

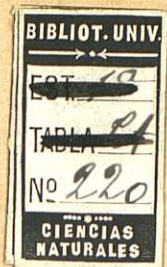
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LEGISLATIVE ASSEMBLY.

NEW SOUTH WALES.

REPORT



FROM THE

DIRECTOR OF THE BOTANIC GARDENS, SYDNEY,

ON THE

STATE AND MANAGEMENT OF THE ORANGE PLANTATIONS

IN

SPAIN AND PORTUGAL.

ORDERED BY THE LEGISLATIVE ASSEMBLY TO BE PRINTED,

10 March, 1868.

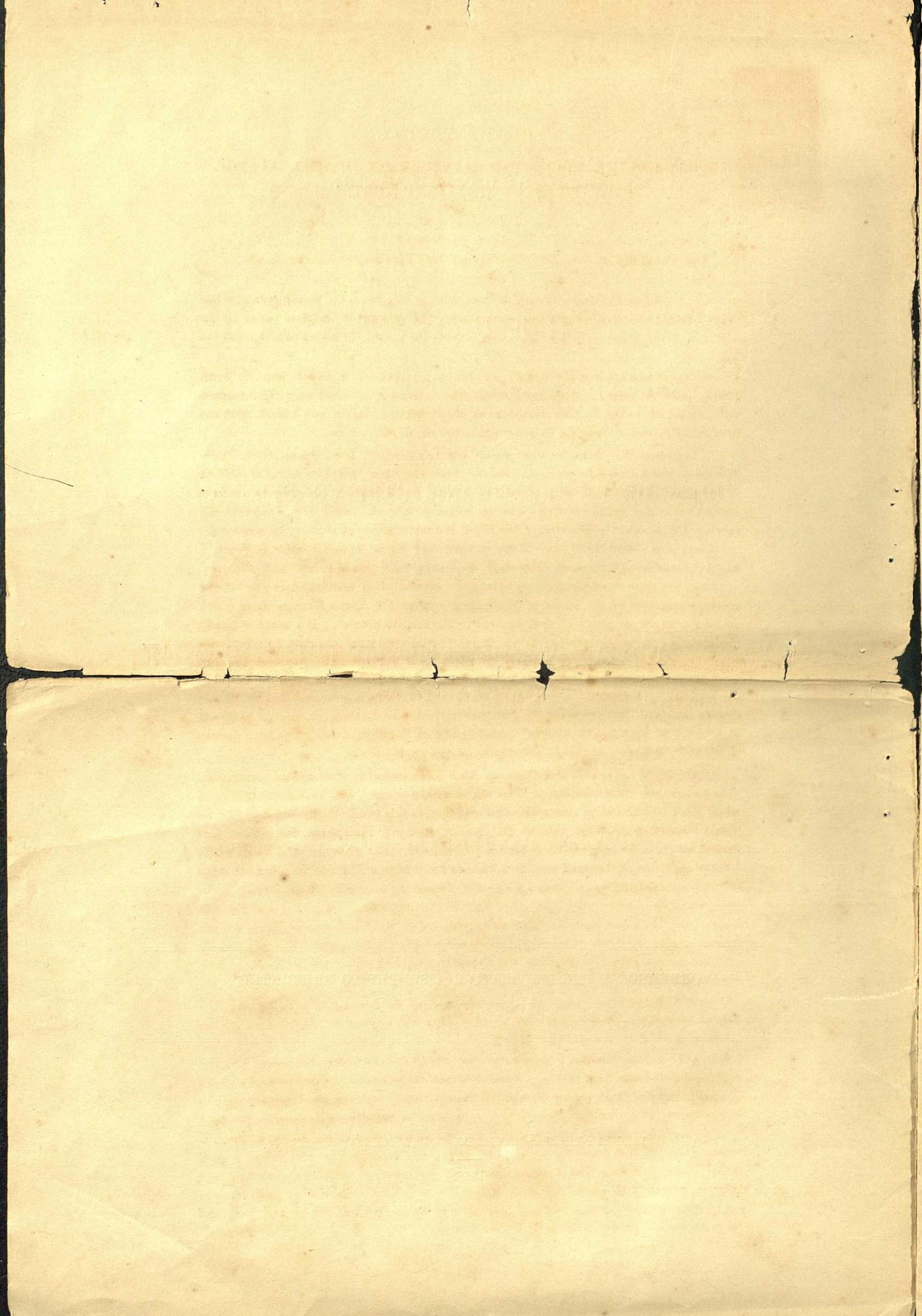
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REPORT ON THE STATE AND MANAGEMENT OF THE ORANGE
PLANTATIONS IN SPAIN AND PORTUGAL.

THE DIRECTOR OF THE BOTANIC GARDENS to THE SECRETARY FOR LANDS.

SIR,

I have the honor to furnish the following Report on the present state of the Orange Plantations in Portugal and Spain, being the result of inquiries made by me relative to their condition in these countries, during the months of August and September last.

Previous to my leaving Sydney for Europe, I received a letter from Sir John Young to the Secretary of State for Foreign Affairs, requesting that I might be furnished with credentials to the English Ministers at the Courts of Madrid and Lisbon, with the view to my receiving their aid in carrying out the object of my visit.

Letters of this character were readily granted to me, by Lord Stanley, to Sir Philip Crampton, the Ambassador to Spain, and Sir Augustus Paget, who held a similar position in Portugal. Desirous of being otherwise assisted in the inquiry which I was about to undertake, by the opinion of some one on whose judgment I could rely, I induced my brother, Dr. Moore, the Director of the Royal Botanic Garden at Dublin, to accompany me throughout the whole of my extensive tour. At Paris, while *en route* to Spain, I was fortunate enough to meet Don José do Canto, with whom I had held a correspondence for some years previous on botanical matters. This gentleman is one of the largest proprietors on the Island of St. Michael—one of the Azores Group—upon which the best oranges are produced that are sent to the English market. His estate is chiefly occupied by orange plantations; he has therefore paid very great attention to everything which has already affected, or is likely to affect their culture. He informed me that serious damage had been done to very many of the plantations upon the Island of St. Michael, by a disease the real nature of which was still unknown, and that no proper remedy had been discovered for its prevention; and added, that the orange had been attacked in an equally fatal manner in many parts of Portugal, but whether by a disease of the same character as that at the Azores he was unable to say.

He urged me to visit these islands after I had seen the Portuguese plantations, that I might ascertain whether the disease in either country was typical of that from which the tree suffered in Australia; and said that, in the event of my not doing so, he would himself, on his next visit to the Azores, minutely investigate the subject, and furnish me with the result of his inquiries. This gentleman's gardener, Mr. Reith, whom I know to be one of the most intelligent men in the profession, in a letter dated 6th June last, states:—"Your task of investigating and discovering a remedy for the disease in the orange will be a difficult one; for, like that in the potato and vine, it is one not well understood, but I feel confident that deep planting is the chief cause. Here, a white fungus attacks the roots, which all plants are subject to in this climate. The only remedy that I have discovered is, to cut off the diseased roots, and expose the others for a short time to the air."

This information, although extremely meagre, is introduced to show that the orange is suffering from some undiscovered cause, in a place so long famous for its production.

On reaching Madrid, I ascertained that Sir Philip Crampton was absent with the Court some distance from that city; and as it was dangerous to proceed further without special credentials from the authorities, in consequence of the then revolutionary state of the country, I applied for these, which were sent to me after a delay of some days. During the interval, I employed my time in seeking for information relative to the districts in which the orange is principally grown, and securing the services of a good interpreter. From all that I could learn, the provinces of Andalusia, Valencia, and Murcia, promised to prove the most fertile for my object. But before proceeding to visit either of these parts of Spain, I decided on going to Portugal, *viâ* Ciudad Real and Badajos.

Badajos. On my way thither, I did not observe any orange gardens until within a few miles of Lisbon. In the absence of Sir Augustus Paget, letters of introduction which I had to several gentlemen in that city proved of much service, as they enabled me to obtain the most reliable information from those best acquainted with the orange districts. Those I found extended more or less from Oporto on the north to Faro on the south, and a disease of a most fatal character had destroyed an immense number of trees, but chiefly about Lisbon, Setubal, and Evora; and further, a Commission had been appointed to inquire into the origin and nature of this disease, but from which no satisfactory results had been arrived at, nor even a report furnished, so far as I could ascertain, as inasmuch as scarcely two proprietors of orange plantations agreed as to the cause of the disease.

I determined to prosecute my further inquiries among the practical cultivators. About Lisbon there was little to do in this way, as only a few solitary trees remain, where formerly, on the road towards Cintra, large plantations existed; but Setubal and Evora afforded me an ample field for my labours. The whole country about the former of these towns is occupied by orangeries, the old trees being more or less affected, in a similar manner, in many respects, as those which perished in our Colony. In every quarter the appearance of the orchards reminded me of those about Ryde, some few years ago, when they were going fast to destruction. The foliage yellow, the tops of the branches dead; the bark dry, shrivelled, and peeling off; a small portion at the base of the stem, on one side, soft, and the wood underneath rotten and discoloured, the roots on the same side being in a similar condition, emitting an offensive smell.

Every tree examined, which was at all affected, presented these characteristics in a greater or less degree.

Both the decayed part of the stem and the roots were minutely examined by lenses of much power; but it was only when the roots were in a very putrid state that any evidence of fungus was observed. Whether this was the cause or effect of the disease it was impossible to determine. No remedy which had been tried had proved effectual. That generally adopted is, on its first appearance (indicated by a resinous gum exuding from the base of the stem), to carefully remove the earth on this side, cut out all the unhealthy parts of the stem and roots, and to take these, together with the soil which had been in contact with them, some distance off, and burn them. Such parts of the plant as are operated on left for some time exposed to the air, and then, fresh, richly manured earth placed about them.

Some cultivators, instead of exposing the roots to the air, cover the wounds with pine pitch or coal tar, and immediately cover the parts with fresh earth. Both plans only retard—they do not cure the disease. In other respects, all the information which I could gain respecting the orange from the Portuguese will be gathered from the following summary of replies which were given in answer to questions categorically put:—

1. Oranges have been cultivated in Portugal for upwards of a century.
2. There is no record of their ever having been diseased until within the last ten or twelve years.
3. Old trees have suffered more from disease than young ones.
4. Many young plantations are now quite healthy, although situated close to those of older growth much affected by the disease.
5. It is not known in what part the disease commences. Some persons believe that the young roots are first attacked; others, that it begins at the base of the stem.
6. The upper parts of the stem, the branches and leaves, continue in apparent health long after many of the roots are quite rotten.
7. Sometimes only one half of a tree will die, and the other half bear good fruit for two or three years, and then perish.
8. Excepting in very light soils, the ground is always trenched from fifteen to eighteen inches deep before planting.
9. In the best managed orchards, the trees are all top-dressed with a rich compost, at least once in every two years.
10. In every case, constant irrigation during the dry season is considered to be indispensable.

11. Plants from seed do not bear fruit until they are from nine to ten years old. Those from buds—the only other way of propagating adopted here—in from four to five years.

12. The seedling orange is considered to be a better and more permanent stock than the lemon.

13. The tree attains here a considerable age, and few were known to die until the present disease appeared.

14. Only one crop a year is obtained, or considered desirable. When a second crop occurs, which is very unusual, it is deemed a calamity, as the tree in consequence is much weakened, the fruit in that case being of a very inferior description, and generally blown off by the strong winds which prevail here during the spring season.

15. Trees from seed have usually several stems; those from buds, one only.

16. The trees are only pruned to the extent of cutting out the dead branches.

17. The common or sweet orange is almost the only kind cultivated.

From Portugal I proceeded to the Province of Andalusia in Spain. About Cadiz, and Jerez—the districts nearest to the coast—the country is wholly occupied by vineyards; but at Seville, and between that city and Cordova, some distance in the interior, oranges are extensively cultivated; and most of the plantations are in beautiful condition, no disease, as yet, being happily known in this quarter. The foliage and fruit are, however, subject to the white or mealy bug, by which they are both much injured, causing the latter, while in a green state, to exude a gummy substance, by which large quantities are rendered unsaleable. The fruit of both the bitter and sweet kinds are almost wholly exported to other countries, there being very little local consumption. The poorer classes use the juice of the sweet orange for flavouring a much relished dish called “olla,” which consist of pumpkins, cabbages, lettuces, and turnips, boiled up together, with or without meal of any kind; while the pulp of the bitter orange is universally employed as a stomachic, by being eaten in the early part of the morning, dipped in salt. The juice, added to a little magnesia and butter, is considered to be an excellent remedy for all bilious disorders. In the neighbourhood of Seville, as well as of Palma, Mairena, and at Cordova, the plantations are mostly on soil of a light loamy nature, in low and comparatively flat situations; but the trees look equally well, if not better, on the slopes of the Sierra Morena—a mountain range near the latter city, where the soil is of a much stronger character. In every case constant irrigation was resorted to, and to such an extent that, in some places, I observed the water standing on the surface around the trees, and retained there by means of basins formed by ridges of earth; the whole extent of the ground being so thoroughly saturated as to be quite unfit to walk upon.

The heat at this time was so excessive as to be almost unbearable. Here, trees from buds are considered preferable to those from seed, both because they bear sooner and the branches have fewer spines; the fruit, in consequence, being less liable to injury. The bitter orange is preferred as a stock, but the citron and lemon are also used for this purpose. The largest trees were about 18 feet in diameter and 25 feet in height. These are said to yield an average crop of 2,000 fruit annually, which are sold for about 40 reals, or 8s. of English money. The soil is annually well forked up, and top-dressed with good rotten manure, which is never placed in contact with the stem. When the trees show any evidence of bad health, they are strengthened by the fruit being pulled off at an early stage. This is continued until they quite recover their vigour. So far as I could learn, only the bitter, and one variety of the sweet orange, were usually cultivated in this province. The fruit of the latter is, however, exported under different names, to indicate the locality or particular place of growth. The rind is comparatively smooth and thin; but whether the latter or both of these qualities is peculiar to the fruit under all circumstances, or whether it only becomes so on the tree attaining a mature age, I could not ascertain. Orange plantations were observed to extend beyond Cordova, a distance inland of some sixty or more miles. The great orange-producing parts of Spain, however, are further to the eastward of this; much of the rich, low, cultivated land in the Province of Valencia and Murcia, towards and along the Mediterranean coast, being occupied with this fruit. I therefore proceeded to examine these districts, and entered the former province *viâ* Almansa, passing through the beautiful valley called Huerta de Manuel—one of the most extensive, rich, and best cultivated parts of the country. On every side oranges appeared, and all apparently affected by some disease; signs of decay being evident in the yellow foliage, and in the great number of dead and dying branches.

At



At Valencia I found the acting British Vice-Consul to be a gentleman greatly interested in orange culture, and from him I obtained much valuable information and assistance. Guided by his aid and advice, I was enabled to visit the districts where the trees were the most seriously affected by the disease, and I then had an opportunity of examining it in all its stages. I found that, both in the young and in the old trees, the main characteristics of the disease were the same, and corresponded in most respects with what I had previously observed in Portugal, where it would appear to have commenced, in the first instance, in the same manner as here. It or any other disease was entirely unknown until about five or six years ago.

Usually I was informed that, before the plant presents any appearance in branches or foliage of being affected, the disease has made serious progress in the root and stem. Its presence is first indicated either by a black gummy substance exuding from one side of the stem, a little above the ground, or, in the bark at the very base of the stem becoming soft and discoloured. In either case, when these symptoms appear, certain portions of the bark, wood, and roots, are already in a decomposed state, and emit a most offensive smell. When the stem at the base is attacked, and the disease extends in a lateral direction, or round the stem, the tree seldom or never recovers: when, on the contrary, it proceeds upwards, affecting one side of the stem only, it may be checked, and effectually eradicated, by cutting out every part that is diseased both in stem and roots, covering the wounds with a liquid preparation of lime and sulphur; removing all the soil which had been in contact with the diseased parts, and supplying its place with a rich compost of fresh soil, enriched either by guano or good rotten manure, and thoroughly incorporated by lime and sulphur in a powdered state. This process, I was assured, when carefully done, and attended to on the first appearance of the disease, had saved every plant on which it had been tried. The plan which I noticed in Portugal, of cutting out the affected parts and taking away the soil from the diseased side of the tree, and leaving the roots exposed to the air for eight or ten days during summer, and longer during winter, then filling up the space with fresh, richly manured soil, is also in very general use: but as a remedy it is slow, tedious, and uncertain, and on this account not nearly so valuable as the former method, presuming that to have the effect. The application of lime and sulphur, and the beneficial results arising from their use, would naturally lead to the inference that the disease, in this part of Europe, is attributable to a minute fungus, whose insidious *mycelium* or spawn penetrates the softer tissues of the roots, extending in the course of development upwards to the stem, and unless speedily arrested, causing the death of the tree.

In many of the plantations I noticed both the large and small kinds of scale or coccus so common in the Colony, as well as the white or mealy bug, which is regarded as a much greater evil than either of the others, as it causes the fruit to become spotted and discoloured, and quite unsaleable. All of these pests were known in this quarter previous to the present destructive disease making its appearance. The districts where the disease prevailed to the greatest extent were those of Briana and Villareal, to the east; and Scilla, Alcira, and Carcagente, to the west. There were in these places many fine plantations as yet unaffected, and the trees were in perfect health; but all, whether *healthy or otherwise, were subjected to constant irrigation* during the summer months. This is accomplished in many ways,—by damming up rivers or small watercourses, but usually by means of wells of an immense size, the water being drawn up by antique-shaped earthenware vessels, holding each about half a gallon, fixed between two endless ropes kept rotating by a rude wheel worked almost continually by horses or mules. The water is emptied into shoots which are conducted into such parts of the plantation as may be necessary, so that every tree is kept thoroughly soaked. Notwithstanding that this system of irrigating oranges has been pursued here from their first introduction, there are now many intelligent growers who believe that it may be done to too great an extent; as a proof of which, I had pointed out to me fine orchards occupying the drier situations, in which the trees were altogether healthy. Some persons even attributed the cause of the disease to excessive irrigation; but in Andalusia, where its fatal effects are as yet unknown, the orange grounds are kept as thoroughly and as continually saturated with moisture as any that I had met with.

It is principally the sweet orange which is grown in the Valencia and Murcia country; but the small mandarin, which is the only variety yet introduced into Spain,
and

and called Tangerine, is now beginning to be extensively cultivated, as the fruit sells readily in the Madrid market. Further to the westward, towards Gibraltar, about Algeciras and San Roque, a greater number of kinds are grown than in this quarter. There, the blood and Bahia or navel orange are as general as the common and Tangerine varieties.

The mode of cultivation hitherto practised in Spain seemed to me to be similar throughout. All growers appeared to follow one well-beaten track. It is only since the disease has proved so disastrous that there has been the slightest improvement either in the culture or in the propagation of the plants. Greater attention appears now to be paid to both. Formerly, young trees from buds on stocks of citron or lemon were preferred. These, at two years old, are now scarcely saleable, even at the low price of two reals, or about 6d. each; while those of the same age, on stocks of the bitter orange, are readily purchased at twelve reals, or about 2s. 6d. each. Although the Spaniard is averse to change any old custom, yet the fact that the trees on stocks of the bitter orange were seldom or never touched by the disease could not fail to fix his attention, and the result has been to bring plants propagated in this manner into great demand. One of the many remarkable instances of trees of this description resisting the disease was pointed out to me in what had been a very fine plantation, near Alcira. Here every tree was almost either dead or dying, with the exception of a group of about a dozen, all on the bitter orange, which were entirely unaffected, and in fine healthy condition, while some of those surrounding them which had suffered so severely from the disease were raised from seed; others budded both upon the citron and lemon. Although my investigations were continued into the Catalonian province as far as Barcelona, I failed to get any additional information on the subject, as this fruit is not grown to any extent east of Tarragonia; and, scanty as the results of my inquiries may be considered, yet they contain all that is of interest or value relative to the culture of the orange, and the disease so seriously affecting it, in Spain and Portugal. In the general management of the orange our colonists have little to learn from the people of those countries, who, in this, as in most other respects, continue to tread in the footsteps of their forefathers. The mode of working the soil, and the implements used, being of the most primitive description, are now apparently the same as ~~on the influence of those powerful agents, heat and moisture, both being supplied in a most bountiful manner—the former naturally, the other by artificial means—than on any process usually adopted by the English cultivators.~~ ^{on the influence of those powerful agents, heat and moisture, both being supplied in a most bountiful manner—the former naturally, the other by artificial means—than on any process usually adopted by the English cultivators.} Hitherto, in the Murcia and Valencia plantations, ninety per cent. of the worked orange trees were upon citron stocks; about eight per cent. upon lemons, which were the first attacked by the disease, as were the lemon trees themselves, and with such fatal effects that this fruit has almost ceased to be exported from these districts—at one time the most productive. Only about two per cent. are upon the bitter orange, arising from a deeply-rooted belief which long prevailed, that this kind of stock would give a degree of bitterness to the fruit of any other variety which might be worked upon it. As time, however, has proved this idea to be fallacious, and as, moreover, trees on stocks of this description were scarcely affected by the prevailing disease, they are now, as I have previously observed, preferred (at least in Spain) to any other kind. I could not learn that any regular system of pruning was adopted; all that seemed to be done in this respect was to keep the trees clear of dead or decaying branches. The usual distance between the trees in the majority of plantations was about eighteen feet each way, and all were planted in straight lines. In many places the trees must be of very considerable age; but on this point I could not obtain any reliable information. The largest which came under my observation in any country were not more than about twenty-six feet high, with well-proportioned breadth. Trees of this size are calculated to bear annually about two thousand oranges. Towards the latter end of November the fruit is sufficiently ripe to gather for exportation. If a second crop is produced, which is seldom the case, the fruit rarely arrives at perfection, as it is almost invariably blown off by the high winds in early spring, which not unfrequently cause serious damage to the young and bearing wood. To guard against this, protection is given in exposed situations, either by high walls or by plantations of trees of a more robust character than the orange. Both in Portugal and in Spain the orange is more or less infested with the same kinds of coccus or scale which are or have been so frequent upon trees in the Colony, and are regarded by some colonial orange-growers

growers as the cause or origin of the disease from which so many orchards have been destroyed. In Europe the presence of these insects is not so considered, as they were known to attack the orange long before the present fatal disease appeared. Two kinds of coccus were sent to me by Mr. Pye, from his orchards, near Parramatta. I had them brought under the notice of Professor Westwood, of London, who pronounced them to be allied, if not identical. The small white kind, the *coccus vitis*, and the larger one, commonly called the black scale, to the common mussel coccus of naturalists, both very common in Europe.

In addition to these pests, the Spanish trees are subject to the white or mealy bug, which greatly injure both foliage and fruit, and from which, I believe, the trees in the Colony are yet quite exempt. In Europe, that peculiar form of disease, by which the fruit in the Colony is sometimes attacked, called "Maori," is entirely unknown. Some fruit so affected, kindly sent to me by Mr. Pye, I submitted to the inspection of the Fellows present at a meeting of the Linnean Society; and although some excellent cryptogamists were there, and examined the fruit very carefully, no distinct form of fungus could be discovered, although it was the general opinion that some fungus, in an incipient state, was the cause of the cuticle of the fruit becoming discolored.

In concluding this Report, I would briefly advert to the oranges which I found growing under artificial cultivation—especially those in the Gardens of the Tuilleries at Paris, and those at Sans Souci, one of the Royal residences at Potsdam, near Berlin, in Prussia—as being the best. The latter, under such circumstances, perhaps the finest in every respect in the world. Those at Paris varied in height, as nearly as I could calculate, from twelve to eighteen feet, the largest about eight feet in diameter, while some of those at Potsdam were at least twenty-five feet in height, and from ten to twelve feet in diameter. All without exception were growing in wooden tubs of large size. The trees at Sans Souci, as I saw them in July last, were in magnificent condition. Placed in two perfectly straight rows, upon a noble terrace, with a fine range of glass (their winter quarters) as a back-ground; some in flower, others with fruit nearly ripe, compact and symmetrical in form, free from insects of every description, and in perfect health, they presented one of the most agreeable sights that I ever beheld, and would have gladdened the heart of any orange-grower. How these trees—said to be between two and three hundred years old—can be kept in such beautiful order, is to me greatly marvellous. The tubs in which they grow are so constructed that they can be taken apart without disturbing the roots. This permits of the superfluous roots being taken away, and fresh soil added, when such an operation is necessary, which is seldom the case. The course of treatment which is usually adopted is, to remove annually a few inches of the soil from the top, and replace it with a rich preparation of other soil and manure; to water copiously during the summer and growing season, occasionally with water in which strong manure has been some time in steep; to gradually reduce the watering as the season advances, until when removed into their winter quarters, and during the time they remain there, *i.e.*, under the protection of a glass conservatory, they scarcely receive any water at all. They have thus a season of active growth, and a season when the roots and foliage cease to perform their functions, and the plant is at perfect rest. This alone must tend greatly to longevity. There is, however, another important feature in the management of these trees, which is strongly conducive not only to their general health but also to longevity, *viz.*, the annual pruning or cutting back which they receive. In all places where oranges are thus artificially cultivated, it is necessary to place them under house protection of some kind for some months in the winter season; and as accommodation of this kind is only sufficient to hold plants of a certain size, it follows that when the plants attain this size they cannot be allowed to grow larger, and the consequence is that, by a judicious system of cutting back the shoots, the plants are kept compact in habit and robust in appearance, and always very nearly about the same height and width, and cannot, under such circumstances, exhaust themselves by bearing heavy crops of fruit.

I have been induced to mention these latter facts, as proving that the constant state of activity in which the orange is kept, and the heavy crops which it is allowed to bear under the ordinary system of cultivation followed in the Colony, must seriously affect both the health and duration of the plant.

I have, &c.,

CHARLES MOORE.

