascribed to defective fertilization, in which case the visits of pronubal insects should prove rather useful than detrimental. Moreover, there are many varieties of vines, such as the *Muscats* etc., which have a natural and invincible habit of *shanking*, and therefore in their case a shanky bunch is more normal than otherwise. The habit of *shanking* in very vigorous vines is sometimes markedly persistent, recurring year after year, and occasionally the vine becomes quite sterile. This habit may be corrected by thoroughly draining the land, by frequent trimmings, by late pruning which provokes some bleeding from the exposed tissues, and by exposing the bunches to the action of the sun as soon as they are put forth by the plant, that is long before the blooming period.

Weak buds. This condition is often complained of, and is noted both on the terminal bud of the cane which has been pruned long, as well as on the spur retained in short pruning, and is often seen also on lower buds. These *weak buds* do not show signs of parasitism, and seem quite healthy and good, but develop into very weak shoots, with short internodes and often with rickety leaves, exactly as in the initial stages of *roncet*. The causes of this diseased condition are unknown. It has been ascribed to traumatism, that is to bruises produced by rubbing or striking against stones and other hard objects, but in the case of the terminal buds it is generally due to the mistaken method of pruning, according to which the cane is cut just above the terminal bud. The pith is thus laid open close to the bud, which cannot but suffer the consequences of a partial drying up of the

tissues around the node. It is therefore recommended to cut the cane across the next node above the bud which it is proposed to retain, as this precaution ensures the perfect occlusion of the pith canal above the terminal bud.

Cold. The effects of cold on the tissues of the vine are particularly important in central and northern Europe, but they are also very troublesome in southern Europe wherever the vine is cultivated at a high altitude above the sea, as well as in low lying places exposed to frost. The cold may affect the vine both when it is leafless, in winter, and then the vine may be killed outright, and when it is pushing out the new shoots in spring. Our winters are never so cold as to be injurious to the woody tissues, but occasionally a cold spring may affect the young shoots, although of course these are rare occasions, and the injury caused is never such as to provoke complaints. The congelation of dew or mist on the tender tissues may cause their death, especially if the thawing process takes place at all rapidly. In this case the foliage becomes limp and partly dries up, assuming a burned aspect, and sometimes the leaves which are only partly affected, become covered with red blotches or blisters simulating an early attack of erinosis. Another and more serious class of injuries is that caused by dry frost (It.=*gelate nere*), in which the tender tissues become frozen and the evil is aggravated should the rays of the sun provoke a quick thawing. The foliage and the shoots then become limp and die, assuming a brown or dark brown colour in the course of that day or in the next. These injuries from dry frost may take place on calm and clear frosty mornings towards the close of March or in April, but in Italy and in higher latitudes the same may happen as late as the close of May. A good remedy against frost consists in spraying the vines with water taken from a well, or even with spring water,

as soon as the evil is noticed early in the morning, before the thaw has commenced. The system which is most in use against the frosts of spring consists in protecting the vineyards by means of artificial clouds of smoke. Firewood mixed with tar, or any other material likely to produce a thick smoke, is distributed in small heaps at regular distances all over the vineyard, and these heaps are set on fire at dawn as soon as the signs of frost begin to develop. These clouds of smoke protect the vines from frost very effectively, and various models of fixed and portable apparatus are now in use in most vine-growing countries, in which the clouds of smoke are produced by the combustion of tar and other heavy oils. By the use of the pagoscope, an instrument with a dry bulb and a wet bulb thermometer, a reliable forecast of frosty mornings can be obtained the day before, at sunset.

Sun-stroke and *heat-stroke*. (M = *lup* 1). This diseased condition is met with in July and August, but sometimes also earlier or later, and generally follows when a long spell of calm and sultry weather with a southerly breeze, is succeeded by a dry north wind. It is also frequently caused directly by lively hot breezes blowing from the south or south east. In any case it is always brought about by a loss of equilibrium between the absorbing power of the roots and the transpiration from the green parts of the plant. The affected foliage becomes limp and shrivels, whole branches may die, and occasionally the entire plant dies from its roots. *Sun-stroke* or *heat-stroke* is more frequent on shallow clayey soils which become baked and cracked in summer, but occurs also on deep soils where there is no lack of moisture. Sunburn or sun stroke proper is often limited to the bunches which are exposed to the sun, and is generally noted when the berries are still green and have not yet reached full size.

VEGETABLE PARASITES.

Tubercle of the Vine. (It.= *Rogna della vite*). This disease consists of warty and corky growths on the stem and branches, particularly on the growing callus of wounds caused by pruning or by any other lesion of the woody tissues. The development of the tubercle is due to the presence of *Bacillus ampelopsorae* Trev., just as the tubercle of the olive-tree is due to *Bacillus oleae*. This disease is fortunately rare in our vineyards, and American vines are said to be generally free from this infection, against which it has been recommended to cut off the warty growths and burn them, washing the wound with a strong solution of green vitriol (ferrous sulphate). In cases of severe infection it is better to remove the plant altogether, and burn it.

Black Disease. (It.= *mal nero*). Is a gummosis of the vine, and is due to the presence of a microbe, *Bacillus vitivorus* Baccarini. This disease attacks all parts of the plant, including the stem and the berries, and makes its appearance towards the close of May or early in June; the shoots cease to grow, and become limp at the extremity; the leaves wither, become crumpled and dry, assuming a yellow, reddish brown or purplish brown colour. The shoots show a livid appearance at the node, where they break off easily, dark chocolate brown streaks are formed along the internodes, and the pith becomes soft and rotten, and takes a coffee brown colour. The bunches become atrophied, and few berries are retained. On the stem the disease develops long deep fissures, having a cankerous aspect, from which a dark, thick, sticky fluid oozes out, which is full of the microbe abovementioned. The disease is favoured by bad drainage, and by the habit of deep planting, the infection often starting at the heel of a long cutting which has been inserted deep into the soil. When the disease starts from a wound above the surface

of the soil, it often happens that the infection does not extend downwards and the vine may be reconstituted by suckers thrown up below the ground or below the point of infection. In infected areas, as a preventive against infection it is advisable to wash the wounds caused in pruning with a strong solution of ferrous sulphate, or to paint them over with a strong solution of sulphate of copper or with coal tar. The diseased plants should be cut down and grafted with some resistant variety, and the pruning should be burned at once. It is important not to take cuttings or scions from diseased plants, as these necessarily will perpetuate the evil. This disease is rare in our vineyards, and diseased plants generally assume a healthier appearance in summer, but of course the disease is then only latent, and resumes its virulence in the following spring.

Another disease due to a microbe is caused by *Bacillus uvae*, *Cugini* and *Macchiati*, which attacks the bunch some time before, or at the time of flowering, commencing from the apex and travelling towards the peduncle, often causing the whole bunch to dry and take a dark brown colour. This disease is rare here, and is generally confused with similar lesions caused by vine blight.

DISEASES CAUSED BY FUNGI.

Vine-Blight. (*Plasmopara viticola* Bert et Curt). This disease was first noticed in France in 1878, on leaves of Jacques, a hybrid-American vine then recently introduced from North America, where it was known since 1834, but in two years it extended all over Italy, France, Switzerland, Austria and Spain. It has existed in Malta at least since 1895, and more or less severe attacks have been noted in the following years, particularly in 1902, 1906, 1907, 1911, 1912 and 1921. This disease attacks all the green parts of the plant, being specially

virulent at the time of flowering and until the berries have reached the size of a small pea. It makes its appearance usually in April, on the tender foliage which becomes blotched with yellow pellucid spots, with a whitish or silvery efflorescence on the corresponding part of the under surface, but this whitish efflorescence is sometimes absent. The disease spreads with alarming rapidity, and may infect all the leaves of the young shoot, which soon dry off and take a light brown colour. The infection reappears in autumn, and then the yellow or yellowish blotches have an angular form, with a silvery lustre on the under surface, and whitish tufts of fructifications, especially along the nerves. The vine deprived of its foliage so early in spring remains stunted, the canes do not develop well, so that not only that year's crop is lost but the promise for next year is seriously affected.

However, the principal injury is caused to the flowers and the fruit. The bunches are attacked chiefly, and with great virulence, at the time of flowering, but may be attacked some days before the flowers begin to bloom, although the most dangerous period, at least for this Island, is from the moment that the flowers begin to bloom until the berries have reached the diameter of about 3 m.m. The extremities of the bunch become flaccid, assume a whitish or ashy mouldy appearance, and dry off, the infection progressing quickly and may involve the whole of the bunch. So rapid is the progress of infection that one day there may be only slight traces of disease, and in two days not a single bunch remains unaffected.

A form of *vine-blight* in which no fructifications are produced may attack the terminal berries of a bunch, or the entire bunch, when the berries have reached the size of a large pea, that is late in June or in July. These berries shrink and become wrinkled, take a light chocolate

colour, and their pulp becomes brown ; then they drop off or may remain attached to the bunch.

The tissues of the young shoots are also affected by the disease, greyish blotches are formed on them, which later on become reddish brown. The parasite does not penetrate into the woody tissues, but the shoots remain weak and are easily broken. The bark of the green shoots sometimes becomes fissured, and in this case the fructifications of the fungus appear as whitish tufts along the margin of the fissures.

The virulence of the disease is variable from year to year, being greatest in wet springs, and during spells of light south or south-east winds with calm dewy mornings, the most dangerous period running from the moment that the flowers are about to bloom until the berries are well set and have reached the thickness of 3 m.m. Should the weather prove favourable to the development of the fungus, the crop can be saved or partly saved only by a careful and oft-repeated use of remedial measures ; but if the spring is a dry one and the flowering period, coincides with a spell of cool and dry northerly winds then the havoc will be reduced to a minimum, and may pass almost unnoticed. However this favourable circumstances should not lull the grower into a false sense of security and induce him to abandon or postpone the remedial measures which he was about to carry out, as the weather may change at any moment.

Certain sorts of European vines are more resistant than others to this disease, and this fact is more noticeable in years of comparatively slight attacks, when the more resistant sorts remain practically immune. Most American and hybrid-American vines are practically immune even in years of great virulence, but the grower should apply at least one spraying with Bordeaux mixture, or one dusting with sulphur containing 3 to 5 per

cent. of sulphate of copper, to make sure that his American vines are well protected. It should not be forgotten that *vine-blight* made its first appearance in Europe on the foliage of a hybrid-American vine.

The ravages caused by this disease are unfortunately too well known, and are not so effectually controlled by the use of chemicals, as those of its sister disease the vine-mildew, by the use of sulphur. In certain years with favourable weather the virulence is such that the entire crop of a vineyard is lost in two or three days, and the aggregate loss to the industry is enormous, but with good preventive treatment undertaken at the proper time the ravages of *vine-blight* are greatly mitigated even in very bad years, although the very best treatment so far known cannot confer perfect immunity. The best remedies against *vine-blight* are undoubtedly those the action of which depends on the presence of salts of copper. Millardet in 1885, has proved that 2 or 3 parts of sulphate of copper dissolved in 10,000 parts of water are sufficient to kill the spores of *Plasmopara*, and soon after it was proved that sulphate of copper united with sulphur in the proportion of 3 to 5 per cent., or even more, and applied as a dusting has a distinct action against the disease. This mixture of sulphur and sulphate of copper is now sold ready made, and is applied by means of a duster as a preventive against blight and mildew, but it can be easily prepared by the grower, by dissolving 5 kilos of sulphate of good quality in a sufficient quantity of hot water, pouring the solution in a tub containing 100 kilos of flowers of sulphur, or better of fine precipitated sulphur. The moistened sulphur is then allowed to dry and reduced again to a fine powder.

The so-called *pasta Caffaro* which is produced in Brescia by an electrolytic process contains about 16 per cent of metallic copper, and is a mixture of chloride of copper, hydrated oxide of copper, and

chloride of lime, has proved to be a highly efficacious remedy against *vine-blight*. Bordeaux mixture is another good remedy against this disease, and is extensively used in most vine-growing countries. The best formula for Bordeaux mixture is probably that given by Cavazza, which is the following. Fresh lime is dissolved in sufficient quantity in water in a tub, and stirred well to make a milky solution. This solution is allowed to rest for about one quarter of an hour, and then it becomes clear, the excess of lime being deposited at the bottom of the tub. Of this clear solution of lime 100 litres are taken out into another tub, and over it is poured a solution of sulphate of copper prepared beforehand by dissolving completely 720 grammes of the sulphate in some hot water and then allowing it to cool. The mixture is stirred well, and should have a sky blue colour, and though when sprayed on the foliage it is not so visible as other heavier mixtures containing more lime and sulphate of copper, it is very effective and economical, is sprayed more easily because it contains no concretions to choke the spraying apparatus, and is not so corrosive to the spraying pump and to the clothes of the workman as other mixtures. In the Burgundy mixture the lime is substituted by soda, and in *eau celeste* ammonia is used instead of lime or soda, but in any case the Bordeaux mixture is certainly cheaper and is said to be more efficient. Various brands of Bordeaux mixture are now sold ready made, as well as dusting compounds such as Strawsonite which are applied by means of a duster as a fine powder.

Grey mould of the Grape. This is due to the ubiquitous *Sclerotinia Fuckellania* De Bary, an Ascomycetous fungus belonging to the group Discomycetes, which is generally met with, and described, in its conidial form of *Botrytis cinerea* Pers. or *Polycactis cinerea* Kunz. The *grey mould* attacks the grapes when they are ripe or

when they are approaching maturity, and then the diseased berries take on an ashy grey colour, shrivel and dry, their surface becoming covered with the ashy grey fructifications of the fungus. The attack may develop when the bunches are still in flower, and then they rot and drop off. The attack on the green parts and flowers in vines grown in the open air was formerly considered rare, but lately has been prevalent in certain districts of France and Northern Africa. The fungus attacks also the newly grafted plants or cuttings during the forcing process, and is the cause of many failures, and it thrives also on any recent wounds of the green parts of the vine. On the other hand, an abortive or larvate form of the disease attacks the ripening berries in the Rhenish provinces, and provokes certain alterations owing to which the juices of the grape become concentrated, with an increase in glucose and in glycerine, and the wine which is produced takes a more delicate flavour, hence this form of disease is called the *noble rot* of the grape. However in other regions of France as well as in Italy and elsewhere the attacks of *Boltrytis* are justly dreaded as they invariably result in wines of poor quality.

As a remedy against this disease it has been suggested to apply to the bunches, at the time when the berries are beginning to ripen, one or two dustings at an interval of a few days, with powdered lime or powdered chalk, preferably with the addition of a small quantity, about 5 per cent, of finely powdered alum.

Vine-mildew. Is due to *Uncinula spiralis* Berk. = *U. americana* Howe = *U. necator* Ferraris = *Oidium Tuckeri* Berk. = *Erisiphe Tuckeri* Tul. The fungus is generally known in its conidial form (*Oidium*), the ascophorous form (*Uncinula*) being very rarely met with. It appeared for the first time in Europe on the vines cultivated under glass in Margate (England) in 1845. In 1847 it was noted in France and Belgium, and soon

afterwards is spread all over Europe and Northern Africa. This fungus attacks all the green parts of the vine, viz : the leaves, the green shoots, and the bunches, from the time of flowering until the grapes are approaching maturity, causing superficial greyish and greasy spots on the upper surface of the leaves and on the green epidermis of the shoots. The greyish spots on the shoots become brown when the epidermis takes its normal reddish colour of ripened wood. On the green berries the disease takes its well known form of greyish or rusty spots, and if the spot is large enough to cover practically the whole berry, the growth of the rind is interfered with, and the internal pressure causes the berry to burst. The perithecia are developed on the stems, where they hybernate during the winter, and early in spring they produce the disease in its conidial form on the newly formed green tissues of the plant.

The only remedy against this fungus is dusting with finely powdered sulphur, which has a specific action both against the conidial form in spring and summer, and against the ascophorous form in winter. The first dusting with sulphur should be done very early, that is when the bunches are yet quite small and compact, and partly covered with their original hairy production. The second dusting should be done when the flowers are in bloom, at which time the ovaries are more liable to infection and the virulence of the fungus is almost at its height. This second dusting is also useful to assist fertilization and to cause the berries to set more easily, and is therefore a preventive against shanking. The third dusting is done after an interval of about fifteen days, when the berries are as large as a pin's head ; and is advisable to apply a fourth, and in certain cases also a fifth, dusting at other intervals of fifteen days. There are in commerce various types of sulphur in powder, viz : triturated, ventilated, sublimated and precipitated, but the efficacy of any par-

ticular type rests chiefly if not entirely in the fineness of the particles of sulphur and in its purity from admixtures of earthy substances. The use of sulphur containing 3 to 5 % of sulphate of copper has the advantage that it is also a preventive against *vine-blight*. Spraying the vines with a solution of common salt (1 kilog to about 100 litres of water) or with a mixture of about 1 part of sea-water to two parts of fresh water, has given fairly good results, both against *vine-blight* and *vine-mildew*, and may be used as a substitute, should sulphur be at any time unobtainable.

Black-rot is due to *Guignardia Bidwelli* Viala et Ravaz.=*G. ampelicola* Roze.=*Phoma uvicola* Berk et Curt.=*Phyalospora Bidwellii* Ellis.=*Phyllosticta viticola* B et C. This is another disease of American origin, which was first noted in Europe in 1885, and has caused notable injury to the vineyards in certain districts of France. The fungus attacks the leaves, the shoots and the bunches. The leaves are infected in May or early in June, with the production of elongated spots of a red or reddish colour with a dark brown margin, and on these spots numerous black dots are formed which are the fructifications of the fungus. The same spots are formed on the green shoots, the lesion extending deep into the woody tissues. On the green berries the attack develops like sunburn, but the brown spot extends, and the berry shrivels and partly dies, assuming a purplish or black colour, and on the rind of the diseased berry the fructifications of the fungus are soon formed as small prominent black dots. The diseased berries which afterwards drop to the ground produce in spring the two types of fructifications of the fungus, viz: the conidial and the ascophorous, by means of which the disease is reproduced on the new tissues. The development of the fungus is favoured by a moist condition of the atmosphere in May and June. The remedy most in use against this disease,

which is so far not known to exist in these Islands, consists in spraying with Bordeaux mixture, using slightly stronger doses or more frequent sprayings than in the case of blight. Spraying with a solution of 2 to 3 % of sulphate of copper also gives good results.

White-rot, due to *Coniothyrium diplodiella* Sacc. = *Metasphaeria diplodiella* Berlese. = *Charrinia diplodiella* Viala et Ravaz, is more widely distributed than *black-rot*, but develops much more slowly. It attacks occasionally the green shoots, but is generally confined to the berries, which shrivel, take a dull white appearance, and dry up gradually, in the meantime the rind becoming dotted with the greyish white fructifications of the fungus. The disease is occasionally met with in our vineyards, but should it threaten to assume alarming proportions, it may be checked by dustings with sulphur containing 3 to 5 % of sulphate of copper, or by spraying with $2\frac{1}{2}$ % of bisulphide of lime, made slightly acid by the addition of a small quantity of sulphuric acid; or with a 3 % solution of bisulphide of magnesia.

Anthracnosis of the vine. This disease which is due to *Sphaceloma ampelinum* De Bary, is common enough in all countries where the vine is grown, but is rare in our vineyards. It attacks all the green parts of the plant causing deep lesions on the young wood, owing to which the produce of the following year is often jeopardized. The young shoots become infected early in spring, especially near their union with the old wood, producing spots which become cankerous and corrode the tissues very deeply, and deform or destroy the shoots, the process being only stooled when the new tissues become lignified. On the foliage the disease develops at the same time, the black spots assuming also a gangrenous aspect corroding the entire thickness of the tissues and causing perforations and lacerations, and often the leaf dries up altogether. On the young

bunches the cancerous spots may eat into the substance of the stalk and destroy the bunch, the same spots with a black margin being formed also on the berries which are destroyed in the same manner. The disease is more frequent in low-lying and badly drained vineyards, and develops with greater intensity in wet springs

The best preventive treatment for this disease consists in hard pruning, and painting over all cankerous wounds on the wood which cannot be removed, with 10 per cent. solution of commercial sulphuric acid, afterwards washing the whole plant with a saturated solution of ferrous sulphate. All prunings should be removed at once and burned. Dusting with sulphur containing 3 to 5 per cent. of sulphate of copper, or spraying with Bordeaux mixture, may check somewhat the course of this rebellious disease in spring and summer, but the real treatment should be done in winter.

Aureobasidium vitis Mont. = *Exobasidium vitis* Viala et Boyer. This fungus occurs in France, and in its white variety (var. album Mont.) occurs in Italy. The disease attacks the berries and the foliage. On the berries are formed small brownish spots, with a depression of the cuticle; on the cuticle are developed small pustules containing cylindrical basidiospores, and in the tissues underneath the cuticle is found the *mycelium* with ramified *hyphae* of a golden yellow colour, the basidia in the pustules being of the same colour. In the white variety the colour is white. On the foliage the disease forms yellowish white efflorescences, similar to irregular spots with a chalky appearance, chiefly on the tender surface of the leaf, on which are also formed the pustules abovementioned. The leaf assumes a reddish colour and becomes curled, and similar efflorescences are also formed occasionally on the stalk of the bunches. This disease which seems to be of little consequence, has not been detected in these Islands, but should it make its

appearance the affected foliage should be collected and burned, and the vines dusted frequently with sulphur containing sulphate of copper.

Root-rot. The disease may be due to the presence of several fungi, viz : *Dematophora necatrix*, Hartig., *D. glomerata*, Viala., or to *Armillaria mellea* Vahl. The lesions caused by these species of fungi are much the same, and have been already described elsewhere. *Dematophora glomerata*, Viala., so far has not been found in Malta, and *Armillaria mellea*, Vahl., is much more common than *Dematophora necatrix*, Hartig. As already stated elsewhere the *mycelium* and other *rhizomorphic* productions of *Armillaria* are easily distinguished on account of their emitting a singular phosphorescence when taken in a dark place. The *mycelium* of *Dematophora* is made up of an abundant production of snowy white filaments which covers the diseased roots, among these filaments are formed thick root-like cordons, with the production of sclerotia in the shape of large pyriform concretions on which the conidial fructifications are produced. The vine attacked by these fungi soon assumes a chlorotic appearance and a fatal result is the rule. The remedies suggested against these fungi consist in (a) thoroughly draining the land, (b) removing and burning all diseased tissues, (c) disinfecting the soil by watering it with a 3 per cent. solution of sulphate copper, leaving the place empty, and the soil well exposed to the action of the sun, for some time before replanting. For the treatment of nurseries and new vineyards Foex has suggested the use of bisulphide of carbon injected into the soil at the rate of 70 grammes for every square meter of area.

The sooty fungus (*Capnodium salicinum*, Mont. = *Fumago vagans*, Pers. attacks all the green parts of the vine, and also old stems and branches, but this is in reality a saprophytic species living on the honey-dew

exuded by aphides or by scale-insects, and is not directly injurious to the plant.

Irregular dull brownish spots are produced on the surface of the leaf, of which the affected area soon dies, and is followed by the formation of small whitish dots which are the basidia of a fungus *Gloeosporium physalosporum*, Cav. The berries may become affected in the same manner, but the disease never assumes a serious aspect. *Colletotrichum ampelinum*, Cav. is a fungus which produces small irregular spots of a light olive green or yellowish brown colour, on the under surface of the leaf. This fungus is common on *Vitis Labrusca* (the Isabella grape), the leaves of which are often entirely covered by these small spots, particularly if the plant shows signs of chlorosis.

Dark spots, often hardly distinguishable, are produced on the under surface of the leaf by the fungus *Macrosporium Vitis*, Sorok., and small irregular or roundish spots of an olive green colour which soon become brown and dry are due to *Sphaerella Vitis*, Fckl. These fungi are checked by frequent dustings with sulphur.

Gloeosporium ampelophagum, Sacc. is the cause of the so-called small-pox of the vine, or anthracnosis of the leaf. The lesions consist in roundish spots or prominences, which are at first brown and soon their central part becomes grey or reddish. The disease is apt to recur year after year, and as a preventive, all affected leaves should be collected and burned.

Cladosporium viticolum, Ces. and *Cl. Roesleri*, Catt. are two fungi which produce roundish or elongated brownish spots along the nerves, invading both sides of the leaf, and are more frequent on the lower leaves of the shoots. *Cercospora viticola*, Sacc. causes dry brown spots, often quite large, on the upper surface of which are developed a number of minute black dots. *Dendryphium*

Passerinianum, Thum. causes similar dry spots, but the black dots are formed on both surfaces of the leaf. Irregular purplish brown spots on the upper surface of the leaf are produced by *Septoria Badhami*, Berk. et Br. Another species of the same genus, *Septoria vineae*, Pass. causes the formation of numberless small, irregular, reddish, brown spots, often disposed close together along the margin of the leaf, with minute black dots within each spot; and a third species which also has not yet been seen in our vineyards, but is frequent on American vines is *Septoria ampelina*, Berk. et C., which causes numerous light or pinkish brown spots, which later become darker or black, killing the tissues of the leaf, and sometimes unite together in large blotches. *Alternaria Vitis*, Cav. which so far has been noted only in Italy, causes the formation of irregular ashy spots disposed along the nerves on the upper surface of the leaf, which spots later become dotted with the minute black fructifications. Against these diseases which are generally so slight as to pass unnoticed by the grower, the only remedy is a preventive one and consists in picking the diseased foliage and burning it.

A form of *black-rot* of the leaves and also of the berries is due to the presence of *Phoma uvicola*, B. et C., which is known to exist in America and also in France and Italy. On the leaves this fungus causes the formation of roundish spots or blotches, of a light brown colour, on which the black fructifications are developed often in concentric lines and on both surfaces of the leaf. On the berry the disease takes the form of a dark brown depressed spot, on which small black pustules are developed. This disease is of rebellious and recurrent nature, and requires frequent sprayings with strong Bordeaux mixture to keep it in check.

Other species of fungi of minor importance, frequent in France and Italy, but which do not exist in these

Islands are *Phyllosticta Bizzozzeriana*, C. Mass., *Ph. viticol*, Sacc., *Ph. Vitis*, Sacc., *Septonema Vitis*, Lev., *Septocylindrium dissiliens*, Sacc., *Ascochita ampelina*, Sacc., *Phoma Negriana*, Thun., *Ph. ampelocarpi*, Pass., *Ph. longispora*, Cooke, *Ph. viticola*, Sacc., *Ph. Vitis*, Bon., *Ph. lenticularis*, Cav., *Robillardia Vitis*, Prill et Delacer, *Fusarium Savianum*, Sacc., *Roesleria hypogoea*, Thun. et Pass., *Leptosphaeria vitigena*, Sacc., *L. appendiculata*, Pir., *L. Cookei*, Pir., *L. Gibelliana*, Pir., *Paraphysella radiculicola*, Krassl., *Monilia fructigena*, Pers., *Acladium interaneum*, Thun., *Macrosporium uvarum*, Thun., *Gloesporium crassipes*, Speg., *Tubercularia acinorum*, Cav., *Pestalotzia Thumenii*, Speg., *P. uvicola*, Speg., *P. viticola*, Cav., *Briosia ampelophaga*, Cav. and *Napicladium pusillum*, Cav.

Plasmodiophora Vitis, Viala et Boyer, is the cause of the disease known as *brunissure* in France, and *imbrunimento* in Italy, which develops at first as small dark brown spots on the upper surface, which soon coalesce together and invade the whole surface of the leaf, assuming then a reddish brown, and afterwards a greyish brown colour. A similar disease but of much more serious character, comparable to that of Phylloxera, as it is frequently followed by the death of the vine in about two years, is the Californian disease of the vine, due to *Plasmodiophora californica*, Viala et Sauv. This disease has not yet been imported in Europe. It attacks the foliage, the shoots, the stem and the roots. On the foliage it develops as irregular yellowish spots, which become red and then dark red, surrounded by a margin of a lighter colour. These spots increase in size. The shoots of diseased vines develop badly, with short internodes, and show spots like those on the leaves, and the wood shows zones of diseased tissue of a brown or black colour. The same lesions are found in the wood of the stem and branches. The bark of the roots becomes black

and separates from the wood, which dies and becomes black and rotten. Diseased vines should be uprooted and burned, and the soil allowed to rest for some years before replanting.

DISEASES CAUSED BY ANIMAL PESTS.

The *eel-worm*, *Heterodera radiculicola* Mull., a nematode worm belonging to the *Anguillulidae*, attacks the roots of the vine especially in badly drained lands, causing the formation of small roundish galls on the rootlets, within which the *eel-worm* is coiled. A serious attack of *eel-worm* in spring may simulate an attack of *Phylloxera* but the root galls of the latter are distinctly curved or hooked, and at the same time an attack of *eel-worm* is hardly ever directly fatal.

Tetranychus telarius, L., a "red-spider" belonging to the *Acarinae*, attacks the foliage sucking its juices, and causing the formation of roundish spots of dry tissue chiefly on the under surface, which may be so numerous as to coalesce, and cover the whole leaf. Another minute arthropod belonging to the same order is *Phytoptus Vitis*, Land., which is the cause of *eriosis* or *phytoptosis* of the vine. This well known disease of the foliage is met with at all stages of active vegetation, being present on quite tender leaves, as well as on the foliage which is about to drop off in autumn, and is shown by characteristic blisters of variable size on the upper surface, while the corresponding part of the under surface there is a thick production of felt-like silvery hairs, which afterwards become yellowish red or brown. Against these parasites it is recommended to collect and burn all dry foliage in winter and spring.

Acridium migratorium. L., the common locust, *A. coerulescens*, L., the blue winged locust, *A. femur-rubrum*, L., the red-legged locust, are three species whose *larvae*

as well as the winged insect, feed on the foliage of the vine, but are rarely numerous enough to cause serious injury. *A. stridulum*, L., the red-winged locust, is a fourth species common in France and Italy. The scale-insects are represented by *Pulvinaria Vitis*, L., and *Lecanium Vini*, Bché, the first species with its characteristic cushions is occasionally present in our vineyards. *Lecanium cannabinum* and *Ceroplastes Rusci* occasionally visit the vineyard, but are not known to give serious trouble. *Dactylopius Citri*, one of the mealy bugs is frequent on the vine, particularly if trained on pergolas, and *Dactylopius Vitis*, Nied. is another mealy bug which lives on the green parts, and on the berries which it destroys, but resides chiefly on the roots. This mealy bug is known to cause indirectly serious havoc in the vineyards of Northern Africa and Palestine (Jaffa disease), where in order to seek protection from the heat it descends to the base of the stem and to the roots, causing wounds in those tissues from which exudes a sugary liquid which moistens the soil all round. On the stem and roots moistened with this honey dew, as well as in the soil saturated with this liquid develops a fungus (*Bornetina corium*), whose *mycelium* forms a thick mass which protects the insects from the drying heat, but destroys the roots by depriving them of air, and the vine dies soon after. The disease, often called *phthyriosis*, may extend over large areas and then assumes a grave character. As a remedy it is recommended to make use of quicklime digging it deeply around the stem of infected trees. Carbon bisulphide injected into the soil close to the stem is also a good remedy, in both cases the remedy acting against the insect and against the fungus.

Another scale-insect closely allied to the mealy bugs is *Rhizococcus falcifer*, Künckel, which is known to exist in North Africa and Sicily. The original host plants of

this pest are certain species of *Convolvulus*, and it lives chiefly on their underground stems, and roots, whence it passes frequently to the roots of the vine, inducing a state of exhaustion owing to which the plant may succumb.

The vine-aphis, *Aphis Vitis* Scop is green and brown, and occasionally attacks the tender foliage late in summer in France and Italy. *A. Persicae* Fons. is another species which attacks the vine in these Islands as well as in Southern Europe.

The *Phylloxera* of the vine (*Phylloxera vastatrix*, *Planchon*) has acquired an evil name on account of the vast destruction which it has caused in almost all countries where the vine is cultivated. This insect was first described by Asa Fitch in 1854 under the name of *Pemphigus vitifolii*, a name which he applied to the insect in its larval stages within the galls on the foliage of American vines in the neighbourhood of New York, and subsequently received other names, until it was fully re-described by *Planchon* and placed among *Aphids* in the genus *Phylloxera* of Boyer de Fouse. It was first noted in Europe in 1863, when it was described by Westwood from specimens found in the greenhouses at Hammer-smith near London, where it was introduced on the roots of infected vines from America. Soon afterwards it was observed in France, and in 1865 it was detected in Portugal. In 1879 the *Phylloxera* was found to exist in Italy, Australia, and in a few years more it had spread to vast regions in France, Italy, Germany, Austria, Hungary, Russia, the Balcans, North Africa, South Africa, etc. In 1880 it had already passed to Sicily, but for a long time the Maltese Islands continued to enjoy perfect immunity from this disease. Unfortunately in July 1919 it was found that a considerable centre of infection existed at Ramla (Gozo) as well as smaller centres here and there in that Island, so that the local

vine grower has now to deal with this dreaded parasite and to take his precautions accordingly.

The *Phylloxera* of the vine is not known to attack other plants besides the various species of the genus *Vitis*, and lives on the roots and foliage of the American vines without causing any serious trouble. Its leaf-galls are rarely found on the foliage of the European vine, but the roots of this species and its varieties are so susceptible to this pest that the plant sooner or later succumbs to the attack.

The life-cycle of the insect on its natural host plants, the American vines, is the following. The female insect which has been fertilized late in summer or in autumn, deposits a slightly cylindrical egg, with a hooked prolongation at one end, and a dark red, small micropile at the other end. This egg is deposited deep in the fissures of the bark of the stem or branches, and is at first bright yellow, but in 24 hours becomes definitely of a bright olive green, with its surface wrinkled and dotted. This egg hatches in spring and the young larva (foundress larva or mother larva) proceeds to the upper surface of a leaf to which it fixes itself by its long beak, and causes the formation of a small purse-shaped or wart-shaped gall, usually protruding on the under surface of the leaf with its opening or orifice on the upper surface surrounded by many rigid hairs, but sometimes the opening is on the under surface and the gall protrudes on the upper surface. These galls are sometimes found on the tendrils or on the petiole of the leaf, and there may be quite a number of these galls on the same leaf. These galls are rarely found on the European vine, but are common on the American vines and also on their hybrids, and the winged insect which deposits the winter egg has the instinct to seek out the American vine to deposit the egg on its stem, in preference to the European vines which may be in close proximity, but in any case the injury

caused by the presence of these galls on the foliage is quite unimportant. The larva within the leaf gall, after four moults becomes a *gall-larva (gallicola)*, and is a wingless insect about $1\frac{1}{4}$ m.m. long and 1 m.m. thick, and is a yellowish or greenish colour, with short legs and no tubercles on its back, but with red eyes and 3-jointed feelers, of which the first and second joints are short and thick, but the third is long and pointed. This wingless insect proceeds to lay parthenogenetically about 600 eggs, which are roundish or slightly elliptical, pale yellow and pellucid. These eggs are about $\frac{1}{3}$ m.m. in length, and each becomes covered by a netting showing hexagonal meshes. From these eggs are hatched the *neogallicolous larvae*, which coming out of the orifice of the mother gall, produce other galls on the foliage, and in this manner there may be three to five generations. Among the *neogallicolous larvae* of the third generation there may be some which abandon the upper parts of the vine and descend to the roots where they become *gallicolous-radicolous*, and many or most of the *larvae* of the fourth and fifth generations adopt also the parasitic life on the roots, where they produce the characteristic uncinatate galls on the rootlets or develop small colonies on the larger roots.

The larva met with on the roots is wingless, of an oval form, and often pyriform, terminated behind in a prolonged and pointed abdomen. The colour is yellowish or reddish, but in winter is brown. The last joint of the antennae is thin, but much longer than the corresponding joint of the antennae in the larva which inhabits the galls on the rootlets. There are seventy tubercles on the back, each terminated by a hair, and the feet are short and stumpy.

On the roots, also, the *Phylloxera* multiplies parthenogenetically, but from the third generation, which takes place in June and onwards, some *larvae* instead of

developing galls, become pro-nymphs and then nymphs, and after four moults develop into the winged insect. These nymphs are more numerous on the nodosities of the roots, and the winged insects which result from them and fly away in the course of afternoon, are always sexuparous, that is their offspring have sexual characters.

These winged sexuparous insects are reddish or orange-red with the exception of the second thoracic segment which is black, the length of the body being 1 to $1\frac{1}{4}$ m.m. The antennae are about one third the length of the body and terminate in a fine point. The eyes are red, with three eyelets. The beak is short, and the feet are long. The abdomen has eight distinct segments, narrowed posteriorly, but obtuse. The wings are transparent and iridescent, the anterior pair being much larger and longer, and both pairs are disposed horizontally on the body when the insect is resting. The sexuparous winged insect deposits its eggs parthenogenetically on the stem and branches of the vine, chiefly in the fissures of the bark, but occasionally also on the foliage, each winged insect depositing only female eggs or only male eggs, usually only one in number but occasionally as much as five or six. These eggs are elliptical or elongated, of a shining yellowish white, with a slightly netted surface, the eggs which give birth to female individuals being $\frac{2}{5}$ of a millimeter in length, and about $\frac{1}{5}$ of a millimeter in thickness, while the eggs which give birth to male individuals are smaller. In July-August these eggs are hatched, and the young after about four days, copulate and the fertilized female proceeds to hide as deeply as possible in the fissures of the bark or under the bark, where in about 24 hours it lays the winter egg.

On the European vine the life-cycle of the *Phylloxera* is modified. It is generally held that the sexuparous or winged insect is produced all the same, but that it seeks

the American vines on which to deposit the eggs from which are born the male and female individuals which in their turn produce the fertilized winter egg. Should there be no American vines in the neighbourhood the winter egg laid on the stem of the European vine hatches all the same, but the *larva* (*foundress larva* or *mother larva*) is rarely able to produce the typical gall on the foliage of the European vine, in order to renew the life-cycle. Should this take place, the young produced within the original gall instead of proceeding to form new galls on the foliage, descend to the roots where they multiply with great rapidity. It is therefore supposed that in the case of the European vine the spread of *Phylloxera* takes place chiefly by means of the *larvae*, of the roots and rootlets, hybernating during the winter, and spreading slowly from root to root, mostly underground in sandy and porous soils, or coming to surface and descending again on the roots through the fissures of the soil in clayey or heavy lands. These *larvae* are also transported from one vineyard into another along with the feet or induments of workmen, on the implements used in tillage, by means of prunings, manure, by the action of wind and rain, of running water, by the animals employed in tilling the land or in carrying the produce, by plants or other produce to which infected soil is attached, and in many other ways. The activity of the *larvae* on the roots is at its height in spring and early summer, but after June this activity slows down gradually, to almost a complete standstill in winter.

On the rootlets the *Phylloxera* provokes the formation of tubercles or galls, and at the growing end of the rootlet are produced nodosities, generally of a characteristic hooked shape. These formations interfere seriously with the functions of the rootlets, and when sufficiently numerous the physiological function of the roots is totally

impaired and the vine dies. A newly infected vine usually shows no sign of disease, but in the following year or sometimes late in the same year, it is noted that the shoots remain small, with small leaves, which turn yellow and dry off very early in summer and in the second or third year the vine dies. In the meantime the vines around the centre of infection are already infected, and succumb soon after, the infection spreading in concentric lines until the whole vineyard is destroyed.

In order to check the spread of the evil it has been suggested to uproot and burn all the vines within the infected area, including those vines which are as yet apparently healthy, to burn the vines on the spot along with their roots and foliage, and to disinfect the soil by means of bisulphide of carbon or petroleum, which should be injected deep into the soil, and the surface of the ground rolled over, to maintain as long as possible the action of the disinfectant. Carbide of calcium, or the residues left after the production of acetylene gas, or a mixture of carbide of calcium and phosphate of lime (phospho-carbide of lime), have been used with some success against the *Phylloxera*, owing to the poisonous nature of the gas (hydrogen phosphide) which is developed. It was also suggested, where possible, to inundate the vineyard for four to six weeks, keeping the water at about 10 c.m. above the level of the soil all that time. But these various methods of treatment, and many others which were recommended from time to time, have afforded very little relief from the ravages caused by this insect, and have hardly helped to check its spread in those countries where it had obtained a footing. The only true remedy consists in grafting the European vine on American vines or American hybrids of proved resistance to the disease, or by planting American hybrids "direct producers", that is which are capable of producing fruit of the right quality for the table or for the

press. These "direct producers" are a comparatively modern creation, and many of them leave much to be desired both as regards the quality of fruit and their resistance against the pest, but we have had so many surprises in the realms of Agriculture and Horticulture that we need not despair to see one day 'hybrid direct producers' which to a satisfactory degree of resistance against the *Phylloxera* and other serious diseases of the vine, unite the valuable qualities of the European vines.

Among the *Hymenoptera* there are several species which cause notable damage to the ripe grapes. The chief of them is *Vespa germanica* L., which is well known all over Europe and destroys ripe grapes as well as other fruits. *Vespa vulgaris*, L. and *V. crabro*, L. are two other species frequent in our vineyards. *Polistes gallica*, L. which is common in vineyards and gardens, is also known to destroy many a fine bunch of grapes. The nests of these wasps should be found out and destroyed, and grapes which it is proposed to keep long on the vine should be placed in wire-gauze bags, or wrapped up in a sheet of paper which is tied up above the bunch, and kept open below to allow frequent inspection and the circulation of air.

The *Lepidoptera* include a large number of species which are known to be injurious to the vine in other countries, but fortunately the most destructive species *Conchylis ambiguella*, Hübn. does not exist in our vineyards, and the injury caused by other species is never widespread or serious enough to occasion complaints.

Ino ampelophaga, Hübn. is common in France and Italy. It is a small moth, about 2 c.m. broad from one wing to the other, of a dull brown colour. From April to May the female moth deposits about 300 eggs on the old buds or on the new shoots, and the young which soon hatch, perforate and eat up the buds, or eat and

destroy the tender foliage. The *larva* is yellowish with two brown lines on the back, and a black line on each side. In cases of severe invasions the vines are sprayed with arsenical mixtures, chiefly of arseniate of lead.

Agrotis fimbria, L., *A. aquilina*, Hb., *A. crassa*, Hb., *A. segetum*, Schiff. and *A. pronuba*, L., of which the last three are present in these Islands, may cause some damage to the tender foliage in spring, but direct their attentions to other vegetables as soon as the leaves of the vine have acquired some consistence.

Chaerocampa celerio, L. is a large moth whose *larva* sometimes attacks the vine in these Islands as well as in Italy and France. A nearly allied moth, *Deilephila elpenor*, L. is frequent in Italy and France but never causes serious trouble ; so also is the case with *Deilephila porcellus*, L. which is likewise unknown in these Islands.

A much more serious pest of the vine which fortunately has not yet made its appearance in our vineyards, but is frequent enough all over the continent of Europe as well as in Asia Minor and Japan, is *Conchylis ambiguella*, Hübn., a small straw-coloured moth, not more than $1\frac{1}{2}$ c m. across the expanded wings, with a broad dark brown band across the anterior wings, and dark grey posterior wings. The *larva* is pale olive green, with brown yellow tubercles, each terminated by a hair. The *chrysalis* is greenish purple, about 6 m m. long. In April or May, the hibernating *chrysalis* develops into the moth, which proceeds to lay eggs on the inflorescence of the vine, and after a few days the young *larvæ* are hatched, and prey first on the flowers and then on the young berries, completing their metamorphosis in two or three weeks. In June or July a second generation develops which preys on the berries, and probably a third generation follows somewhat later to complete the work of devastation. In September the

larva proceeds to the crevices of the bark of the stem and branches, where it is transformed into a *chrysalis* and *hibernates* throughout the winter to renew its activities in the following spring. Another small moth, *Polytchrosis botrana*, Schiff. sometimes referred to under the name of *Eudemis botrana* or *Grapholitha botrana*, Schiff. or *Albinia vochiina*, Briosi., has three generations in the year and causes injuries similar to those caused by *Conchylis*. It is common all over Europe and North Africa, but is not known to exist in these Islands. This moth is smaller than *Conchylis*, and is of a yellowish brown colour, the anterior wings being grey, with a yellow base having two or three black dots upon it; and small black dots are also present on the middle and apical part of the wing. The posterior wings are dark grey. The male moth is smaller than the female. The *larva* is dull green, sometimes greyish or slightly bluish. These moths have several natural enemies, which are now bred artificially and distributed in those regions where an invasion is threatened; the more important of these natural enemies being *Phytomyptera unicolor*, Rond. which attacks both the *larva* and the *chrysalis* of the moth. Arsenical sprays, consisting of arseniate of soda, of lead or of copper, and also solutions of tobacco juice, and sprays containing *pyrethrum* powder have given good results against these moths.

Other species of *Lepidoptera*, such as *Tortrix Pilleriana*, Schiff., *Antispila Rivillei*, Stt., *Ochneria dispar*, Hb., and *Naenia typica*, L. prey on the flowers or on the foliage of the vine in France and Italy, while the large *larva* of *Acherontia atropos*, L. the death's head moth, occasionally preys on the foliage of the vine in our vineyards. *Antispila Rivillei*, Stt. was first discovered in these Islands by Gohen de Reville in 1750.

Coleoptera. In our vineyards, perhaps the worst enemy of the vine is *Lalidostomus taxicornis*, Labill.

which devours the young foliage and sometimes also the inflorescences in April and May, but ceases to molest the vine as soon as in the ordinary course of treatment for other diseases, it is sprayed with Bordeaux mixture, or dusted with sulphur containing 3 to 5 per cent. of sulphur of copper. This small beetle, with dark bluish green head and thorax, and yellow elytrae, is also well known for its devastations in the rose garden etc., but as its *larva* breeds in the ground, it is usually beyond the reach of remedial measures. The large chocolate-coloured beetle, *Oryctes nasicornis*, L. occasionally breeds in the rotten wood at the base of old stems of vines and other trees, but has little pathological importance. *Melolontha vulgaris*, L. the May bug, feeds upon the roots of the vine all over the continent. The same habit has *Anomala Vitis*, Fabr. which occasionally causes much havoc in the vineyards of Central and Lower Italy. The large fat, grey *larva* of *Geotrupes laevigatus*, Fb. (M. = *bughauuar*) lives on the thick roots of the vine and other trees and plants, close to the surface of the ground, and may cut down or destroy young vines. This *larva* is met with practically all the year, and is kept down by digging and stirring frequently the soil around the stems of vines. Various species of *Otiorrhynchus*, such as *O. raucus*, Fb., *O. picipes*, Fb., *O. sulcatus*, Fb., *O. nigritus*, Schh., *O. lugens*, Germ., *O. Ligustici*, L., and especially *O. armatus*, Boehm, prey also on the roots of the vine in Italy, France and Germany, but the local species of *Otiorrhynchus* do not appear to cause appreciable trouble in our vineyards. *Rhynchites betuleti*, Fb., feeds on the leaves of the vine in central Italy, and is sometimes the object of special enactments to keep it in check, *Haltica ampelophaga*, Guer. a very small beetle of metallic green hue, feeds on the tender foliage and flowers of the vine in Italy, France, Spain

and N. Africa, and *Adoxus Vitis*, Chev., is frequent on the roots of the vine in Italy, where it sometimes causes serious trouble. Other beetles which occasionally attack the vine in continental Europe are the following : *Lethrus cephalotes*, Fb., *Polyphylla Füllo*, L., *Anisoplia adjecta*, Ericks., *Oxythyrea stictica*, Muls., *Agrilus viridis*, L., *A. subauratus*, Gabl., *A. derasofasciatus*, Lacord., *Synoxylon muricatum*, Fb., *S. sexdentatum*, Ol., *Peritelus hirticornis*, Hbst., *P. griseus*, Ol., *Metallites marginatus*, Steph., *M. geminatus*, Fb., *Vesperus Xatar-ti*, Mlsnt., *V. luridus*, Rss., *Cryptocephalus Coryli*, L., and *Chrysomela lurida*, Fb.

The rat (*Mus decumanus*) and several small birds, chiefly the sparrow, are a frequent source of trouble in our vineyards.

THE SMALL FRUITS.

From the gardener's point of view the small fruits are a class by themselves, and are not included under the general term of *fruit trees*, for the reason that they are not *trees*, but merely perennial plants or bushes. They include the Gooseberry, the Currant, the Raspberry, the Blackberry and the Strawberry, and they are qualified as *small* on account of the size of the plant, rather than that of the fruit.

In these Islands the cultivation of small fruits on a commercial scale is limited to that of the strawberry, the other small fruits being only met with here and there in the gardens of amateurs, but as they are generally grown apart, either in the kitchen garden or in the orchard, and some of them claim the same general treatment as fruit trees proper, it may not be desirable to omit them altogether from this work. The corresponding Italian denomination for small fruits is *frutta minori* and include also the melon and watermelon, which are annual plants and are more properly classed as field crops.

THE GOOSEBERRY.

Ribes Grossularia, L. and *R. Uva-crispa*, L.—
GROSSULARIACEAE.

It.=*Uva-spina*, *Ribes d'Inghilterra*. Fr.=*Groseillier épineuse*
or *Groseillier à marqueriaux*.

The Gooseberry requires a cooler climate than ours, but thrives fairly well in moist soils and cool situations along a northern wall. The plant may be grown from seed sown in autumn, or the seed may be stratified for the winter and then sown in early spring, in pans or pots

with a rich soil well mixed with old manure or leaf-mould. The seedlings are planted out separately when they are a year old, and usually commence to bear fruit when about three years old. The plant is best propagated by cuttings of ripened wood in autumn or in early spring before the buds begin to swell. These should be planted in beds with well prepared soil, or better, in pans, and the rooted plants are separated and planted out when a year old. Suckers, with or without roots, offer another useful method of propagation.

The Gooseberry requires shade, but should not be planted in the thick shade of trees, as the plant will be more liable to diseases, and cannot produce fine fruits. An open and cool situation along a northern wall is the best for the gooseberry, which should be also manured every year or in alternate years. It can be transplanted at any time from autumn until February, and as it never reaches full development in this climate, it is not necessary to plant it at a greater distance than one metre apart. Many sorts of gooseberries have been introduced from time to time, but generally die off after a few years of uncertain existence. The plant is best trained as a half standard, with a stem about half a metre high and pruning should be limited to the removal of dead wood, and of old or sickly twigs, and shoots which are too long may be trimmed back to a well placed bud. New wood should be spared as much as possible, as it invariably produces the finest fruit.

THE BLACK CURRANT OR QUINSY BERRY.

Ribes nigrum, L.—GROSSULARIACEAE.

It.=Cassis. Fr.=Groseillier noir à cassis. M.=Ribes isued.

The Black Currant thrives fairly well in shaded and cool situations, and in a rather stiff and clayey soil, but

the fruit is only useful in a cooked state, having a rather unpleasant flavour if eaten raw as a dessert fruit. The best sort is the Naples variety which has finer fruits than any other, The black currant requires the same cultivation as the red currant.

THE RED CURRANT.

Ribes rubrum, L. and *R. rubrum* var. *album*.—
GROSSULARIACEAE.

M.=*Ribes*. It.=*Ribes à grappoli*. Fr.=*Grosseillier rouge*.

Both the red currant and the white varieties, thrive very well in rather clayey soils, in shaded and cool situations. They are easily propagated by well ripened cuttings taken in winter, or by rooted suckers which are thrown up around the stem of old plants. The cuttings or the suckers may be planted in pans with sandy soil well mixed with leaf mould or old manure, or in beds in a shaded corner of the garden. The rooted cuttings may be planted out when they are a year old, but it is better to allow them to remain in the nursery bed for another year to acquire strength. The currants are planted out in winter, December-February, at a distance of one metre apart. In northern countries they are usually planted two metres apart, but in this climate the bush never attains full size, and a distance of one metre from one plant to another is quite sufficient.

The currant blooms in March and April and the pretty bunches of fruit mature in May, June and July. The plant is very sensible to drought, and should be watered frequently throughout the summer. It is owing chiefly to want of proper attention as regards watering that so many currants imported by amateurs die off in three or four years, when they had apparently become

perfectly established. Both the red and the white currants should be grown more frequently in gardens, as the bushes in fruit present a most attractive appearance, independently of the use to which the fruit can be put either as a dessert fruit or for the kitchen.

THE RASPBERRY.

Rubus Idaeus, L.—ROSACEAE.

M.=*Frambò*. It.=*Framboè*, *Lampone*. Fr.=*Framboisier*.

The Raspberry can be grown in full sunshine, but prefers a cool and shaded situation, and does well in the shade of large trees. It can be propagated by seed or by cuttings, but it is best multiplied by division of the suckers which are thrown up in profusion all round the plant. These suckers are produced in the course of spring and summer, and soon after the first autumnal rains they become well provided with roots, and can be taken up in the course of winter or very early in spring before the resumption of active vegetation. They may be planted rather deeply, about two meters apart, and trimmed off slightly at the extremity. Before planting, the soil should be trenched and well manured, and if the suckers are carefully tended as regards watering they will not fail to produce some fruit the same year. In the course of the following summer each plant will through up a number of suckers, which in their turn will fruit in the following year. In this way the original plant soon becomes a nice clump, and will be in full bearing when about three years old.

The raspberry grows and fruits all the better if watered regularly during the dry season, and the fruit has an agreeable acid flavour which seldom fails to please, especially if it is further sweetened by the addition of

sugar, and is also useful for making tarts, jams and sweetmeats. The details of cultivation are simple enough. Thick clumps should be thinned out to secure better fruit, the extremities of the canes if too long are trimmed back, and old wood which has fruited, as well as sickly or decayed canes are cut off. The plant flowers in spring and the fruit matures in the course of summer. The raspberry is very little grown in our gardens, and is considered more as a curiosity than as a serviceable fruit. In fact, as a dessert fruit it cannot compare either with the black mulberry or with the strawberry. Several varieties of the raspberry have been introduced from time to time, but their cultivation has been allowed to fall into neglect.

The Japanese raspberry or Japanese climbing bramble, *Rubus phoeniculasius*, was introduced by the late Professor N. Tagliaferro and soon became fully established wherever it was planted, but failed to arouse interest with the growers.

The Blackberry or Common Bramble (*Rubus fruticosus*, L.—ROSACEAE), yields a strongly acid and astringent fruit which is useful for tarts and pies. The plant has many varieties, the variety *dalmaticus*, Tratt., and the subvariety or form *ulmifolius*, Schott. being common in our valleys and ravines. Improved sorts have been imported now and then, but the cultivation of this plant has never met with favour. Its culture is simple, and the plant is easily propagated by suckers and cuttings in winter, or by layers throughout the year. The loganberry, a hybrid between the raspberry and the blackberry obtained by Judge Logan in America, has not been introduced in our gardens.

THE STRAWBERRY.

M.=*fraula*. It.=*fragola*. Fr.=*fraisier*.

The Strawberries grown in these Islands belong to three species :

1. *Fragaria vesca*, L.—ROSACEAE; the Wild or Wood strawberry, known at the local market as Maltese Strawberry (*Fraula Maltia*). This is by far the strawberry which is grown more extensively and is universally appreciated on account of its strong perfume and delicacy of flavour. There is only one variety in cultivation, the slight differences in size, colour and tenderness being dependent on the sort of soil where it is grown and the cultivation to which it is submitted, and also to the different epochs at which the fruit attains maturity, that maturing in full season, in May, being often larger and better than the fruit maturing earlier or later. This strawberry has been cultivated extensively for centuries, and it is probable that it has acquired quite fixed characters which entitle it to be considered as a distinct local variety. The hampers are borne erect, but the fruit is more or less pendulous, globose, or broadly and obtusely conical, of a lively vermilion colour, with white flesh, very slightly tinged pink. The fruit begins to mature early in April, and the production continues without intermission until July, ceasing altogether towards the close of that month.

2. *Fragaria alpina*, Pers.=*F. semperflorens*, Duch. This is the Alpine strawberry which has become recently a favourite with many continental growers. Several sorts of Alpine strawberries have been imported in these Islands from time to time, but their cultivation has never been undertaken on an important scale, nor is it likely that the Alpine strawberry will ever displace the local wood strawberry in popular favour. The best sort is probably the perpetual or "four season" Alpine straw-

berry, which was introduced here in 1904, and thrives as well as the wild or wood strawberry. The Alpine strawberry resembles very much the wood strawberry in foliage, habit and requirements, and is not so sensible to brackish water as the wood strawberry, but the flowers are much smaller, and the fruit is long and pointed at both ends, and the flesh is orange red or pink. It is almost as productive as the wood strawberry, and has the advantage of producing an abundant second crop in autumn, but the hampers are weak and therefore the fruit often gets soiled with earth, and its texture and perhaps also its flavour are coarser than those of the wood strawberry. Notwithstanding, this Alpine strawberry is commendable for those who desire in autumn a strawberry with the flavour of the local wood strawberry.

3. The Pine-apple strawberry or English strawberry. *Fragaria grandiflora*, Ehrh. This is probably a cross between the Chilian and Virginia strawberries, and has given origin to hundreds of splendid sorts which have mostly supplanted other strawberries on the continental markets. The only pine-apple strawberry which is sometimes grown on a commercial scale in these Islands is the Victoria strawberry, but many other sorts have been introduced during the last twenty years, and are cultivated here and there in private kitchen-gardens, though never on an important scale. Among the sorts which have been introduced the following may be mentioned: Royal Sovereign, British Queen, General Chanzy, Louis Gauthier, Docteur Morère, Sensation, Duc de Malakoff, Lucas, Myatt's Prolific, Premier, Gloire du Mans, Noble, Early Laxton, Madame Meslé, and Saint-Antoine de Padoue, the best being Royal Sovereign, Louis Gauthier, Docteur Morère, General Chanzy and Sensation. Most of these pine-apple strawberries produce a second crop of fruits in autumn and even in winter,—if they are grown in a well sheltered

situation, and some of them, like Louis Gauthier and General Chanzy, are best grown in beds where they develop quickly and yield astonishing quantities of fruit. Others, like Royal Sovereign, Sensation and Docteur Morère will give the best results if grown in broad pots or in boxes along a sheltered wall, which is well shaded off in summer.

The strawberry thrives best in the red soils which are not too light or sandy, but will do well also in moderately stiff clayey soils or whitish soils. The land should be trenched to a depth of 50 c.m., and heavily manured throughout, and then laid out in beds with a view to subsequent irrigation. A sunny situation is necessary to obtain an early crop, but the beds should be capable of being properly shaded off in summer, otherwise many plants will be killed by the burning sun, however assiduously they may be watered. January is the best time for planting out strawberries, but the operation can be performed at any time from October to the first days of March. The plants should be taken up, if possible with a good many roots, and should be planted with their roots spread out, and with the "neck" of the plant at a level with the soil or just above it. The Wood and Alpine strawberries are planted 20 c.m. apart in the row, with 30 c.m. from one row to another, the English strawberries being planted at greater distances. Old plants should be avoided, as well as the weaker of the new plants which are not yet well provided with roots. At the same time the plants should be cleaned of the dry and sickly foliage, and of the dry stipules around the neck of the plant.

The strawberry is propagated by seed or by plants produced at the nodes of the runners, and a few bushy sorts which have few runners or none at all are propagated by dividing the clumps of old plants. Propagation by seed is rarely practised, except when it is desired to

raise new varieties, but the Maltese or wood strawberry, and most Alpine strawberries very generally come true from seed, and are far from being so liable to variation as the English strawberries. The seed may be sown at any time from March to September; in a pan or shallow pot with good soil, well mixed with old manure and leaf-mould. The pans are placed in a shaded situation and the soil sprayed frequently. The seedlings soon make good growth and may be planted out separately in the following winter. They generally fruit in the following spring, and undesirable sorts may then be pulled up and thrown away.

The best and readiest way to propagate the strawberry is by means of the plants which are produced at the nodes of the suckers and at their extremity. These plants will be found well rooted wherever they touch the ground, and are generally produced in great profusion as soon as the fruiting season is ended. However there are certain sorts which produce runners very sparingly and their propagation is necessarily tedious. In their case the cultivator must make use of even weakly plants which would be otherwise thrown away, and he has to continue to cultivate the plants very carefully long after they have ceased to fruit, so as to induce them to produce as many runners as possible. Such sorts are in the habit of forming suckers around the neck of the mother-plant, and these being usually well rooted, are separated and planted out. Certain sorts of Alpine strawberries which produce no runners, are propagated exclusively in this way.

The beds of strawberries are given a good mulching of well-rotted manure early in March, the manure is digged in lightly and the beds are watered. When vegetation is in full action and the plants are in bloom, it may become necessary to cover the beds, in the spaces between the plants, with chopped straw, in order to

prevent the fruit from getting soiled, this precaution being more necessary in the case of the Alpine and the English strawberries, the fruit of which more often than not, touches the ground. Watering should be attended to with the utmost care, the beds being watered lightly at least twice a week. Late in autumn or in winter the beds are scraped lightly with a garden rake to remove the dry leaves, and the dry thread-like runners, and the soil is hoed several times to keep it in an open and porous condition. In the case of the Wood and the Alpine strawberry the beds will continue in good bearing condition for three years, but after the third year many plants will die, and new beds will have to be made elsewhere, leaving the site occupied by the old beds to be availed of for other cultivations. In fact, strawberry beds should not be made on the same site where other beds had stood, before the lapse of three or four years, thus allowing time for the poison left in the soil by the former plants to disappear.

The pots for the cultivation of English strawberries should not be less than 30 c.m. in diameter, and as much in depth, with thick sides to keep up the required degree of moisture for the roots and to protect these from injury from overheating by the sun's rays. Each pot should not have more than four or five plants, a good layer of crocks should be placed at the bottom of the pot to secure perfect drainage, and the compost should be a rich mixture of 2 parts of red soil of the best quality and one part of old manure. The best manure for this purpose is pig's manure, as it will provoke a very vigorous growth, without any danger from overdosing. The pots should be stood in a sheltered and rather shaded situation, and when the plants are in active vegetation and begin to bloom profusely, they should be watered daily, as any deficiency of moisture will reduce the production of fruit, and brings about an early

development of runners. Strawberries grown in pots must be repotted every year, in January or February, and each time the old compost should be discarded altogether, fresh soil being used instead.

Strawberry plants should be shaded off in summer. Plants in pots can be easily removed to a shaded situation along a northern wall or under a shady tree or pergola. Strawberry beds are usually shaded by planting or sowing in each bed a club-marrow (*Lagenaria leucantha*). This trailing plant will soon shade the bed very effectively, and the expense for summer cultivation of the strawberry beds will be amply recouped by the sale of the green fruit of the club-marrow, which always finds a ready market as a vegetable. The Pumpkin is sometimes used for the same purpose, but its vegetation is too rough, producing a very thick shade, so that the strawberry plants are often choked and killed. French runner beans and such other plants as capsicums and egg-plants are also useful as shade-producers.

DISEASES OF SMALL FRUITS.

The Small Fruits abovementioned, with the exception of the strawberry, have been cultivated here on a very small scale, and so far as it is known there have been no complaints on account of parasitical diseases, nor is it likely that their cultivation in these Islands will ever assume such proportion as to confer importance on the study of their diseases. Nevertheless some reference must be made to them, for the guidance of amateur growers.

The American gooseberry mildew, due to *Sphaerotheca Mors-Uvae*, Berk. is common enough in Northern Europe, and so also is *Microsphaeria Grossulariae*, Lév. another mildew of minor importance. These fungi are kept in check by spraying in winter with lime-sulphur wash, or with a rather strong solution of liver of sulphur or sulphide of potassium. Other fungi affecting the gooseberry in France and Germany, are : *Aecidium Grossulariae*, Pers. which produces on the leaves small blotches of a deep red colour, with pustules surrounded by a whitish edge and filled with orange red spores, and *Cronartium rubicolum*, Dietr. which develops on the upper surfaces of the leaves as orange red pustules, with small horn-like orange red productions on the under surface. *Melampsora epitea*, Thun. is another fungus which produces large orange red powdery blotches on the under surface of the leaf, but is much rarer than the preceding two species.

Phyllosticta Grossulariae, Sacc. is also found on the foliage, and produces dry irregular serrated spots of a greyish colour surrounded by a dark edge, and *Septoria Grossulariae*, Westd. produces similar spots of a rounded shape, which are at first brown and then become grey or whitish. *Cercospora marginalis*, Thum. causes the edges of the leaves to dry and become brown, and afterwards the fructifications of the fungus develop as minute black dots on the under surface. This disease has been noted on local plants. *Vermicularia Grossulariae*, Fckl. develops as brown spots with dark brown pustules on the fruits, which drop off immature. *Aphis Grossulariae*, Kalt. has been noted on the growing twigs and tender foliage of the gooseberry, and *Schizoneura Grossulariae*, Schule. is another *Aphid*, powdered with a waxy white efflorescence, which attacks the roots.

Aphis Grossulariae, Kalt. of which the wingless insects are green with blue spots, attacks also the cur-

rants, which are moreover liable to suffer from other two *Aphids*, viz : *Aphis Ribis*, L. and *Siphonophora ribicola*, Kalt. In the first species the wingless insects are of a shining yellow, and in the other species the colour is shining green. The fungi *Aecidium Grossulariae*, Pers., *Melampsora epitea*, Thun. and *Cronartium ribicolum*, Dietr. are also found on the currant. Other fungi attacking the currant are: the currant rust, *Puccinia Ribis*, D.C. which develops as roundish dark brown spots, surrounded by a yellow margin, with yellow spots on the corresponding part of the under surface ; a downy mildew, *Peronospora ribicola*, Schroet., which develops as yellowish spots with a downy formation on the under surface ; *Phyllosticta ribicola*, Sacc. which produces large dry, white blotches ; and *Sphaerella Ribis*, Fuck. which, forms small angular spots of a dark red colour.

The "big-bud" of the currant is due to an Acaroid viz : *Phytoptus Ribis*, Nal. which sets up an irritation, causing the leaf buds to become unduly swollen in autumn and winter, and the foliage which develops in spring has a short stalk and is malformed and curled. This disease is often very troublesome. The "big-buds" should be picked off by hand in winter, and burned. In severe cases it will be necessary to cut down the plant in winter, and to disinfect the stump and the soil around it by means of lime milk made from fresh lime. An aphid, *Schizoneura Grossulariae*, Schule., often attacks the roots of the currant and may kill the plant. It is kept in check by chimney sweepings or soot thickly digged into the soil close to the stem and around the plant, or by means of one or two injections of 30 grams of bisulphide of carbon, 20 c.m. deep in the soil and about 20 c.m. away from the stem.

The Raspberry is liable to the attacks of several fungi. A mildew affecting the growing twigs and tender foliage is brought about by *Erysiphe Rubi*, Fckl., and

small brown spots on adult leaves are produced by *Phyllosticta ruborum*, Saec. Both these fungi are found on our native blackberry. *Septoria Rubi*, Westd., *Phragmidium Rubi-Idaei*, Wtr., *Coleroa Chaetoniium*, Rbh., *Peronospora Rubi*, Rbh., *Pyrenochaeta Rubi-Idaei*, Cav., *Cladosporium herbarum*, Lk., *Asteroma Rubi*, Fuck. and *Ascochyla Pallor*, Berk. are met with on the raspberry all over the continent. *Siphonophora Rubi*, Kalt. and *Aphis urticae*, Kalt. are the two Aphids which attack the raspberry.

The diseases and pests affecting the Strawberry are much more important from the point of view of the local grower. The strawberry leaf-spot due to *Sphaerella Fragariae*, Sacc. is common everywhere on all strawberries, but chiefly on the large fruited sorts. The disease consists in round spots, which are at first dark red, and then become dry and brown changing afterwards to white or grey, with a reddish border. A similar disease is caused by another fungus, *Phyllosticta fragaricola*, Desm. As a preventive against the strawberry leaf spot it is suggested to dust the plants rather heavily with fresh lime or with flowers of sulphur containing 5 % of sulphate of copper, or to spray repeatedly with Bordeaux mixture or with Burgundy mixture. In a bad attack a severer line of treatment should be adopted. When the fruit season is over pick off all the foliage and burn it, and cover the strawberry beds with a litter of straw about 5 c.m. deep, spray lightly with paraffin and then fire the straw. The fire will cause little or no injury to the crowns protected by their stipules. Soon afterwards dig and manure the plants and water liberally to encourage vegetation and secure a quick recovery.

Other fungous diseases affecting the strawberry are: *Gleosporium Fragariae*, Mtge. which produces dark red blotches on the leaves, the central part being dark brown; *Phragmidium Rubi-Idaei*, Wtr. which causes

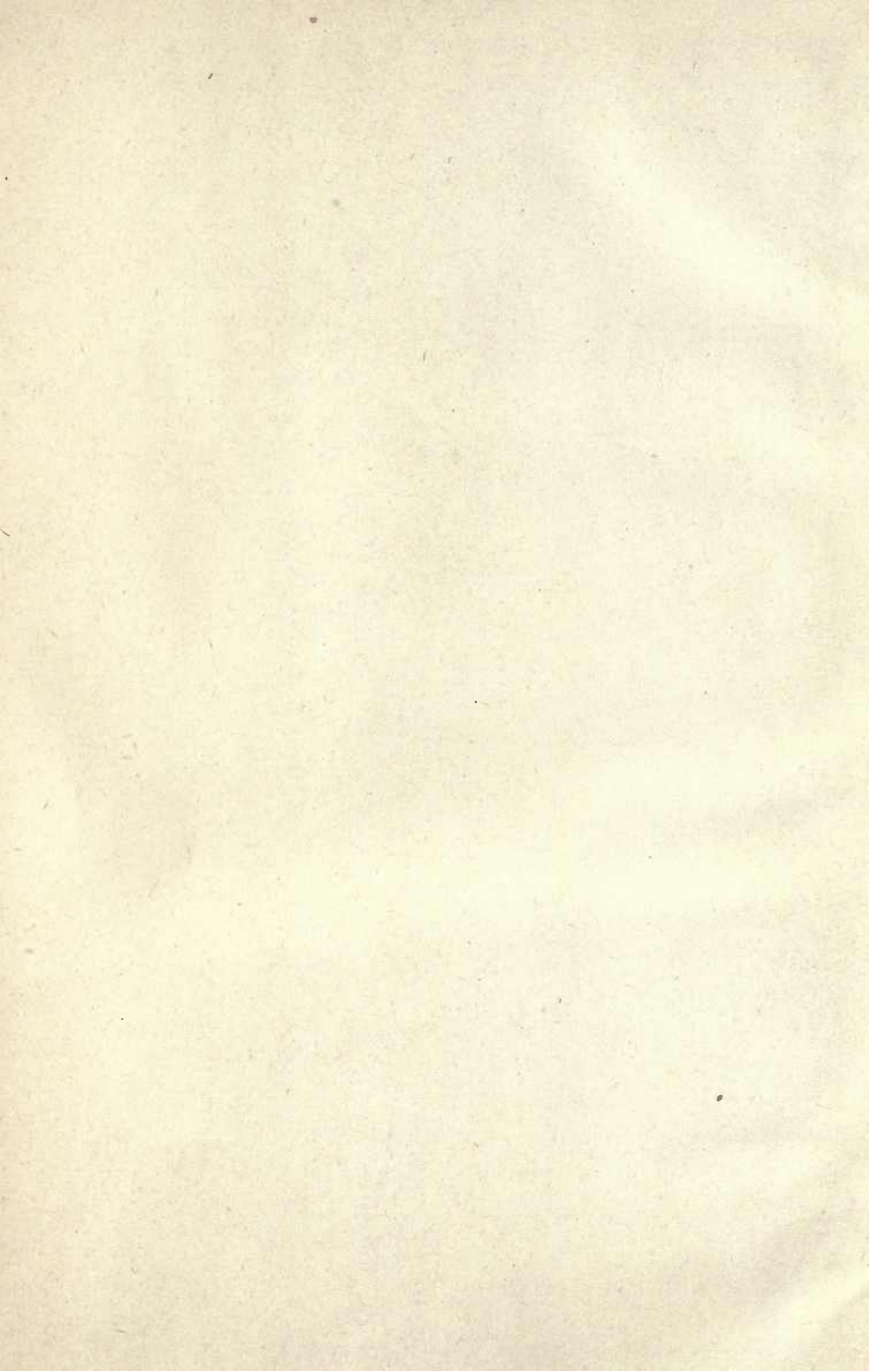
the strawberry rust, consisting in minute orange red powdery pustules on the under surface of the leaf, which afterwards develop into larger pustules of a yellow colour, with other small black pustules intermixed; *Stagonospora Fragariae*, Br. et Har. which forms large irregular brown blotches on the upper surface of the leaf; and *Peronospora Potentillae*, D. By. which produces yellowish green spots on the upper surface of the leaf, with a thick downy formation of a whitish or purplish white colour on the corresponding part of the lower surface. Finally, *Sphaerotheca Castagnei*, Lév. is the cause of a mildew consisting in a light powdery formation on the lower surface of the leaf, which is also usually more or less wrinkled or curled. This disease is seen occasionally on our strawberry plants growing in the shade towards the close of summer, but attacks also the flower-stalks and the green fruit in early summer. The best preventive treatment against these diseases consists in good cultivation, and in dustings with flowers of sulphur or in sprayings with cupric mixtures.

Rhizobius Sonchi, Pass. lives on the roots, sucking the juices, and interferes seriously with the growth of the plant. Another insect, a species of *Dactylopius*, lives on the foliage, on the leaf-stalks and flower-stalks, and the neck of the plant close to the roots. Various species of *Lecanium*, and sometimes also *Ceraplastes Rusci*, the well known fig-scale, are found on the foliage of the strawberry in these Islands. Another scale-insect, *Aleurodes Fragariae*, Walk. attacks the strawberry in Italy, France and Germany, but is unknown here.

The *larvae* of various small moths of the genus *Nepticula* make irregular tunnels in the substance of the leaf; and the *larvae* of other moths such as *Teras comarianæ*, Zell., *Psyche viciella*, Schiff. and *Lampronia praelatella*, Schiff., prey on the foliage, living isolated

or in small colonies entwined with web-like structures secreted by them. The *larvae* of other moths such as *Agrotis Rubi*, View., *Leucania cornigera*, Fb. and *Hadena ochroleuca*, Esp., which move about at all hours, prey on the foliage and may become a serious nuisance if the grower neglects to pick them off. For obvious reasons, spraying with poisonous mixtures may be adopted only before the fruit begins to set, or when the fruiting season is over.

The ripe fruit is often eaten or seriously injured by a centipede. *Julus terrestris*, and by the common wood-louse *Oniscus Asellus*. Both species are sometimes very common in the strawberry beds, and are also troublesome in the case of strawberries grown in pots. The free use of soot sifted lightly around the plants is generally attended by good results.



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