

MADRAS RECORD OFFICE.

Government of Madras.

Revenue DEPARTMENT.

G.O. No.	1509	Press
	165 166	Mis.
Dated	11. 7.	18 62.

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*Proceedings of the Madras Government, Revenue Department,
11th July 1862.*

No. 165. Read the following letter from W. G. McIVOR, Esq., Superintendent Government Chinchona Plantation, Ootacamund, to J. D. SIM, Esq., Secretary to Government, Revenue Department, Fort Saint George, dated Ootacamund, 31st May 1862, No. 8:—

SIR,

1. I have the honor to forward herewith the Report on the Government Chinchona experiment on the Neilgherries for the official year ending the 30th ultimo. The accounts which form an appendix to this Report require further examination, and will be forwarded hereafter.

2. I trust the Government will not consider that I have strayed from the legitimate subject of this report, by entering into a minute detail of our system of cultivation. My object being to endeavour to place in the hands of our Assistants such information as may prove useful to them in the management of the plants. Should the Government approve of this, and be pleased to sanction the Report being printed in a convenient pocket form, I respectfully beg to solicit the favor of being supplied with 50 or 100 copies for use of the Establishment, and for distribution to those anxious to try Chinchona cultivation in this country.

Report on the Government Chinchona Experiment on the Neilgherries for 1861-62.

1. It is now little more than a year since we fairly began the cultivation of the Quinine yielding Chinchonas on the Neilgherries, and although our operations are necessary in the first stages, the information which has been obtained with reference to the nature and requirements of the plants, their propagation and cultivation, and the general success which has attended our efforts will, I trust, render this report not uninteresting. With the view of rendering the various subjects treated more easily referred to, I have arranged them under the following heads:—

<i>Introduction of plants, reasons for attempting to introduce and cultivate in India...</i>	...	...	Paragraphs 2 to 4
<i>Species and varieties introduced, their nature and value...</i>	...	do.	5 to 17
<i>Selection of sites for cultivation...</i>	...	do.	18 & 19
<i>Cultivation:—Outline of system pursued...</i>	...	do.	20 & 21
Do. Propagation by seeds...	...	do.	22 & 23
Do. Do. by layers...	...	do.	24 & 25
Do. Do. by cuttings...	...	do.	26 & 27
Do. Do. by leaves and buds	...	do.	28 & 29
Do. under the shade of living trees	...	do.	30 to 32
Do. in the open ground...	...	do.	33 to 35
Do. outline of proposed system...	...	do.	36 & 37
Do. proposed treatment for the yearly production of constant and uniform supplies of bark	...	do.	38 to 40
Progress of operations	...	do.	41 to 46
Establishments...	...	do.	47 & 48
Concluding remarks	...	do.	49 to 52
Accounts.—Appendix A.			

2. The supply of Peruvian Bark has for many years been inadequate to the demands, hence the steady and yearly increase in the price of this valuable medicine, and without any apparent hope of this state of the market giving way to a better, as the Chinchona Forests of South America are rapidly disappearing before the axe of the Cascarilleros, and it is evident that the produce of the Andes cannot long continue to meet the demands of European markets. In 1859, the Secretary of State resolved to attempt the introduction and cultivation of the various species of Quinine yielding Chinchonas into India; and an expedition was organized in the early part of 1860, under the direction of Clements R. Markham, Esq., with a view to accomplishing this

undertaking. Mr. Markham was assisted by Messrs. Spruce and Pritchett, as also by two practical gardeners, one of whom Mr. Cross, a very intelligent and enterprising young man, has aided much by his perseverance and judgment in bringing the introduction of the Peruvian Bark to its present satisfactory issue; and it reflects much credit upon the Secretary of State, the judgment displayed, in the selection of the agents employed to carry out this very hazardous and difficult part of the undertaking.

3. At the commencement of this expedition, Mr. Markham resolved not to cease in his exertions until all the various species and varieties of commercial value were successfully imported to India, and this indeed has been nearly accomplished; as we now possess nine of the most valuable species known in commerce. Three species or varieties in addition are known to produce rather inferior descriptions of bark, and these although of less value than the species we possess will, we trust, be introduced also, as their qualities may fairly be expected to improve under cultivation in this country; as indeed has been the case with most plants when imported and cultivated in other countries. For instance, we find that Sugarcane, a native of this country, was exported to the West Indies in 1506, and although a few shoots only were successfully transplanted in their new abode, so well did they thrive, and so rapidly was the cultivation extended, that by the beginning of the eighteenth Century, no less than 300 ships were employed in conveying this one product from the West Indies to different parts of the world. Rice also, a native of this country, was accidentally imported into America, where its cultivation extended with such surprising rapidity, and the quality of its produce so much exceeded that of India, as to be worth double the price in the market. Cotton, also a native of this country, was introduced into Egypt with equal results; so much indeed did it improve in quality that even up to the present day, ordinary Egyptian Cotton commands a price fully a half higher than the finest grown in India.

4. The present condition of our Chinchona experiment holds out great promise, that its importation into India will be attended with results equal to those I have described, as being effected by the introduction of Sugarcane into the West Indies, Rice to America, and Cotton to Egypt.

5. In dealing with this subject I have considered it desirable not to encumber this Report by Botanical descriptions, and shall therefore proceed briefly to notice the species introduced, their commercial value, localities, and habits of growth.

6. *Chinchona Succirubra* the "Cascarilla colorada" or "Genuine Red Bark" of commerce. This species grows to a lofty tree, and is the most valuable known, being the richest in alkaloids which generally amount to as much as 3 to 4 per cent., and thus "fair average samples are valued in the market at more than twice the price of Calisaya Bark." The present price of Red Bark varies from 2s. 6d. to 8s. 9d. per lb. of dry bark. This sort is also hardy, its range of growth extending from 3,000 to 8,000 feet; the plant, according to Mr. Spruce, prefers open ground with "plenty of air, light, and room, wherein to develop its proportions," "the bark is thin in proportion to the diameter of the trees when growing at low elevations, and thick in proportion when growing at high elevations." The amount of alkaloids are also much affected by elevation. Mr. Spruce informs us that "Senor Cordovez (who has analysed the Red Bark collected at various altitudes) found that the greater the height at which the tree grows, the larger is the proportion of alkaloids contained in the bark." Of this species we now possess, upwards of 14,000 plants, all in very fine health.

7. *Chinchona Calisaya* or "Yellow Bark of Bolivia." This species grows to the height of a large forest tree, and was long considered the most valuable of all the medicinal barks; and certainly it was so, until the discovery of the Red Bark; the present price of Calisaya or Yellow Bark, varies from 2s. 10d. to 7s. per lb. Of this species we have evidently two varieties, very distinctly marked even when growing under the same conditions. According to Mr. Markham

and Dr. Weddell, "the tree Calisaya grows on declivities and steep rugged places of the mountains 5,000 to 6,000 feet above the sea, in the hottest forests of Carabaya and Bolivia." Subsequently, Mr. Markham in writing of this species states, "there can be no doubt that the correct method of cultivating the Chinchonas is planting them out, in the open, with plenty of light and air. They may require shade from the direct rays of the sun at first. The only really fine well grown plant of Chinchona Calisaya that I saw in Carabaya was one that had been planted in a small clearing entirely exposed, those in the forest were poor straggling things in comparison." Of this species we possess 237 plants in fine health; it is equally as hardy as the Red Bark, and as easily propagated.

8. *Chinchona Condaminea* Var, *Uritusinga*; the "Cascarilla fina" or "Original Loxa Bark." This species, which in the days of La Condamine was a noble and lofty forest tree, is now almost extinct, the trees of a large size having entirely disappeared from the Andes; it is rich in alkaloids, good specimens giving a total of 3.8 per cent., and in this respect it equals the Calisaya Bark of Bolivia, it was common on the mountains of Uritusinga, and grows at elevations from 6,000 to 8,000 feet; a general opinion prevails among the Cascarilleros that the bark of this species "differ in quality according as it is exposed to the morning or evening sun." Of this sort we possess only one plant, liberally presented to the Indian Government by J. E. Howard, Esq., it arrived here on the 18th April 1862, and although much damaged by the journey is now in very promising condition.

9. *Chinchona Condaminea* Var, *Chahuayruera*; the "Cascarilla Colorada del Ray" or "Cascarilla Amarilla," or the "Rusty Crown Bark" of English commerce and of equal value to the preceding. This is nearly allied to the *Uritusinga*, inhabiting the same localities, but perhaps growing at greater elevations; in the days of Pavon this was a slender tree of little more than 24 feet in height, and is considered to be the species that produced the bark which cured the Countess of Chinchon. At the present time Mr. Cross informs us "but few trees are to be seen of these dimensions. The plants from which the bark of commerce is now taken are in general not more than 8 to 10 feet in height. When the plants are cut down, three or four young shoots, or suckers in general spring up, but this does not always happen, as some of the more industrious Cascarilleros frequently pull up the roots, and bark them also. The bark is taken from the smallest twigs, thus the annual growths are sometimes taken, especially if they are strong." Mr. Cross also observes that "the alluvial deposit in the ravines where this species is found growing is shallow and in many places not more than 6 inches in depth." Of this sort we now possess upwards of 8,000 seedlings, and more are daily coming up. This sort is very hardy and promises to be one of easy cultivation, and well suited to the highest ranges of these hills, especially the Dodabetta site.

10. *Chinchona Condaminea* Var, *Crespilla* (C. *Crispa* Tafalla) or "fine Crown Bark." This species is a small shrub and contains a smaller quantity of alkaloids than the preceding; still it brings a high price in the market, being a "very fragrant and pretty looking bark." It grows at great elevations from 7,000 to 10,000 feet in a deposit of peat, and where the temperature sometimes falls to 27° Fahr. We possess 105 seedlings of this species, which will no doubt prove well suited to the highest part of the Dodabetta site.

11. *Chinchona Lancifolia* from Java, or "Crown Bark." This is a species of third value, it is also hardy and easily cultivated, inhabiting the high and cold regions of the Andes, when growing in exposed situations it produces a good bark. I regret, however, to state that this species cannot be considered as successfully introduced. Four plants of this sort were imported by Dr. Anderson from Java in December 1861, at the time they arrived the plants appeared in good health, but on removing them from the Wardian cases they were found to be affected by rot and fungi at the roots. They made some progress after being transplanted, and two of their tops were layered and successfully rooted. In January one of the plants died, and towards the middle of March the others were evidently affected by fungi and becoming sickly, as soon as the decay was observed to be making progress the rooted tops were removed and placed in fresh earth and promised to do well. By the end of March, the three original plants had died, and by the 15th April one of the rooted tops began to show symptoms of decay and speedily died away. On

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examination it was found that the fungi had extended along the pith. We still possess one rooted layer, but it is doubtful if it will survive, as I fear it is also tainted with disease and may any day die off.

Chinchona yielding Cinchonine.

12. *Chinchona Nitida*, "Qina cana legitima" or "Genuine Grey Bark." This is a lofty tree abounding in the higher regions of Huanuco, its predominant alkaloid is Cinchonine, and is consequently of less value than the preceding species, which belong to the class yielding Quinine; the analysis of the bark from which our seeds were gathered gave 2.22 per cent. of alkaloids consisting chiefly of Cinchonine. Mr. Howard has however found Quinine in samples of the fine Grey Barks of commerce; this species grows in exposed places at elevations from 6,000 to 8,000 feet, and is said to delight in "free air, cold, water, and sunshine." Of this sort we possess about 3,000 plants, all in very fine health.

13. *Chinchona* species without name. Allied to the above, and raised from seeds gathered by Mr. Pritchett, near Huanuco. Mr. Howard is of opinion that this species may prove to be identical with *Chinchona Obovata* of Pavon. It is said to be a "good bark," and extensively imported with the Grey Bark of commerce. We now possess upwards of 1,000 plants of this species, and we considered it desirable to stop the extension of the propagation of this plant, until we receive more correct information of its identity and value.

14. *Chinchona Micrantha* the "Cascarilla Provinciana" or Grey Bark. This is a lofty tree, inhabiting warm and damp forests, where it attains a great circumference; one tree frequently yielding from 200 to 250 lbs. of dry bark. The bark is generally rich in alkaloids, yielding as much as 2.70 per cent. principally consisting of Cinchonine. Of this species we possess upwards of 3,700 plants.

15. *Chinchona Peruviana* the "Cascarilla Pata de Gallinaza" or "finest Grey Bark." This species attains the height of an ordinary sized tree in the forest of Cocheros, where it is still abundant, growing at a lower elevation than *Chinchona Nitida*, and yields a bark of considerable value; the bark of the trees our seeds were collected from when analysed by Mr. Howard yielded three per cent. of alkaloids, "comprising chiefly Cinchodine and Cinchonine." It thus ranks among the most valuable of the Grey Barks. Of this species we possess 357 plants all in good health.

16. *Chinchona Pahudiana* the "Cascarilla Crespilla Chica" from Java. This species was met by Dr. Hasskarl in the neighbourhood of Uchubamba on the eastern side of the second Cordillera, "at an elevation of 5,500 to 6,000 feet above the level of the sea, in a very sandy micaceous soil, on dry sunny hills, without much shelter from the sun." A large number of this species were imported from Java by Dr. Anderson, and a few also were raised here from seeds obtained from the same source. We possess 425 plants of this sort, and as it is of no commercial value, the number will not be further increased.

17. The Dutch in Java having fallen into the very serious error of erroneously attaching the name of a well known and valuable species to this worthless plant, and proceeded in its cultivation "to a much greater extent than its properties at all warrant." This discovery indicated the necessity of caution on our part with reference to the value of our plants, and the correctness of the names attached to them; and an investigation of this subject, also made under the direction of Mr. Markham together with the valuable assistance of Mr. Howard, has led to the most satisfactory results; and I believe that a doubt cannot be entertained as to the correctness of the names attached to our species, as in many instances the bark of the trees from which the seeds were gathered, and the layers procured, was subjected to analysis, in order to prevent the possibility of mistake.

Selection of sites for cultivation.

18. As early as June 1859, the Right Honorable the Secretary of State for India, called for information on the subject of the best localities in this Presidency for the cultivation of *Chinchona*; and the Right Honorable Sir C. Wood in a Despatch, dated 17th August 1860, directed that sites might be selected and "prepared for the cultivation of the plants." At that time we felt our information

inadequate to enable us to perform this very important task with that degree of certainty required, although the sites likely to prove suitable were named, it was suggested that prior to their final adoption they should be examined and approved by Mr. Markham. It will be observed from what has already been said that the various species of *Chinchona* require different elevation and exposure, and only by a person thoroughly conversant with the subject could so very important a task as the selection of sites be expected to be successfully accomplished. Mr. Markham visited India towards the end of 1860, and feeling a difficulty in forming a correct opinion owing to his inexperience of this climate requested my aid in this matter; while on the Andes Mr. Markham noted with great minuteness the various influence affecting the growth of the *Chinchonas*; these observations were placed in my hands, which, combined with a long personal intercourse, enabled us fairly and impartially to discuss the altered conditions of our climate, and the consequent modifications required to be possessed by the sites we selected, in order to ensure success. It was felt at the time that much would have to be developed by practical experience; and so far as our operations have progressed the correctness of the opinions originally formed by Mr. Markham have been faithfully developed.

19. It was proposed to confine our operations in the first instance to two sites, namely, one suited for the experimental cultivation of the higher growing species, while the other was selected for such species as require a warmer temperature. With this view the site near Neddivattum was fixed upon for our first operations possessing as it does several advantages with reference to exposure, and varying in elevation from 4,500 to 6,300 feet above the level of the sea. The species to be cultivated here at the lowest elevations is the Red Bark of Ecuador, and the Yellow or Calisaya Bark of Bolivia; and on the higher elevations the Crown Barks of Loxa, and the Grey Barks of Huanuco. The site at Dodabetta is of limited extent, being originally but a little above 60 acres, however since the receipt of the *Chinchona Crespilla* we have included in this site about 25 acres more, as being likely to suit the habits of this species; and I trust that this arrangement will meet with the approval of Government. This site possesses a great variety of exposure, and a great variety of soil also, and thus offers great advantages for an experimental plantation. The species intended to be cultivated here are the *Chinchona Nitida* or Genuine Grey Bark, and varieties of *Chinchona*, *Condaminea*, namely, the Original Loxa Bark, the Rusty Crown Bark, and fine Crown Barks of commerce. Northern exposures have been selected for all the sites, this has been considered desirable as the sun's declination is southerly during our dry and cloudless season; consequently, the northern slopes of the hills are much more moist during this season than the southern slopes which receive the rays of the sun at nearly a right angle, consequently they become parched and dried up; and this we considered would be injurious to the *Chinchonas*, and consequently avoided selecting southern exposures for our plantations.

20. The great losses which have generally been sustained by placing newly imported plants at once out in the open air, suggested to us the desirableness of placing our plants in the first instance under the protection of glass. This gave us the power of rapidly increasing the plants, while it offered the great advantage of enabling us to note with much accuracy the various conditions affecting their health and growth; and this was rendered of more importance as the information we originally possessed with reference to the cultivation of these plants, was so vague, and ambiguous, and in many cases indeed so conflicting, contradictory, and absurd, that it rendered the attainment of early practical knowledge of great value; while we based our theory of cultivation upon the observations of Mr. Markham and the other agents employed in introducing the plants to India. Our first care was to ascertain the conditions on the Andes most favorable to the perfect development of the plants, it was also necessary to ascertain and fairly understand such conditions as were unfavorable.

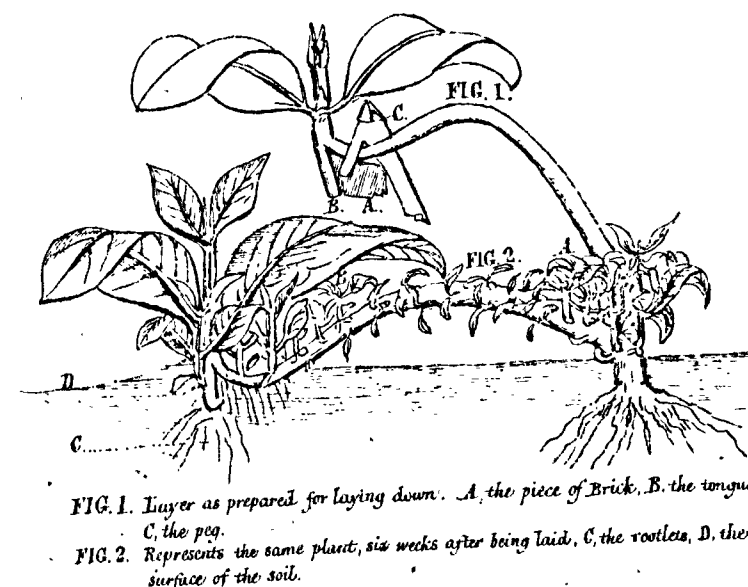
21. In the system of cultivation pursued here, we have simply endeavored to administer to the greatest extent possible those favorable conditions, and to mitigate or remove the adverse

ones. Although this system has been met by great opposition by gentlemen in this country, it is nevertheless one which has secured to us the great success we have obtained in so short a period; because the true principles of cultivation clearly points out, that while we follow nature in all that is beneficial, we should assuredly reject all that is injurious. Under this impression we have latterly followed the system of open cultivation in every respect; we rear our seeds, strike our cuttings, and place out our plants in the nurseries, using as little shade as possible, and our results have incontestably established its great advantages.

22. The first sowings of our imported seeds took place in February 1861, and no certain data being given, our first operations were necessarily experimental, and consequently a number of the seeds were lost by being sown in too retentive a soil, and supplied with what (to Chinchona seeds) proved to be an excess of moisture. The greatest success obtained in our first attempts was by the use of a soil composed almost entirely of burned earth, on which nearly 60 per cent. of the seeds germinated, the temperature of the earth being kept above 70° Fahr. The period required before germination took place varied from 62 to 68 days.

23. A supply of seeds recently received of the valuable varieties of Chinchona Condaminea have made more satisfactory progress; these were sown on the 11th February 1862, on a very light open soil, composed of a beautiful open felpathic sand with a small admixture of leaf mould. Our experience with the first seeds plainly indicating that the Chinchonas are very impatient of an excess of moisture great care was taken in the preparation of the soil used in this sowing. The leaf mould was in the first instance exposed to the sun for two or three days and thoroughly dried, it was then heated to about 212° Fahr. in order to destroy all grubs or larva of insects; after being allowed to cool, it was brought into the potting shed and watered sufficiently to make it moist, but only to that degree of moisture that the particles of soil would not adhere together when pressed firmly with the hand, that is, the earth on being laid down was sufficiently dry to break and fall into its usual form. The leaf mould pressed down, and the seeds sown thereon being lightly covered with a sprinkling of sand. The pots were then plunged into beds of moist sand on a bottom heat of about 75° Fahr.; these were never watered in the strict sense of the word; when the surface became dry they were merely sprinkled with a fine syringe, just sufficient water being given to damp the surface, but never to penetrate or consolidate the soil; under this treatment the seeds began to germinate very strongly on the 16th day after sowing, and still continuing to germinate. The principal art appears to be to keep the soil in a uniform state of moisture, but never wet. The least excess of moisture causes the seeds to mould and damp off in thousands, while as a matter of course if kept too dry they become parched up. As soon as the seeds have germinated they are carefully pricked out into fresh earth (prepared as above described), this operation is a very delicate one; the radicle being carefully raised out of the original seed-pot is removed to the new pot, being carefully covered with soil, while the seed lobes are kept well above the surface; in this way from twenty-five to fifty seedlings are transplanted into a five inch pot, and then treated in every respect the same as the seeds, that is, they are never watered; the surface being merely sprinkled and the pots plunged in beds of damp sand, as before stated, to keep the soil in that medium state of moisture in which it was when first placed in the pots; the necessity for this care is to prevent the seedlings from damping off, to which they are very liable when treated otherwise, it also greatly facilitates their growth and the formation of roots, the earth in which they are placed being so perfectly open that it is readily affected by the action of the atmosphere; and thus kept in the most favorable condition for promoting vegetation. When treated in this way our seedling have made an average growth in one year of over thirty inches, while many of our seedlings which were raised and grown on a retentive soil have not attained the height of three inches in the same period.

Cultivation.—Propagation by layers. 24. As soon as our imported plants and seedlings had attained sufficient size they were propagated by being layered as illustrated in the margin,



in this way they were found to root readily in about six weeks or two months at the latest, and the plants being bent down it caused them to break or throw out shoots from every bud along the whole length of the stem and not only this, but many latent buds were developed and a fine growth of young wood produced for succeeding layers and cuttings, in this way each plant was treated as it gained sufficient size, namely, from eight to ten inches in height, until we had procured about 3,000 layered plants. Beyond this we have not extended our stock of plants for propagation, as we calculate that 3,000 plants will always yield us

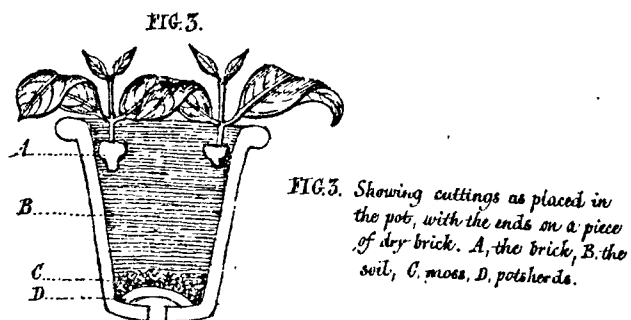
as many layers and cuttings as we can possibly require. The principle of layering we have adopted is somewhat different from that usually practised, as we found the juice of the Chinchonas when cut flowed so freely from the wound that if merely placed into the soil it was apt to cause mildew and rot. To remedy this a piece of perfectly dry brick is placed into the cut as soon as it is made, this absorbs the juice and effectually prevents the ill effects it produced.

25. The layers when well rooted are removed from the parent plant, potted off, and kept in a close atmosphere for a few days until they become established. In removing the layers great care must be taken, for if they are cut off before the shoots shown in Figure 2 at A and B have attained a good size and fairly developed their leaves, the stock or parent plant is almost certain to die off. The reason of this is, the sap flows into the plant with equal vigor, but cannot be elaborated because of the removal of the leaves attached to the layer and consequently it ferments and causes rot in the parent plant. So marked and undoubted is this fact, that if our trees are at any time cut down for their bark, not one in ten will survive, hence appears the necessity of the mode of cultivation detailed from paragraphs 38 to 40.

Cultivation.—Propagation by cuttings.

26. Our object being to produce the largest number of plants in the shortest possible space of time, our attention was early turned to growing the Chinchonas by cuttings; and in this respect also our first operations were not attended with the success desired. We soon discovered that cuttings from old wood or rather from wood of three or four months growth was difficult to root, requiring from two to three months and that it frequently damped off. It soon became plain that the youngest wood that could be procured was the best adapted for making cuttings, as young tender shoots a fortnight or three weeks old formed roots in a very short space of time; the majority of these cuttings being invariably rooted within a month; it is however difficult to deal with this description of wood, and to secure success requires a great amount of care; the earth in which these cuttings are placed is prepared as before described for the seeds; it is however kept a

little drier. The cuttings on being made are placed around the sides of the pots, the cut end of each being pressed firmly on a piece of dry brick as shown in the illustration in the margin. Each pot contains from 20 to 25 cuttings, and as they are filled they are immediately removed to the propagation frames and plunged into beds of damp sand on a bottom heat of about 80° Fahr.



27. The cuttings are now carefully watched, and their leaves moistened by a fine syringe when the atmosphere in the cases appears dry; they are however never watered, it being very necessary to ensure success to avoid this, as we have invariably found that when the earth is once watered that it causes the cuttings to damp off and seriously retards their rooting. The cause of this appears to be that the cuttings not only suffer from excess of damp; but the soil when watered in the usual way after the cuttings are placed in the pots, by its expansion and adhesion from the action of the water the particles of soil are forced far too close together to be beneficial for the development of roots. With young wood our losses with cuttings has recently not averaged 3 per cent. In removing the cuttings from the stock plants one or two pairs of leaves and buds should, if possible, be left between the plant and the part cut; this is done in order not to decrease the succeeding supplies of young wood, which would be the case if the cut was made close to the parent stem. Another circumstance very necessary to be attended to in order to ensure success is to be careful to place each cutting as it is made into the pot with the cut end on a piece of dry brick, this must be attended to because where the cut is made the juice begins to flow, and this juice if not immediately absorbed by the dry brick causes mildew and rot. When the cuttings are placed in the cases they are exposed to as much light as they

Cultivation.—Propagation by buds. 28. In December last it occurred to me that the plants could be successfully propagated by leaves with the bud attached; and as this method offered very considerable advantages in producing a large number of plants



FIG. 4. 1. Represents the bud A, prepared for placing in the pot, showing the cut part B, upon the brick C. 2. A pot of buds of Chinchona Calisaya 41 days after planting. 3. A bud of Chinchona succubra also 41 days after planting.

from a limited supply of wood, we resolved to attempt the experiment, which has been carried out most satisfactorily. The figure in the margin illustrates the method by which this is accomplished, the whole secret of success depends entirely on the amount of moisture given, if this is supplied in excess they rot immediately even in a day; but if sufficient care is exercised, the losses will not exceed 3 or 4 per cent., and this percentage has not been exceeded by many thousands we have propagated in this way: by this method fine plants

are obtained in every respect resembling strong, healthy seedlings. The period required to form roots is nearly the same in all the species, varying from three to six weeks. In the figure above given the pot on the left represents six Chinchona Calisaya buds put in on the 30th January last, which were all rooted in 41 days after, being the date on which the drawing was made last by Mr. Batcock. This drawing on the right represents a rooted bud of the Red Bark put in at the same time. It may be observed that it is not indispensable that a leaf be attached to the bud; this is no doubt a great advantage although we have struck many buds without any leaf attached.

29. The usual way in which we prepare the buds is to remove the point of the shoots for a cutting: the stem is then divided near the middle of each internode, split down the centre, and immediately placed upon the brick in the pot: the bud itself being covered with about $\frac{1}{4}$ inch of soil, while the leaf of course projects above the surface. The pots are then plunged in damp sand and treated in every respect the same as the cuttings.

30. The entire adoption of this system has been endeavoured to be forced upon Government by the scientific gentlemen who have visited and who conduct the Java plantations. It is however a system of very questionable utility, as it has been in operation in Java for many years without producing the desired results; it moreover seems to have been adopted from a want of confidence in discriminating between the conditions which are beneficial, and those which are injurious in a state of nature: hence a slavish imitation of what has been described as the natural conditions under which the plants grow in their indigenous localities on the Andes. In cultivation, this implicit imitation of all the natural conditions under which plants must of necessity grow in a wild state, has invariably led to bad results; as indeed it must of necessity do: because the whole art of culture is vested in the very simple art of administering to the plants such conditions only as are conducive to their perfect development, and of removing or mitigating to the greatest extent possible such conditions as are injurious. To give a near example: When Coffee cultivation was attempted in Ceylon and in the Wainád, numerous intelligent and enterprising gentlemen imitated nature in this respect, and planted their Coffee under shade; after eight or ten years it was discovered that no return whatever could be obtained under such circumstances, and after this amount of time lost, money expended, and hopes disappointed, they had to begin and fell the whole of the shade, to the almost utter destruction of the plantations; and although we have been subjected to the criticisms of "obstinacy" and "stubbornness," in recommending a different course, I feel that it must be admitted that had we accepted arguments or opinions against facts daily developed before our eyes, together with the practical experience of generations, we would have given cause for much more serious strictures.

31. With the concurrence of Government, we have arranged to plant this season 75 acres of Chinchona plants under various degrees of shade of forest trees; but only a few acres of this will be under dense shade, as our present experience has taught us that under such conditions Chinchona plants cannot flourish. The main cause of this is that the roots of the forest trees immediately fill up the holes into which the Chinchona plants are placed, thus depriving them of nourishment at the roots, while they are choked above for want of light and air. The production of alkaloids also cannot take place until the Chinchona plants have overtopped the forest trees and expanded their heads in the open sunshine to enable them perfectly to elaborate their juices; and as this will require a period of 40 or 60 years, and the necessity for the destruction of the plantation to obtain the produce even after this lapse of time, this system I fear cannot be considered as one at all desirable to be followed.

32. The further suggestion which has recently been recommended by Dr. Anderson, to the Government of India, to grow Chinchona Pahudiana, because "nine hundredth of a grain of Quinine" had been found in the roots of one of these plants by Dr. DeVrij, seems insufficient to justify an expenditure of money in order to test the value of this discovery; as at this rate, to produce an ounce of Quinine will require 5,330 trees. It is however added, that this had confirmed DeLoudre's discovery made about 20 years ago, "that the roots of Chinchonas contained a large proportion of alkaloids than the bark." Unfortunately DeLoudre himself

gives an account directly the reverse of that above quoted as the results of his discovery, namely, that he obtained a much smaller proportion of Quinine in the roots than in the bark, and that this small quantity was impure, incrustalizable, and consequently of no value. In order that the Government may not be misled, I may mention that DeLoudre's discovery refers to the roots of Chinchonas producing bark rich in alkaloids, hence so far from going to prove the correctness of the discovery of Dr. DeVrij, its tendency is to prove the reverse; for if the roots of Chinchonas producing bark rich in alkaloids only yielded a very small quantity of impure Quinine, the conclusion is plain that a species such as the Chinchona Pahudiana which contains little or no alkaloids in its bark, must have still less in its roots.

33. In the early part of last season, several plants of different species of Chinchona were planted out under different conditions in order to test experimentally which would be the safest system of cultivation to pursue. These plants have been carefully watched and treated in every respect alike, and the result has been that the plants placed without the protection of any living shade has made the most satisfactory progress, and borne the dry and cold weather without the least injury. The plants placed under living shade were found to be damaged in some degree during the rains by the incessant drip; however, on the weather clearing up they threw out fresh leaves and quickly recovered, but towards the end of the dry season these plants were found to be suffering considerably from the drought; on taking a few of them up it was found that the holes in which they were placed had become filled by the fibres of the roots of the forest trees in the neighbourhood, which had drawn up the whole of the moisture and nourishment from the soil in which they were planted. The average growth of the plants under shade from the end of September 1861 to the 14th May 1862, has been about three inches.

34. In putting out the plants which were placed in the open without any living shade whatever, we saw from the first that we had to combat with the young plants the bad effects of excessive evaporation, during our dry season under a bright and scorching sun; we also saw the injury likely to be done to the plants by excessive radiation during bright and cloudless nights. To obviate these disadvantages the plants were sheltered on the approach of the dry weather by a rough enclosure of bamboo branches with the leaves adhering to them, so as to give the plants sufficient shelter both from the effects of evaporation and radiation. The

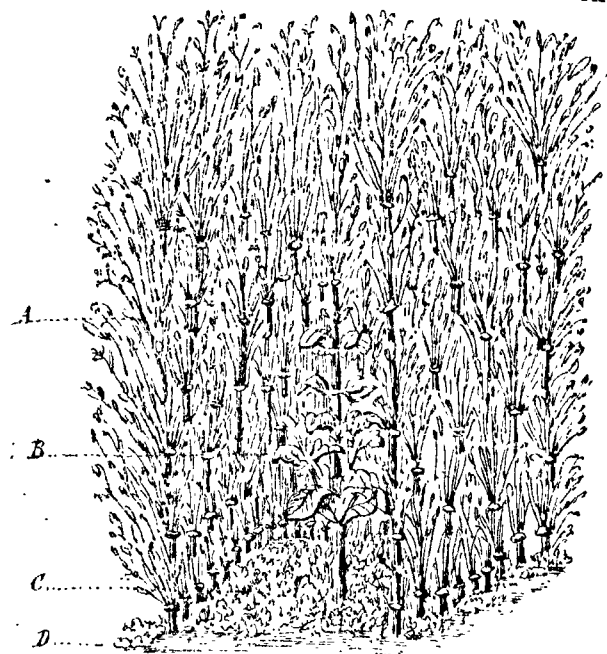


FIG. 5.
Represents the manner in which the dead shade of Bamboos is applied, the open space being on the North side. A the Bamboos, B the plant, C the dead leaves, D the ground.

of great strength had penetrated the covering of decayed leaves. The following table illustrates

the growth of six plants placed out in a cleared spot on the highest and coldest part of the Neddivattam plantation :—

Height of plants when planted on the 29th September 1861.				Height on the 14th May 1862.	
No. 1.	Chinchona	Succirubra	9 inches	2 feet	5 inches.
" 2.	do.	do.	4 "	2 "	3 "
" 3.	do.	Micrantha	3½ "	1 "	4 "
" 4.	do.	do.	3 "	1 "	4 "
" 5.	do.	Nitida	3½ "	1 "	7 "
" 6.	do.	do.	3 "	1 "	6 "

35. This result cannot but be viewed as most satisfactory, it establishes beyond a doubt that our Chinchona plants will grow well under open cultivation, and thus the experiment will no doubt secure to us all the advantages we can desire. It is not only upon these six plants which this opinion is founded, but also on observations made upon many hundreds of plants placed out in our nurseries in December last; a portion of our nurseries were left partially shaded by living trees, while other portions were entirely open; at the end of March the plants shaded by living trees had scarcely made any progress, while those in the open portion of the nursery had grown upwards of a foot, we therefore cut down the whole of the trees which shaded the nursery with the exception of one which could not be felled without damage to the young plants.

36. From the observations made under the preceding head, I would respectfully recommend to the Government that in our operations of next season, the principle of open cultivation alone be pursued. This system is not in fact so great an outrage "on the habits of the genus" or on the opinions of authorities on Chinchona cultivation as recently represented by Dr. Anderson. The descriptions already given of the plants abundantly proves this fact. And with reference to the opinions of authorities, with the exception of the gentlemen in Java, they are unanimous in pronouncing this open system of cultivation to be right, even Dr. Weddell,* who has been frequently quoted as entertaining a different view of the matter, distinctly approves of this system of culture.

37. The advantage of open cultivation are such as cannot fail to carry conviction to the mind of every man who will give the subject a moment's serious consideration; as it enables us at once to place our plants out under the most favorable conditions to promote their growth. The soil is not impoverished by the roots of neighbouring trees, the plants cannot suffer from drip, nor from the effects of evaporation or radiation, as the dead shade affords them in this

* "My reason for recommending the young plants to be placed in the open field, jointly with young trees of some other order, and rather more fast growing than these, originated from the fact of my having always seen the Calisaya tree dwarf and stunted when growing in exposed or entirely open situations, whether the same thing takes place with other species seems doubtful, as Mr. Spruce says that the Red Bark tree thrives in open ground."

"At all events I should never recommend planting any of these trees in the dense shade of the forest. In such a situation the greater part of them would evidently soon be smothered."

"If I have said that shade appeared indispensable to the trees, at an early age, I never meant that they should have too much of it. I think that the trees in India ought to be planted in open ground, and close enough (if unmingled with other trees) to oblige each other to run up, sufficient space and air being gradually provided by judicious pruning and thinning out. A most important condition of success may be found in the choice of the proper time for planting out, the best being probably the beginning of the rainy season."

(Signed) H. A. WEDDELL.

(True Extract.)

(Signed) W. G. McIVOR,
Superintendent Government Chinchona Plantations.

respect, a far more efficient and certain protection than could possibly be given by any living shade, while instead of impoverishing, it enriches the ground, it also possesses the incomparable advantage of being entirely under our own control, it can thus be adjusted exactly to suit the seasons. In the wet weather, when shade would be decidedly injurious by promoting the growth of fungi and causing rot, it can be removed; while, in the dry season, it can be increased to any extent necessary. It also enables us at once to place the plants under the most favorable conditions for the development of the alkaloids, and under this system of cultivation I have no doubt that many of the species will give a supply of bark, in from six to seven years after planting, and that in eight to ten years they will give a large yearly supply. This artificial shading will of course be required until the plants attain sufficient size to cover the ground, which will probably be in two years or less.

Proposed treatment for the yearly production of constant and uniform supplies of bark.

38. In a state of nature all products are reaped in the most improvident and reckless manner possible; but the moment the plants are brought into cultivation this must cease, and the harvesting of the produce of the present year must be effected in such a manner as not to injure that of succeeding years. Although in the forests of the Andes the trees are cut down and stripped of their bark, such a system can never be profitably put into operation in cultivation, and another more suited must therefore be devised. I would suggest that our trees be planted in such a manner as to secure the constant and uniform yearly supply of bark by simply lopping and pruning the trees, if this operation is conducted with skill, the plants will be benefited rather than injured by the yearly removal before the middle of the dry season of a certain portion of their branches. This will not retard the growth of the plants, nor indeed can any damage arise from an attempt to carry out this system, which has been brought to the notice of Mr. Howard, and that great chemical authority considers "that a large produce may be realized in this way."

39. In the first years, probably from the sixth to the eighth after planting, the produce will be comparatively small, and be entirely of the description known in the market as quill bark, but after the twelfth year of the growth of the plants a large proportion of the loppings and prunings will produce what is known in the market as flat or trunk bark. As an argument against this system, it has been advanced that Chinchona plants do not throw out any branches, but this is a mistake, as we have some plants, although a little more than fifteen months old, with eleven to thirteen branches, and some of these branches themselves measure $3\frac{1}{2}$ feet in length and the secondary branches 1 foot 4 inches. There is certainly nothing in the habits of all the species of this plant but what promises to be admirably suited to this method of cultivation; and from our own observations I feel convinced that much if not the whole success of the cultivation depend upon our results in this part of the operation. For if, as stated by the Dutch in Java, the plants will not attain sufficient size to produce bark under 50 or 10 years, then Chinchona cultivation can never become of commercial importance, but this is not at all likely to be the case, for if our plants continue to attain the same rate of growth as they have done, we have every promise of a small supply of bark even before the lapse of the period mentioned above, and we can reasonably expect that our plants when once well established will attain greater luxuriance than they have hitherto done.

40. In order to obtain the greatest produce from our plantations at an early date it appears to be desirable to place our plants rather close together, and with this object in view in our operations of this season we have prepared to place the shrubby varieties at a distance of from 7 to 8 feet apart, which will give about 889 and 680 plants respectively to the acre. The larger grown species at 9 and 10 feet apart which will give about 537 and 435 plants to the acre, this of course would be much too close to remain to attain their full size, but when they begin to crowd and impede the growth of each other they can be thinned out, and this operation will no doubt furnish a large supply of bark as they will probably not require to be thinned out before the twelfth year of their growth, as when they first begin to crowd sufficient light and air will be afforded by lopping and pruning a portion of the branches.

41. The propagating house sanctioned by Government in July last was finished by the end of December, and has been found most complete and efficient in its working details, some delay was caused in the progress of this work owing to the heavy rains in October and November, as also

by the inexperience of the workmen in erecting a building, it was found difficult to get the furnaces and flues built in such a manner as to give a steady and efficient heat to the soil in the propagating frames. This however was successfully accomplished, and the house in full working order and filled with plants by the 1st of January. The house contains fifteen propagating frames and each of these holds about 1,200 cuttings, or in all sufficient space for about eighteen thousand cuttings, the house also contains as much space as that occupied by the propagating frames for the growth and propagation of plants by layers and for hardening off such plants as are rooted. The costs of this building amounts to about 2,100 Rupees.

42. *House for European Gardener.*—This building was completed by the latter end of January, at a cost of about 1,350 Rupees; at the suggestion of His Excellency the Governor, who visited the work at the time the foundations were being laid, the rooms were enlarged, and the house now contains two main rooms 12×14 , three verandah rooms, one being 7×14 , the other two 6×14 , with open verandah $7\frac{1}{2} \times 14$, together with kitchen, store-rooms and pantry.

Overseer's house, Dodabetta Plantation.—This building is not yet quite finished, but is in a very forward state. In estimating for this building it was proposed to be done temporarily, namely, with bamboo roof; but, as our operations progressed, I considered it desirable to construct this as also a house for the Head Propagator in a permanent and durable manner, and consequently the buildings have been substantially erected with burnt bricks, the corners, jams, and chimneys being laid in chunam, and the whole of the timber and roofs of teakwood, I hope to be able to finish these buildings in this substantial manner for only a trifle more than the estimates for the temporary buildings, and I trust the Government will approve of the alteration.

Propagator's house.—This has been erected close to the propagating house, as it was found indispensable that the Propagator should be on the spot in order to give the plants and cuttings that amount of attention which is necessary to ensure success. This building will be completed in a few days.

Coolies' quarters.—These have been built with burned bricks, teak rafters, and bamboo reapers.

43. The difficulty experienced in getting artizans to proceed to Neddivattum, has rendered it now impossible to get the permanent building there completed before the setting in of the rains, therefore small but comfortable temporary buildings with teak-wood doors and windows have been erected for the Assistant Superintendent in charge of the plantation; as also for the Overseers, with store and tool houses, and accommodation for about 200 workmen. The permanent buildings will be proceeded with immediately the rains are over, all the material including doors, windows, &c., being finished there will then be no delay.

44. *Felling.*—On the Neddivattum plantation about 85 acres have been felled, cleared and prepared for planting this season; and as our work was much delayed last season by the forest not being felled in time, I considered it desirable to fell about 50 acres for next year's planting, so that our work may not be delayed at the commencement of next season. On this plantation about 15 acres have been cleared for planting under the shade of living trees, and on the Dodabetta site about 55 acres have been prepared for placing out the plants under various degrees of living shade; in only a small portion has the underwood been cleared away, and here the Chinchona plants will be placed out under dense shade; but the greatest portion of the land is almost entirely cleared, only sufficient living trees being left to give efficient shelter and slight shade. Here also five acres are entirely cleared of forests; consequently the results on this plantation will enable us to form a correct opinion of all the advantages and disadvantages likely to accrue from the two systems of cultivation, and all the intermediate stages between them.

Trenching and pitting.—After the roads being either formed or marked out our trenching and pitting operations were begun, at Neddivattum ten acres of trenching have been completed, and on the Dodabetta site about 21 acres of land has been trenched, and 25 acres pitted. The whole of this site will be prepared by the end of May, when with the approval of Government we will proceed to pit and trench the 25 additional acres on this site intended for the cultivation of *Chinchona Crespilla*.

45. *Enclosures.*—As above mentioned, the difficulty of getting artizans to proceed to Neddivattum, the walls to enclose this plantation have not been begun, although many of the bricks have been made; it has therefore been found necessary to enclose this site with a strong temporary fence. The Dodabetta site is nearly enclosed by a turf wall and ditch on three sides, and on the fourth by a wooden fence; the brick wall around the nurseries is now in progress.

46. *Increase of plants.*—Next in importance to that of introducing a valuable plant is its increase and multiplication, and with this object in view great attention has been given to this part of our operations, which has been much facilitated by the efficient working of the new propagating house. The following table gives the number of plants on the 30th of April, or at the end of the official year:—

Botanical names.	Commercial names.	No. of plants.	Value in the London market per lb. of dry bark.	Remarks.
1. <i>Chinchona Succirubra</i>	Red Bark	14,450	s. d. s. d.	
2. Do. <i>Calisaya</i>	Yellow Bark... ..	237	2 6 to 8 9	In fine health.
3. Do. <i>Condaminea</i> Var, } <i>Uritusinga</i>	Original Loxa Bark...	1	2 10 to 7 0	Do. do.
4. Do. <i>Condaminea</i> Var, } <i>Chahuarguera</i> ...	Rusty Crown Bark ...	8,000	2 10 to 7 0	Promising.
5. Do. <i>Condaminea</i> Var, } <i>Crespilla</i>	Fine Crown Bark.....	105	2 10 to 6 0	In good health.
6. Do. <i>Lancifolia</i> from } <i>Java</i>	Crown Bark... ..	1	1 8 to 2 10	Do. do.
7. Do. <i>Nitida</i>	Genuine Grey Bark...	2,922	1 8 to 2 9	Unhealthy.
8. Do. Species without } name.....	Fine Grey Bark... ..	1,211	1 8 to 2 10	In fine health.
9. Do. <i>Micrantha</i>	Grey Bark... ..	3,786	1 8 to 2 9	Do. do.
10. Do. <i>Peruviana</i>	Finest Grey Bark.....	357	1 8 to 2 10	Do. do.
11. Do. <i>Pahudiana</i> from } <i>Java</i>	Unknown... ..	425	Worthless.....	Do. do.
Total number of plants.....		31,495		

Although this increase is highly satisfactory, we have been materially retarded in this respect by supplying, at the end of December last, to Dr. Anderson, for cultivation in Bengal

204 well established plants of different species of *Chinchonas*, the greater portion of these being of the most valuable species we possess; these by this time would have produced many thousands. Still the distribution of these plants will be more beneficial to Government than if they had been retained here, should the localities selected for their cultivation prove suitable the plants will no doubt be increased with the same rapidity as has been attained here. With our Red Bark plants the increase of the year is upwards of 2,000 per cent., and equal results have been attained with all the species in proportion to their value: that is, species of less value have not been propagated to such an extent.

47. General difficulty was experienced especially in the first stages of our operations in getting together a tolerably efficient Establishment; and although this condition of affairs has lately considerably improved, still we are far from possessing an Establishment with the general requirements necessary for conducting operations of this description. This indeed was to be expected as the cultivation of the plants is new; and even in organizing an Establishment for any undertaking it requires time to bring it to an efficient state of working. In the propagating Department the effects of carelessness and ignorance in the management of the plants were productive of the most serious losses; I have been much assisted since the arrival of Mr. Batcock in October last; and I have every reason to be highly satisfied with the intelligence, ability and zeal, with which he has performed the duties entrusted to him. Mr. Patmore, the Head Overseer on the Neddivattum plantation, has also taken a great interest in his work, exhibiting an unusual amount of skill in the management of the plants, and is in every respect well qualified for promotion. Mr. Lyall, the European gardener recently engaged by the Secretary of State, arrived here on the 18th ultimo, and has been placed in charge of this plantation. The other Overseers although willing and anxious to give satisfaction, have exhibited a want of knowledge in the management of the plants, and the direction of labor, which I have found great difficulty in improving. Every endeavour, however, is being made to obtain men possessing the various qualifications required.

48. *Office.*—I have seriously felt the want of a good Accountant and Office Manager, the salary, Rupees 40, at present allowed being insufficient to secure the services of a man possessed of the abilities required. Mr. Hollis, recommended by the Forest Department, conducted the Office duties until the end of October last, when being offered a higher salary by the Coffee Planters he left this employ without due notice, or delivering over the records and account of his office, which put me to much inconvenience.

49. So far as our operations have progressed, this experiment has been eminently successful both as regards the number, genuineness and value of the species introduced, their increase and cultivation. The very important fact has also been established that the climate of the Neilgherries is suitable for the growth of all the most valuable species of *Chinchona*, and that the plants possess as great power of withstanding extremes of wet and drought, as is generally the case with Evergreens. It has also been ascertained that the *Chinchonas* like nearly every other plant has a distinct period of growth, which extends over about nine months of the year, the remaining three months being one of comparative rest, this has especially been clearly demonstrated by our seedlings in the glass houses, for although the temperature and moisture was kept nearly uniform through the year, yet towards the season of rest, the growth of the plants became less rapid, the upper leaves assuming a leathery texture, while the lower leaves became red and fell off, thus exhibiting the usual signs of a definite season of rest; this was the case with all the species, but not so marked in the *Chinchona Nitida*, although this species also exhibited unmistakeable signs of a season of comparative rest, while immediately on the return of spring the whole of the species began to grow with renewed vigor. I record these observations as it is generally believed that the conditions most favorable for the growth of these plants "are those of continuous vegetation;" and although this is literally correct, because vegetation never fairly ceases, yet it conveys somewhat an erroneous impression, for it is

16 *Proceedings of the Madras Government, Revenue Department,*
11th July 1862.

evident from the indications the plants themselves have given of their nature, that to urge them to an equal, continuous growth would do serious damage, by preventing the perfect elaboration of the juices of the plants, a condition to which they are undoubtedly subjected in their natural localities on the Andes, and this condition is no doubt essential to their well-being.

50. Our plants have in the most satisfactory manner possible passed through all that we had to fear from the effects of this climate, namely, the dry season, and hail storms, to which we are liable in the spring of the year. Our dry weather certainly presents no insurmountable difficulty to the successful cultivation of the Chinchonas, and it is likely to prove highly beneficial in promoting the production of alkaloids; the only difficulty our dry season presents is that it renders the operations with the young plants more difficult for a year or two, but when once the plants are fairly established it cannot be productive of any inconvenience whatever. It is indeed very questionable if our dry season especially on the western side of the Neilgherries is so severe or of so long continuance as that of the Chinchona region on the Andes, as we frequently read of the jungles there being periodically set on fire, while here the drought has seldom been experienced sufficiently severe to render this possible. The hail storms as they happen before the young leaves of spring are expanded do comparatively little damage to the plants. From the effects of hail our Chinchonas have not suffered more than many other introduced plants which luxuriate all over these hills.

51. Although the increase in the number of the plants of last season has been very satisfactory, still we may expect far greater results this year, as we now possess a more perfect knowledge of the system of propagation, and more efficient appliances, so that during this year we may calculate on producing at least 150,000 plants, I would therefore respectfully suggest that the plants be offered for sale to the public in January next, at the following rates, namely, Rupees 500 per 1,000, Rupees 300 for 500, Rupees 200 for 150, Rupees 100 for 50, or Rupees 4 per plant for any number under 50; we have now numerous applications for plants, both from planters in this Presidency and from Bombay, and as the number required is generally large I thought it desirable to fix a low price upon the plants when a thousand or upwards are taken by one purchaser, and I think it is more desirable that our plants be sold to private individuals than gratuitously distributed, which is apt to lead to the loss of the plants; because persons do not generally value that which they receive for nothing, whereas those who purchase plants at a fair price establish by this act that they value and consequently will take care of them; moreover, it will induce purchasers to propagate and increase the plants themselves, and thus greatly facilitate the extension of their cultivation.

52. In concluding this report I beg to tender my grateful acknowledgments to His Excellency Sir William Denison, and the Government of Madras for the confidence they have reposed in me while conducting the operations of this important experiment through its most critical stages, and at a time when the correctness of our own views had not been practically developed, and many conflicting theories pressed upon Government. My best acknowledgments are also due to Clements R. Markham, Esq., for much valuable assistance and information which has greatly contributed to the successful development of this undertaking. Also to J. E. Howard, Esq., for his contribution of the valuable species of Chinchona Uritusinga and for much important scientific information.

GOVERNMENT GARDENS,
OOTACAMUND,
31st May 1862.

(Signed) W. G. McIVOR,
Superintendent Government Chinchona Plantations.

No. 166.

ORDER THEREON, 11th July 1862, No. 1,509.

Ordered to lie over.

(Signed) P. P. HUTCHINS,

Acting Deputy Secretary to Government.

No. 8.

Government Gardens
Ootacamund 31st May 1862

From

W. G. McIVOR Esq.
Superintendent Government Chinchona
Plantations

To

J. D. SIM Esq.
Secretary to Government Rev. Dep.
Fort St. George
Madras

Sir,

I have the honor to forward
herewith the Report on the Government
Chinchona experiment on the Neil-
gherries for the Official Year ending
the 30th Ultimo. The accounts which
form an appendix to this report
require further examination and
will be forwarded hereafter.

I trust the Government
will not consider that I have stray-
ed from the legitimate subject of
this report, by entering into a mi-
nute detail of our system of
Cultivation

10
-cultivation. My object being to
-endeavour to place in the hands
of our assistants such information
as may prove useful to them in
the management of the plants.

Should the Government approve
of this, and be pleased to sanction
the report being printed in a
convenient pocket form, I res-
pectfully beg to solicit the favor
of being supplied with 50 or 100
copies for the use of the establish-
ment, and for distribution to those
anxious to try Chinchona Cultivation
in this Country-

Print 350-20
L. & Co. 100
of the same
at 100 each

I have the honor to be
Sir,

Your Most Obedient Servant

Wm Loe
Supt. Govt Chinchona Plantation

