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*Proceedings of the Madras Government, Revenue Department,
9th July 1868.*

Read the following papers :—

No. 155. From the Superintendent of Government Chinchona Plantations, to the Secretary to Government, Revenue Department, Fort St. George, dated Ootacamund, 16th May 1868, No. 51.

I have the honor to forward the Administration Report of the Government Chinchona Plantations for the official year 1867-68.

REPORT ON THE GOVERNMENT CHINCHONA PLANTATIONS AND BOTANICAL GARDENS, OOTACAMUND, NEILGHERRIES, FOR THE OFFICIAL YEAR 1867-68.

1. The past year has been somewhat unfavorable to our planting operations. The South-west monsoon was heavy, but of short duration, and accompanied by very high winds. The North-east monsoon was almost a failure, consequently the young plants transplanted into the plantations during last year have suffered considerably; but the high winds and dry season have not impeded the usual luxuriant growth of the established plants.

2. The works on the Dodabetta, Neddivuttum, and Pykara Plantations have made rapid progress, and all the heavier preparatory works, such as felling, pitting, road-making, draining, &c., are completed. Should this monsoon prove favorable, the planting will be rapidly proceeded with. The average monthly increase by propagation throughout the year is 48,267 against 66,950, the result of last year. There being now no demand for plants, except for our own requirements, it will be necessary to limit our propagating operations, as the quantity of plants on hand already are nearly sufficient to complete all our plantations. The maximum monthly increase by propagation has reached as high as 123,480 against 176,349, the highest monthly increase obtained last year. The total number of plants on the 31st March of the current year was 2,353,370 against 1,926,044, the total of last year. The number of plants issued to the public is 44,693, making the total number up to 31st March 1868, 170,740. The number of plants permanently planted out is 740,912, which gives 339,701 plants permanently planted out during the past year. From this number about 120,000 must be deducted for failures caused by the drought and frost. The first plants permanently planted out in August and September 1862, have attained heights varying from 17 to 18 feet, the larger plants having been cut down for their bark to be sent to the European market. These plants now fairly shew their tree-like character; and together with those planted in 1863 and 1864, are now yielding abundance of excellent seeds of third, second, and first rops, according to the age of the trees. The demand for seeds has been very great, and a large quantity has accordingly been supplied. The "Notes on Chinchona cultivation" has enabled private planters to raise the seeds successfully.

3. The analysis of the last sample of barks sent to Mr. Howard continue to shew, in a very striking manner, the efficacy of mossing. The bark of *C. Pahudiana* (a species hitherto considered worthless) has under this process increased in its yield of alkaloids from 0.761 to 2.21 during the year 1867.

4. The public sales of bark, as noted in the Despatch of the Secretary of State for India, No. 32, dated 23rd of August 1867, have realized very satisfactory prices, ranging higher than those obtained for the same description of American bark.

5. The details of this report are arranged under the following heads :—
- 1st.—Propagation.
 - 2nd.—Condition and growth of plants.
 - 3rd.—Cultivation.
 - 4th.—Do. under the shade of living trees.
 - 5th.—Do. results obtained by private Planters.
 - 6th.—Formation of alkaloids.
 - 7th.—Chinchona, new varieties introduced, remarks on.
 - 8th.—Sales of bark in the European market.
 - 9th.—Establishment.
 - 10th.—Convict labor.
 - 11th.—Progress of operations.
 - 12th.—Botanical Gardens.
 - 13th.—Tea Plantation.
 - 14th.—Concluding remarks.
 - 15th.—Appendix A., accounts from the commencement to 31st March 1868.
 - 16th.—Do. B., Meteorological observations at Neddivuttum.
 - 17th.—Do. C., do. do. at Ootacamund.

6. PROPAGATION.—The stock of plants continues to be maintained principally from seedlings. In consequence of the scarcity of seeds, in the early part of the season, of *C. Officinalis*, we were obliged to propagate a number of this kind from cuttings; this system has, however, now been discontinued, as we have an ample supply of seeds. The *C. Succirubra* and *C. Officinalis* are most extensively propagated, as these species are the most remunerative kinds for general cultivation. They are hardy and grow luxuriantly, and are suited to every climate on the Neilgherries.

7. Our crop of seeds has again been very large, so much so that the greater part of the Grey Barks and kinds of inferior value have not been collected. *C. Lancifolia* is the only species which has not produced seeds, and has, therefore, still to be propagated by cuttings.

8. CONDITION AND GROWTH OF PLANTS.—The growth of the *C. Succirubra* and *C. Officinalis* continues to be most satisfactory, the stems, especially of the former, have increased to that degree of stability as to have been able to withstand uninjured the violence of our last very stormy season. When the plants get up, and their branches begin to meet, they resist storms as effectually as most species of indigenous trees on these hills. *C. Succirubra* evidently succeeds best at an elevation of from 4,000 to 6,000 feet, as at Neddivuttum, where the vigor of growth and luxuriant appearance indicate that they are quite at home. A few plants of this species have been planted in a sheltered spot in the Dodabetta plantation as a trial of elevation, but their progress is by no means satisfactory, their yellow appearance and stunted growth shewing the altitude to be too great. The varieties of *C. Officinalis* thrive well at all elevations in which they have been planted. On the Neilgherries there is no elevation too great for the successful cultivation of these kinds. The three original varieties, known as *C. Officinalis* a *Condamenia*, *C. Officinalis* B. *Bonplandiana*, and *C. Officinalis* var. *Crispa*, are sufficiently characteristic to mark them as distinct varieties, but numerous intermediate forms

occur, partaking more or less of the characteristics of one or other of these varieties. The original variety of *C. Calisaya* (*Josephiana*?), introduced from Java and from Kew, flourishes; but owing to its diminutive size, and bark of inferior value, is not likely to become a profitable or desirable plant to cultivate, consequently it has not been extensively propagated. Several kinds of *Calisaya*, with very distinct characteristics, have been raised from Mr. Money's seeds; some of these promise to attain a considerable degree of luxuriance, and if the bark is good, they will no doubt supply the hitherto deficient Yellow Bark from our plantations.

9. The high winds of last year's monsoon had an injurious effect upon such plants of the Grey Barks as were fully exposed to their influence, many of these plants in exposed situations dying from the top downwards. The cause of this appears to be in consequence of the natural action of the leaves being arrested, as during the monsoon months the air is so completely saturated with moisture that no evaporation can take place; hence, apparently, the dilute juices in the plant ferment, and decay is the consequence, commencing at the point where the plant is less protected by elaborated woody fibre, namely, the terminal shoot. The readiness with which the Grey Barks are attacked in this way, seem to shew them to be of a habit unsuited to exposed situations. Plants of *C. Officinalis* and *C. Succirubra*, standing in the same ground and among the Grey Barks, escaped with no further injury than being stripped of a portion of their leaves by the violence of the gales. As the monsoon passed over, some of the injured Grey Bark trees threw out shoots from the base of the stem, and the weather being favorable, they made rapid progress, though, under such circumstances, the plants are necessarily converted into mere shrubs. The *C. Lancifolia*, though it is quite healthy, does not attain that desirable degree of luxuriance and rapidity of growth seen in *C. Officinalis* and *C. Succirubra*.

10. CULTIVATION.—A large extent of grass land has this year been brought under cultivation, and larger tracts are still under preparation. The *C. Officinalis* seems to thrive equally well on grass as on forest land, their foliage is vigorous and healthy, and their stems stout and sturdy. The progress of *C. Succirubra* on grass land has not as yet been so fairly tried as the *C. Officinalis*, but all the experience we at present have on this head goes to prove that their growth will be satisfactory. A wide field is therefore opened for enterprising capitalists, as the above two kinds of Chinchona, without doubt the most valuable medicinal plants of the world, may be cultivated with certainty over the whole plateau of the Neilgherries, and that too on grass land, where the preparation requires but a small outlay of capital, and where their verdure will add to the beauty of the landscape. Full exposure seems essential for the successful cultivation of all the species of Chinchona, the plants simply requiring a little shade to establish them in the first instance, and this is effectually provided for by the methods described in previous reports.

11. The first frosts last year occurred in October, fully a month before they were expected, consequently some of the young plants of last season's planting were nipped, and more or less injured, especially such as were in hollows filled with condensed moisture every night, while the plants on hill-tops, or sloping land, escaped without injury, except when the plants had overtopped the shading of turf, &c., placed around them. In such cases, the top of the plants was generally entirely

destroyed, while the bottom was uninjured. It is, therefore, important that the turf-shading should on all occasions be raised higher than the plant for the first cold season after planting. When the plant attains a height of from two to three feet from the ground, it is not affected by frost in these localities.

12. CULTIVATION UNDER THE SHADE OF LIVING TREES.—This system has not been adopted since the planting of the lower portion of the Dodabetta plantation in the earlier stages of the experiment. The results from this prove incontestibly that Chinchonas cannot be successfully grown under the shade of living trees, the deficiency of sunlight, and heavy drip during the wet months, permanently injuring the plants, while one season is insufficient for them to recover from the injury. In addition to this, the roots of the jungle trees take up and appropriate food which would otherwise fall to the lot of the Chinchonas, but the forest trees being larger and stronger, and cultivation being conducive to their growth, similarly with Chinchonas, they necessarily overrun the more recent and, therefore, weaker introductions. The deposit of alkaloid under shade is also much less than in the open ground, for though shade around the bark inert so far as elaboration is concerned, it produces a great increase in the quantity and quality of alkaloid, still that shade, when applied to the active elaborating machinery of the leaves, is productive of much injury, both to the general health and vigor of the plant, as also to its alkaloid elaborating powers.

13. CULTIVATION, RESULTS OBTAINED IN, BY PRIVATE PLANTERS.—Chinchona cultivation, as a private speculation, is gradually gaining ground, and operations have been greatly facilitated by the extensive distribution of seeds from this establishment. Some fine estates on the Neilgherries are progressing rapidly. Among the most promising plantations, those of Mr. Money, Colonel Denison, Colonel and Mr. James Morgan, Captain Jennings, Mr. R. F. Phillips, and Colonel Fyers may be enumerated. During the past year, large supplies of well-established plants have been supplied to Major Elliot, C.B., Superintendent, Ashtagram Division, for trial-cultivation in the different elevated tracts in Mysore, also to W. H. Kerr, Esq., Superintendent in Coorg. Five hundred plants of *C. Succirubra* have been supplied to Mr. Ballard, Collector of Malabar, and 100 to the Collector of Salem. In addition to these, a considerable quantity of seed has also been sent to Northern India, principally to the Punjaub and Darjeeling, so that Chinchona cultivation is not only permanently established on the Neilgherries, but rapidly extending throughout India. We have even had demands from, and have forwarded our seeds for cultivation in, Mexico.

14. FORMATION OF ALKALOIDS.—In addition to the various experiments made with reference to the formation of alkaloids in our Neilgherry barks by Mr. Broughton, the Government Quinologist, and fully described in various reports submitted to Government by that gentleman from time to time, some interesting facts have been ascertained from four samples of Chinchona bark recently forwarded to Mr. Howard for analysis and report. These specimens were selected to throw further light on the effect of mossing, and to elucidate some results noted by Mr. Howard in his report of the 4th February 1867, where he remarks that the original bark of *C. Officinalis*, var. *Crispa*, gave 0.629 as a total yield of alkaloid. This result was obtained from unmossed *Crispa* bark, and Mr. Howard recommended that the cultivation of this species should not be extended, as it would not re-pay the expense of

cultivation. In Mr. Howard's report, noted at foot,* on the four samples of bark abovementioned, the yield of alkaloid in mossed *Crispa* is given at 3.76, a very satisfactory result. Thus it may be considered established that the *C. Officinalis* var. *Crispa*, under the mossing process, is a variety well worthy of cultivation.

* Report of an analysis of the sixth remittance of bark from India.

From J. E. HOWARD, Esq., F.L.S., to the Under Secretary of State for India, August 28th, 1867.

SIR,—I have to report on four samples of Neilgherry Chinchona barks forwarded to me for analysis, with a view of throwing more light on the efficacy of mossing. The "mossed *Crespilla* bark" is improved in appearance,* as well as in produce. The "strong growing variety of *C. Officinalis*" exactly reproduces the bark called *Colorada del Rey de Loja*, and is, therefore, the *C. Officinalis*, var. *Bonplandiana*, *Colorata*. The *C. Uritusinga* bark has a poor and sickly look, reminding of the circumstances under which this plant has been grown, including the effects of the sunstroke from which it suffered on first reaching India. The bark of *C. Pahudiana* is improved in produce of alkaloid, but would not find so much favor in the eyes of ordinary purchasers, as the more slender quills last sent.

No. 1.—Mossed *Crespilla* bark, 3½ years old:—

Crystallized Sulphates, per 100 parts	...	...	...	2.46
Alkaloids soluble in ether, chiefly uncrystallized Quinine†	...	...	...	0.44
Insoluble in ether (Chinchonicine and Chinchonine)‡	...	...	...	0.86
				3.76

No. 2.—Strong growing variety of *C. Officinalis*, 3½ years old:—

Crystallized Sulphates	...	...	...	2.92
Soluble in ether (Chinchonidine and Quinine)	...	...	...	0.41
Insoluble in ether (Chinchonicine and Chinchonine)...	...	...	...	1.20
				4.53

No. 3.—*C. Uritusinga*, received from Mr. Howard, original bark:—

Total weight of precipitated alkaloids	...	...	...	2.43
Oxalate Quinine	...	...	...	1.40
Uncrystallized Quinine	...	...	...	0.17
Chinchonicine	...	...	...	0.70
Resin and loss	...	...	...	0.16
				2.43

No. 4.—*C. Pahudiana*, under moss, 5 years old:—

Crystallized Sulphates	...	...	...	1.60
Soluble in ether (Quinine and Aricine)	...	...	...	0.61
Insoluble in ether (Chinchonine) a trace...	...	...	...	
				2.21

Memorandum.—None of the above crystallized sulphates would perfectly stand the test, all containing a little Chinchonidine. The same remark applies to a portion (the second crystallization) of oxalate Quinine.

I adopted for No. 3, the plan of securing the total weight of alkaloid in the first instance, as I was uncertain of any further result, having only 300 grains of bark to work upon, and that of

* It now resembles more the *Loja* noneuse of Jussien.

† The remainder, probably Chinchonidine. I neglected to substitute the word Chinchonidine for the word Quinine in treating of the var. *Crispa* in my last report. The analysis in which it appears were quoted *verbatim* from Pereira, and were made fourteen or fifteen years ago, when accuracy as to this discrimination was not valued as it now is. I have no reason, from recent analysis, to believe that Quinine is contained in the *Loja* barks.

‡ The amount of crystallized Chinchonine is small in all the *Loja* barks.

C. Pahudiana has also been much improved. Mr. Howard's analysis in his report, dated 4th February 1867, giving 0.761 as the yield of alkaloids in this bark, while in that under date 28th August 1867, 2.21 is given as the result obtained from this bark, which hitherto has been considered worthless. This result is worthy of being communicated to Herr vanGoorkum, the Superintendent of Chinchona cultivation in Java, as this energetic gentleman will, no doubt, at once turn so important a discovery to the benefit of the public, and to the profit of the Dutch Government. In Java they possess an unlimited number of C. Pahudiana, and as the bark of this species can, by the mossaing process, be converted in a few months into one of great value, large supplies could thus be thrown into the market at once.

15. The reports of Messrs. Howard and Broughton are throughout most satisfactory, and are doubtless sufficient to give general confidence and elucidate all that is required, still the value of the barks cannot be too extensively known, or too extensively tested, as in a matter like the cultivation of Chinchona, where profit and benefit to mankind, not only arise from the yield of alkaloids in the bark being good, both in quantity and quality, but more especially from the rapid and safe reproduction of the bark; I would, therefore, respectfully suggest, that specimens of our Neilgherry barks may be, from time to time, forwarded to M. Delondre, of Paris, for analysis and report, this would give our barks a Continental reputation, which could not fail to prove of advantage, as M. Delondre, like Mr. Howard in

poor quality. This plan is, however, deceptive, the alkaloids not being purified. The loss is also more than is apparent, since the amount of the oxalic acid must be added for minute accuracy.

The deductions from the foregoing analysis seem to me to be the following:—

The mossed Crespilla bark is surprisingly improved by the treatment to which it has been subjected. I think that, in the former trial, some portion of the alkaloid must have been unconsciously lost in connexion with the abundant coloring matter which distinguishes this sort, but, with all this improvement, it scarcely equals No. 2, the strong growing variety, of C. Officinalis, var. Bonplandiana, in its natural state. This latter gave me, as last sent, more than 6.50 per cent. of crystallized sulphate, and is consequently by so much (about three times) more worth cultivating. The No. 3, Uritusinga bark, is remarkable for the small amount of coloring matter which it contains, and the consequent ease with which the alkaloids can be purified. It will probably yield a large amount of produce under good cultivation. No. 4, C. Pahudiana, is improved by mossaing, but I have no confidence in it as a source of Quinine, and believe it will prove to be most valuable, as furnishing a new sort of "Rusty bark," or "Rusty Crown bark," as it would probably be called in commerce, and, as I mentioned in my last, would command a good price in this way, if imported in long and slender quills.

Since the last report, I have received from Mr. McIvor well prepared specimens of the flowering branches, the fruit, &c., of the different sorts. Amongst these, the C. Officinalis, var. Bonplandiana, and the Uritusinga reproduce exactly those grown in South America, but it is not so with the Crispa, which seems to be represented by several more or less distinct varieties. These are all elegant, and apparently delicately formed sorts; and one, having (according to McIvor) the habit of the weeping willow, might be called the variety dependens. It remains to be seen what their special commercial value may be. The Crispa (as gathered by Seemann) is distinguished by very hirsute scrobicules, and these are reproduced (but irregularly) in a number of plants of this sort which I have raised from seed received from Mr. Thwaites, but I cannot find them in the specimens from Ootacamund. I miss them also in some very healthy plants which now (in October) are growing in the open air in my garden. Possibly climate may influence their production.

England, is the most eminent Quinologist on the Continent, and whose opinion, as an eminent, practical, and scientific man, would prove of great value.

16. I may mention that M. Delondre has very kindly offered his assistance, in conjunction with Mr. Howard, in ascertaining and fixing the principles necessary to be known, before we can secure complete success in this interesting cultivation.

17. NEW SPECIES AND VARIETY OF CHINCHONA INTRODUCED.—A very valuable variety of C. Calisaya was presented to me while in England by Mr. J. E. Howard for the Indian Government, and I am happy to be able to record that this species has been safely introduced to this country, and promises to do well. It yields one of the best sorts of Yellow Bark, and the plant itself is of rapid growth, although apparently unsuited for cultivation in very exposed situations. Herr vanGoorkum, the Superintendent of Chinchona cultivation in Java, has also very kindly supplied us with seeds of a variety of Yellow Bark gathered at the east of Sorata in Bolivia. With reference to the species still required to be introduced, in order to complete our collection, I append at foot an extract* describing more effectually than I can what remains yet to be done in this matter.

18. ESTABLISHMENT.—It affords me much satisfaction to be able to report the willing co-operation and zeal with which my Assistants have carried out the various operations entrusted to their care. I regret much to intimate that we will shortly lose the valuable services of Mr. Batcock, the Deputy Superintendent, who, in consequence of ill-health, has been compelled to resign the service in order to return to Europe. Mr. Charles Dawson, the Assistant Superintendent at Neddivuttum, has carried out the works there most satisfactorily, as also on the Hooker and Wood Plantations at Pykara, which, during my absence, were placed under his charge. Mr. de Facien, the Assistant Superintendent on the Dodabetta Plantations, has shown great zeal and interest in his work. In the Office Establishment, Narrainsawmy Naidoo and Mr. McNair have given every satisfaction in the performance of their duties as Office Manager and Pay Clerk. Mr. Bennett has been engaged as a Writer pending passing the prescribed examination, as also M. Ramanjaloo Naidoo.

19. CONVICT LABOR.—The employment of convict labor on our plantations has been found to be productive of very satisfactory results. This labor gives the

* In concluding these remarks, I will embrace the opportunity to press upon the notice of the Indian Government the importance of completing the preliminary labors which have been so satisfactorily commenced towards the complete success of the plantations in India, by commissioning the Agent about to be sent out to these districts, to collect, not the red sort of Pitayo only, but all the varieties which have been proved in commerce to be valuable. Very especially Karstin's C. Lancifolia var. discolor, and his small-leaved variety, furnishing the Calisaya of Sta. Fe., both which are, in my opinion, even more promising than the Pinonde Pitayo bark. Also, the original sorts of Pitayo bark, the C. Pitayensis, and the C. Trianae, should be sought for and found, as they cannot be really extirpated, and it is obvious, from the recent success of McIvor in changing the alkaloids by cultivation, that the large free-growing trees, producing early an abundance of bark should be fully tried under the new system in India, even if their yield in their native habitat (as for instance the "Tunita") is more of Chinchonidine than of Quinine.

In order to complete the collection of the Loja barks, the seed of the var. Amarilla del Rey (the best of all barks probably for pharmaceutical purposes) should certainly be obtained, and I would further indicate the barks of the district El. Pan, east of Cuenca, as having great value, and also as growing to the height of 10,000 feet above the level of the sea, and being, consequently, very hardy, and such as might be habituated to comparatively cold climates.

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advantage not only of being more permanent than free labor, but it is available at all seasons of the year; and work can be performed by convict labor with greater certainty, and at a somewhat lower rate than it is possible to perform by free labor. On the Dodabetta Plantation especially, the employment of convict labor has been most satisfactory. Here we have had no escapes, or even attempts at escape, no deaths, and no serious cases of sickness. The men have worked cheerfully, and on the whole are well behaved, notwithstanding many of the convicts being imprisoned for life; some of them also are men of desperate character, such as our Malay convicts. These and the Chinese convicts have proved to be the most useful men we have on the plantations. Every inducement has been offered to cause the convicts to take an interest in their work, and to perform it cheerfully. At Neddivuttum the health of the convicts has not been so good as at Dodabetta, partly in consequence of two batches of the convicts arriving at an unfavorable season; many of these men suffered from the sudden change; dysentery, bronchitis, and chicken-pox broke out among them. Having at that time insufficient hospital accommodation, the diseases spread more than otherwise would have been the case. We have now erected a good hospital at some distance from the Jail, and it is anticipated that in our future reports, we will be able to shew the health of the convicts at Neddivuttum much improved. At present this Jail, although so recently established, bears a favorable comparison with others in the plains; and as the employment in which the men are engaged is very healthy, and in the Jail they have every comfort, so soon as they become accustomed to the climate, there can be no doubt the health of the prisoners in this Jail will shortly equal Dodabetta.

20. PROGRESS OF OPERATIONS.—No extension of buildings has been found necessary in the propagating department. Our operations in this respect must shortly be decreased as, in a few months, sufficient plants will be propagated to complete our plantations. The total number of plants propagated up to 31st March of the current year is 2,353,370, exclusive of 170,740 plants distributed to the public.

21. The following table shews the number and distribution of our plants and seeds on the 31st March 1868:—

Date.	Total number of plants propagated.	Total number permanently planted out.	Total number of plants distributed to private individuals.	Total quantity of seeds distributed to the public.
April 1867	...	...	...	Oz.
May "	35,880	156,340	...	...
June "	30,360	...	141	5
July "	27,270	...	...	6½
August "	48,360	183,361	...	...
September 1867	123,480	...	2,170	2
October "	31,320	...	30,390	5½
November "	54,640	...	135	8
December "	59,920	...	1,337	7
January 1868	17,280	...	500	9
February "	50,700	...	...	6½
March "	40,000	...	10,020	2
	60,000	...	...	14
Previously	579,210	339,701	44,693	65½
	1,774,160	301,211	126,047	224
Total	2,353,370	740,912	170,740	88

22. On the Neddivuttum Plantations, 82 acres have been planted. Thus the total extent under cultivation here is now 526 acres, this extension has been in

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the completion of the Kilgraston and No. 2 Denison Plantations, 180,000 pits have been prepared and ready for planting, and 70,000 pits made, but not filled. On the Hooker Plantation, 35 acres have been planted, making a total of 61 acres permanently planted out on this plantation, and 50,000 pits prepared for this season's planting. The roads, drains, and fences, throughout the planted portion have been completed. At the Jail a detached building, 68 × 30 feet, has been erected as a hospital, and is capable of accommodating 20 patients. It consists of two sick wards, each 25 × 14½ feet, well ventilated and provided with wooden cots, mattresses and bolsters; a Surgery, Office, and bath-room; two new blocks of Police lines have also been erected, consisting of 11 rooms, 10½ × 10½ feet, each room being supplied with a wooden cot. These lines have been erected in lieu of four huts which had to be removed to make room for the new hospital. A comfortable bungalow has also been built for the Police Inspector, together with a new block of warder's lines, so that the whole of the buildings on this plantation are now completed.

23. On the Wood Estate at Pykara 15 acres were planted last year, making a total of 128 acres under cultivation on this plantation.

On the Dodabetta Plantation 41 acres were planted, making the total of 353 acres under cultivation on this plantation. Here, the whole of the land has been fully prepared for planting. On this plantation a new block of Police lines has been built at some distance from the Jail, this completes all the buildings necessary on this plantation.

24. On the Malakoondah Plantations 25 acres have been planted; these are the first plants permanently planted out on this plantation. The Jail and attached buildings are completed, but in consequence of the road not being finished, the prisoners have not yet been located there. The new road to this plantation has been traced and cut out to a bridle-path nearly one-half the entire distance, but it is not bridged, and much yet remains to be done to render this road available for the plantation.

25. BOTANICAL GARDENS.—During the past year great progress has been made in the gardens. The Band-stand has been completed, and the ground around it laid out. A new terrace has been made on the upper side of the lawn, No. 20 in the plan, which accompanied last year's report. This terrace has been laid out in ornamental flower beds, and bordered with Ivy, a system of gardening now much in use on the Continent of Europe. The erection of Mr. Broughton's house last year afforded an opportunity of laying out what was before an unused corner of the gardens, the terrace here has been laid out in a *parterre* in the free style, and the sloping bank planted with ornamental clumps of valuable trees and shrubs. Many of the introductions of recent years now begin fairly to shew their character and adaptability to this climate. Among these may be noticed as valuable economical plants: *Exagonium purga*, the Jalap; *Convolvulus Scammonia*, the Scammony; *Aralia papyrifera*, the Rice paper plant of China; and *Phonium tenax*, the New Zealand flax. All these grow vigorously, and are evidently well suited to the climate. The value of the Jalap as a medicine is established by Mr. Broughton's

analysis (noted at foot)* of tubers grown in the gardens here, by which it will be seen that the quantity of the peculiar principle on which its virtue depends, is as great as in tubers grown in its native country. The Scammony has also grown very freely, but the collection of the medicine differs from Jalap, in requiring more time, since Jalap as a drug is simply the tuber sliced and dried in the sun, while Scammony, as gathered in Asia Minor, is the milky juice collected into shells or other suitable vessels as it flows from the growing root. Such a mode is necessarily a work of time, and as we have not yet collected the juice in sufficient quantity, we are unable to speak to its value as a drug when grown here. A quantity of plants of both the Jalap and Scammony have been propagated for distribution, in the hope that both may become profitable products of these hills. The *Aralia papyrifera* has now been planted in the open ground for about ten months; it grows well, and its large foliage and luxuriant habit makes it a fine ornamental plant. The *Phonium tenax*, or New Zealand flax, has been thoroughly acclimatized, and grows vigorously in every situation in which it has been planted, though these have been much varied to test the endurance of the plant. From various experiments which have been made from time to time in England, it appears that the fibre of the plant occupies a place of great importance as in economical product, indeed at one time attempts were made to cultivate it in Ireland with a view to commerce, but the winters proved too severe. Here the plant grows luxuriantly, but hitherto a difficulty has been found in cleaning the fibre, but even if the fibre was not extracted, there is no doubt the leaves cut and dried would answer for weaving into mats, coarse bags, and blinds, and be much more durable than the common date and bamboo mats of the country. The Cowdie pike of New Zealand has been established, and is growing freely. For some time we have endeavoured to introduce the *Gynerium Argenteum* or Pampas grass, but all the seeds we have received have hitherto failed to germinate; we have, however, succeeded in introducing a plant, which is even more handsome than the Pampas grass, this is the *Arundo conspicua* or New Zealand sedge. Our oldest plants of this are producing their second crop of flowering spikes of over eight feet high, and of a most graceful and feathery aspect. The Cashmere Cherry, referred to in my report of last year, has again flowered freely, but though attempts were made to fertilise many of the blossoms, it failed to perfect a single fruit, this will probably be overcome as the tree gains age. In April last, prior to my leaving for England on six months' leave, the Government sanctioned my introducing a consignment of new and useful plants, such as it might appear desirable to select in England and on the Continent, and to be brought out to India on my return. A large consignment of about 1,100 plants was, therefore, prepared sometime before my departure from England, these I brought out with me, and nearly all reached the Neilgherries in good order.

* Para. 4. I prepared the medicine by drying the sliced tuber in the sun, and reducing them to powder. Of this I made a chemical examination, comparing it with a good specimen of commercial Jalap which I obtained for this purpose from Mr. Hanbury. The active medicinal principle of Jalap consists in its peculiar resin, and the comparative amounts of this substance can be thus stated:—

Indian grown Jalap.		Specimen of commercial Jalap.	
Tuber No. 1,	11.0 per cent.		11.0 per cent.
Do. " 2,	10.6 do.		
Do. " 3,	11.2 do.		

It would be out of place here to give an entire list of the plants thus brought out, but no plant which appeared to be of value and likely to succeed in India was omitted. The list includes a great number of Japanese plants lately introduced to Europe, indeed it is only within the last few years that the flora of Japan has been well represented in European gardens. The advance horticulture has made in Japan has been productive of many curious forms of plants, and variegation seems to be an essential characteristic of popular plants among the Japanese, the consequence is that almost every species in addition to its normal form, has also its variegated form, which is sometimes of great beauty. Among the plants introduced, and now growing freely, are several kinds of hybrid clematis, many species of *Arbatus*, *Laurus*, *Ancuba*, and *Berberis*, the *Aralia Suboldii* and its variegated form, a handsome plant with fine foliage, rivalling the fine *A. papyrifera* noted above, variegated forms of *Yucca* (Adam's needle) and of *Phonium tenax* (New Zealand flax), *Lapageria rosea* and *L. rosea alba*, two superb climbers, natives of Chili, and belonging to the natural order *Smilaccea*, also *Ampelopsis Virginica*, a handsome free growing creeper. The common Holly of England has been frequently introduced, but though we have plants many years old they are not more than a foot high. For a long time it has been wished to introduce some substitute for this favorite and handsome plant, and one that grows freely and retains the characteristics of the Holly, this has now been secured by the successful introduction of several species of the Japanese genus *Osmanthus*, in foliage these are identical with the Holly, both in its green and variegated forms, and they promise at present to do well here. Of the highly ornamental and very useful Japanese timber trees, *Sciadopitys verticillata* (the umbrella pine), *Retimspora pisifera*, *R. plumosa*, *Thupopsis dolabrata*, *Thujopsis latevireus*, *Thuja aurea*, and several species of *Podocarpus*, have been successfully introduced, several of these are now being propagated. The *Olea Europæa*, or true Olive, has also been introduced, both in its normal and variegated forms. Many fine bedding and border herbaceous plants have been introduced, and are now being propagated in great quantities, the most interesting of which are all the leading varieties of perennial Phlox, Violets, Russian and Neapolitan, perennial Lobelias, the best kinds of Delphinium, Sedum and Saxifrage, also the very ornamental Chinese Colts-foot, *Tussilago parfara*, also the best kinds of Fuchsia, all these are now being extensively propagated. In addition to the living plants introduced, many opportunities afforded while traveling through the various Horticultural establishments at home, to collect seeds of plants likely to be of value to this country. To the following gentlemen I am under special obligation for valuable assistance in preparing our collection of plants, viz. to Dr. Hooker of the Royal Gardens, Kew, Messrs. Veitch and Sons of Chelsea, Mr. James McNab of the Edinburgh Botanical Gardens, and Dr. Moore of the Dublin Botanical Gardens. When in the south of Europe, Mrs. McIvor succeeded in obtaining seeds of a very prolific variety of Apricot, and of some handsome *Datura*, which have been reared and are growing freely. Dr. Hooker has recently furnished us with a packet of seeds of *Juniperus Bermudiana* and Syrian Tobacco. To Major Beddome, we are indebted for rare Orchids and Ferns, also some new garden varieties of flowering plants. To Mr. J. Deschamps, Madras, for a large and valuable collection of European seeds, embracing many kinds of flowering plants

*Proceedings of the Madras Government, Revenue Department,
9th July 1868.*

quite new to our gardens, also seeds of several new kinds of fodder-plants from the south of France, several of the latter promise to prove of great utility in this climate. To E. B. Thomas, Esq., for seeds of Magnolia Grandiflora, Olive, Gooseberries, Currants, Filberts, Walnuts, and many other things. From this gentleman we receive occasional supplies of seeds, shewing the great interest he takes in the development of horticulture in India.

26. Table exhibiting the distribution of garden plants and seeds for the official year 1867-68:—

	Fruit trees and shrubs.	Timber trees.	Shrubs and flowers.	Collection of seeds.	Amount.		
					RS.	A.	P.
April 1867	.....	112	28	9	40	2	0
May „	54	6	545	14	259	4	0
June „	.....	250	206	14	131	0	0
July „	12	19	32	10	57	1	0
Aug. „	.....	22	108	14	83	8	0
Sep. „	.....	12	51	22	109	0	0
Oct. „	.....	51	97	39	152	3	0
Nov. „	12	.....	57	11	55	11	0
Dec. „	.....	.....	12	.....	9	8	0
Jan. 1868	.....	.....	33	7	33	12	0
Feb. „	42	.....	13	5	26	7	0
March „	.....	.....	51	6	34	10	0
Total distribution	120	472	1,233	151	992	2	0

27. TEA PLANTATION.—The Tea Plantation has not been extended beyond the number of plants noted last year, viz., 13,500. The plants are generally doing well, as they increase in age the differences in individual specimens become very apparent, many of the plants have flowered during the past year, but they are still too young to produce perfect seeds.

28. A cattle-pen has been built near the plantation to secure manure, as there is no doubt that to make a profitable speculation, it must have high cultivation. In accordance with the instructions conveyed in paragraph 6 of Government Order, under date 20th of June 1867, No. 1,367, a number of tea plants have been raised by cuttings from such kinds as promised by their luxuriant habit to give the greatest quantity of leaf, and these will be separately planted and their produce per acre tested and compared.

29. CONCLUDING REMARKS.—By the above details it will be apparent that the various operations on our plantations have made most satisfactory progress; the Plantations at Neddivuttum, Pykara, and Dodabetta are now extended in their preparatory operations to their full extent, and it is anticipated that the planting operations of this season will go far towards the completion of these plantations. This year 198 acres, additional, have been planted, making a total of 1,093 acres under cultivation.

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9th July 1868.*

30. In conclusion, I beg to tender my grateful acknowledgments to the Madras Government for the interest they have taken in the development of this important national undertaking. To Mr. J. E. Howard, for his valuable contribution of a new variety of Chinchona Calisaya, as also for much valuable information in connection with the formation of alkaloid and the reproduction of bark; also, to Mr. Clements R. Markham, of the India House, for the active interest he has taken in the extension of Chinchona cultivation in British India.

Ootacamund,
15th May 1868.

(Signed) W. G. McIVOR,
Supt. Govt. Chinchona Plantations.

Proceedings of the Madras Government,

A.

Sanctioned estimate cost of each Chinchona Plantation

Particulars.	Superintendent and Office Establishment.			Nursery Department.			Dodabetta Plantations.		
	1860 to 1866.	1866-67.	1867-68.	1861 to 1866.	1866-67.	1867-68.	1860 to 1866.	1866-67.	1867-68.
Establishments including salaries, &c.	34,378	7,773	8,804	20,234	3,711	4,684	29,418	10,736	8,044
Buildings ...				4,000	.....	100	8,160	2,500	1,600
Tool and Store-rooms							500	200	100
Coolies quarters ...							900	.....	200
Felling ...							2,450	400	.....
Clearing, Weeding, &c.							2,330	300	1,000
Pitting ...							2,450	800	500
Carriage of Plants ...							700	1,000	700
Planting and shading							1,250	700	700
Trenching ...							2,900	308	.....
Enclosing ...				756	.....	.....	6,400	500	.....
Road making ...							2,825	.....	.....
Tools ...					400	200	2,525	1,000	200
Contingencies ...		95	100	996	600	200	3,099	700	1,000
Clothing ...					100	30	.....	150	100
Total ...	34,378	7,868	8,904	25,986	4,811	5,214	65,907	19,294	14,144

Actual expenditure on each Chinchona Plantation

Particulars.	Superintendent and Office Establishment.			Propagation and Nursery Department.			Dodabetta Plantations.		
	1860 to 1866.	1866-67.	1867-68.	1861 to 1866.	1866-67.	1867-68.	1860 to 1866.	1866-67.	1867-68.
Establishments including salaries, &c.	32,354	7,715	8,116	16,810	6,536	6,832	18,678	6,405	6,389
Buildings ...				10,725	1,504	660	12,615	3,023	3,200
Tool and Store-rooms							430	.....	200
Coolies quarters ...							1,058	.....	350
Felling ...							3,950	257	.....
Clearing, Weeding, &c.							3,500	78	1,160
Pitting ...							5,108	384	1,011
Carriage of Plants ...							1,535	250	1,330
Planting and shading							4,065	621	1,163
Trenching ...							2,600	800	280
Enclosing ...						548	4,357	350	590
Road making ...							5,670	625	614
Tools ...				170	.....	70	2,754	450	350
Contingencies ...	250	.....	.....	1,150	383	170	3,461	616	989
Excavating ...								450	644
Clothing ...						54	.....	.....	120
Various ...									1,900
Total ...	32,604	7,715	8,116	28,855	8,423	8,334	69,781	14,309	20,329

Revenue Department, 9th July 1868.

from commencement of operations to 31st March 1868.

Neddivuttum Plantations.			Pykara Plantations.			Malkondah Plantations.			Total.
1861 to 1866.	1866-67.	1867-68.	1862 to 1866.	1866-67.	1867-68.	1863 to 1866.	1866-67.	1867-68.	
57,444	12,856	17,120	17,611	2,860	3,036	8,720	4,225	4,376	2,56,030
11,330	3,300	2,500	3,530	.....	.....	3,250	1,075	200	41,545
650	.....	250	975	.....	200	275	400	100	3,650
2,700	300	200	1,200	100	150	750	200	.....	6,700
6,900	800	.....	3,150	800	500	7,050	900	300	23,250
6,900	650	1,500	3,150	500	500	900	800	100	18,630
7,900	400	500	1,900	700	500	900	800	300	17,650
2,200	1,000	1,000	800	200	150	50	300	100	8,200
2,350	900	1,000	2,000	500	150	.....	100	100	9,750
6,000	.....	.....	9,950	.....	.....	1,250	542	.....	20,950
5,250	600	.....	1,300	200	.....	1,325	500	.....	16,831
3,070	.....	.....	2,150	450	.....	2,675	433	.....	11,603
3,182	1,200	400	1,782	600	180	1,841	600	100	14,210
5,634	1,300	1,600	2,896	500	300	1,396	500	400	21,316
.....	200	200	.....	50	70	.....	50	100	1,050
121,510	23,506	26,270	52,394	7,460	5,736	30,382	11,425	6,176	4,71,365

from commencement of operations to 31st March 1868.

Neddivuttum Plantations.			Pykara Plantations.			Malkondah Plantations.			Total.
1861 to 1866.	1866-67.	1867-68.	1862 to 1866.	1866-67.	1867-68.	1863 to 1866.	1866-67.	1867-68.	
39,538	15,350	15,861	5,574	1,935	1,686	2,642	3,050	2,163	1,97,634
15,110	3,294	2,117	1,683	.....	87	1,740	442	375	56,575
1,469	.....	.....	845	.....	.....	300	.....	.....	3,214
3,650	.....	.....	1,900	.....	.....	250	.....	.....	7,203
6,280	983	720	5,750	.....	436	3,251	.....	101	21,728
4,900	700	1,614	5,375	322	408	2,450	415	597	21,519
6,738	913	859	2,955	.....	660	1,488	240	856	21,212
3,511	300	849	1,015	200	264	.....	150	441	9,845
3,938	939	1,078	765	150	426	.....	250	445	13,840
5,387	1,104	.....	1,700	300	35	200	200	175	12,790
3,210	280	887	1,429	200	156	1,050	.....	.....	13,057
4,427	1,030	100	2,404	662	275	2,177	22	90	18,126
3,518	239	441	2,750	200	50	1,000	350	81	12,423
5,105	617	978	1,000	160	207	475	135	190	15,886
.....	1,195	.....	.....	.....	.....	.....	.....	.....	2,389
.....	.....	159	.....	.....	38	.....	.....	35	406
.....	.....	2,250	.....	.....	200	.....	.....	235	4,585
1,06,781	26,944	27,913	35,145	4,129	4,928	17,023	5,254	5,784	4,32,367

*Proceedings of the Madras Government, Revenue Department,
9th July 1868.*

B.

Meteorological observations made at the Government Chinchona Plantations at Neddivuttum, from 1st April 1867 to 31st March 1868.

Months.	Hygrometer.		Maximum in shade.	Minimum in shade.	Rain in inches.	Days with rain.	Days without rain.
	Dry Bulb	Wet Bulb					
April ... 1867	66	59	82	60	1.83	6	24
May ... "	68	58	83	62	4.26	13	18
June ... "	58	57	72	55	23.0	9	21
July ... "	57	56	58	52	46.01	14	17
August ... "	60	60	62	55	12.52	16	15
September ... "	59	58	68	54	19.19	23	7
October ... "	61	60	70	56	7.14	11	20
November ... "	60	56	70	56	1.67	5	25
December ... "	60	57	75	54	...	...	31
January ... 1868	58	51	76	50	3.10	4	27
February ... "	59	55	74	54	0.44	2	27
March ... "	66	65	80	56	...	...	31
Total...	...	...	...	...	119.16	103	263
Mean...	61	57.7	72.5	55.3			

C.

Meteorological observations made at the Botanical Gardens, Ootacamund, from 1st April 1867, to 31st March 1868.

Months.	Hygrometer.		Maximum in Shade.	Minimum in Shade.	Solar radiation.	Rain in inches.	Days with rain.	Days without rain.
	Dry Bulb	Wet Bulb						
April 1867.	63.13	56.26	73.45	52.45	120.03	4.01	13	17
May "	63.38	58.67	73.24	54.27	113.59	5.19	16	15
June "	58.94	56.42	65.90	51.60	100.17	2.81	18	12
July "	59.27	57.19	64.43	52.80	95.40	9.06	22	9
August "	57.19	55.26	66.72	50.46	98.79	1.77	15	16
September "	57.09	55.14	64.45	50.65	101.38	4.48	23	7
October "	58.51	56.39	69.03	51.03	105.90	6.80	23	8
November "	56.16	51.23	68.76	43.87	113.00	1.16	5	25
December "	57.62	48.60	70.87	44.35	132.60	0.28	3	28
January 1868.	57.06	52.08	69.63	45.81	118.94	4.14	5	26
February "	58.44	49.69	67.42	39.97	119.74	0.00	0	29
March "	59.97	51.03	75.50	48.80	133.80	0.84	4	27
Total...	...	...	...	...	...	40.54	147	219
Mean...	58.97	54.00	69.12	48.84	112.78			

OOTACAMUND,
15th May 1868.

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

*Proceedings of the Madras Government, Revenue Department,
9th July 1868.*

No. 156. From the Superintendent of Government Chinchona Plantations, to the Acting Under Secretary to Government, Revenue Department, Fort St. George, dated Ootacamund, 1st June 1868, No. 60.

1. With reference to your Official Memorandum No. 66, dated 27th ultimo, I have the honor to inform you that the cause of the cessation in the demand for Chinchona plants by the public, arises in consequence of the gratuitous distribution of Chinchona seed, which, together with the "Notes on Chinchona cultivation," has enabled planters to rear the seeds successfully. This being the case, it would not pay planters to remove the plants even if they were furnished by us gratuitously.

2. Upwards of 100 ounces of Chinchona seeds have already been distributed to the public from this establishment, and as each ounce of seeds should produce 20,000 young plants, these seeds would furnish the enormous number of 2,000,000, a number more than sufficient to meet the requirements of all private planters, and we are still distributing seeds to all applicants, therefore the demand for plants by the public may be considered to have ceased.

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

No. 157. From J. BROUGHTON, Esq., Quinologist to Government, to the Secretary to Government, Revenue Department, Fort St. George, dated Ootacamund, 21st May 1868.

Concerning the operations of the past year, I beg permission to report briefly, since the greater part of the special details have already been communicated to Government.

I. ARRANGEMENT OF WORKING LABORATORY.—In May, the rooms erected as a laboratory were completed, and the chemical apparatus, which shortly after arrived from England, enabled me to furnish them for experimental and analytical work. The arrangements then made have since been found effective.

II. INVESTIGATION INTO THE QUALITY OF THE VARIOUS SPECIES OF CHINCHONA.—In the early part of the year, an examination of the various species of Chinchona barks was made, when the yield was in nearly all cases found to be satisfactory. The results obtained were published in Proceedings of the Madras Government, Revenue Department, 12th April and 26th July 1867.

III. APPLICATION OF THE BARKS IN INDIA.—Subsequently, experiments were made in order to determine the best means for readily utilizing the febrifuge principles of the Chinchonæ and applying the same. As a conclusion, I had the honor of recommending the employment of the purified amorphous alkaloids, obtained by precipitation, and also the mixed sulphates in a crystalline form. These preparations are now under consideration by the medical authorities. The few medical trials hitherto made with these substances appear encouraging. (Proceedings of Madras Government, Revenue Department, December 13th, 1867, February 17th, and May 18th, 1868.)

IV. SEARCH FOR INDIGENOUS MATERIALS FOR ALKALOID MANUFACTURE.—The ready procurability of certain economic products being important in reference to

*Proceedings of the Madras Government, Revenue Department,
9th July 1868.*

the question of alkaloid manufacture in this country, I obtained the permission of Government for the personal investigation of this subject, and spent some time in the examination of the products of the districts adjacent to the Neilgherries. The results were communicated to Government (Proceedings of Madras Government, 22nd April 1868), and were satisfactory.

V. OTHER WORK.—During the past year, investigation into the natural conditions determining the occurrence of the alkaloids in Chinchona barks has not been neglected, though the results obtained have yet to be communicated.

VI. CONDUCT OF EMPLOYEES.—John Miller, my paid pupil, has made a certain progress in serviceableness and technical ability, though in both his progress has been slow and somewhat disappointing. I have received great assistance in actual chemical work from the intelligence of Mr. W. Davison, who has hitherto fulfilled the post of Writer.

(Signed) J. BROUGHTON,
Quinologist to Government.

No. 158.

ORDER THEREON, 9th July 1868, No. 1,901.

Miscellaneous.

1. Ordered that the above annual Reports be forwarded for the information of the Secretary of State, and that the usual distribution be made to the other Governments.

2. They indicate very satisfactory progress in the important Chinchona experiment.

3. A copy will be forwarded to Herr van Goorkum, the Superintendent of Chinchona cultivation in Java, as requested by Mr. McIvor.

(True Extract.)

(Signed) W. HUDLESTON,
Secretary to Government.

To the Superintendent of Government Chinchona Plantations.
,, J. Broughton, Esq.

Erd. S. T. Augustin.

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(Signed) J. BROUGHTON,
Quinologist to Government.

*It will be noticed in the Admin. Report
that the Govt. have sanctioned the establishment
of a permanent manufacturing on a
large scale.*

Rev = 1868 Oct 4
Bo of Govt. for July
N. 1694.

From
The Sup^r. Govt.
Chinchona
Plantations

Dated 16th 2 May/68
Received 18th 2

18 22-51-
E-1-✓

I wish to have printed
 copy. N.
 No. 155

+ of Cont. Serv. Months
for the offl - years
1867/68 -

1867/68 -
24 May/68 R 26. R C 1 July 68

Forwarding Admin.
-istration Report +
WOM

12th
W-1901-
Rev. Dept.

Proceedings of the Madras Government
Under date the 9th June 1868

Read the fol-
-lowing papers:-

From the Supt. Govt. Chin. Plant. }
Forwarding Administrative } (Here enter 16th May/68 N.51)
Report of the Supt. of Chin. }
Plantations for the official }
year 1867/68 -

Do ————— Do
Informing that the cause }
of the cessation in the demand } (Here enter 1st June/68 N.60)
for Chin. Plants by the }
Public arises in consequence }
of the gratuitous distribution }
of Chin. seeds -

From the Govt. Zoologist }
Submitting a brief report } (Here enter 21st May/68 N.)
of the operations of the }
past years

W.R.

by

Ordered that
the above annual
reports be forwarded
for the information
of

of the Secretary of State
and that the usual
distribution be made
to the other Posts.

They indicate
very satisfactory
progress in the im-
portant Chincona
experiment.

A copy will be
forwarded to Herr
van Gookum the
Supt. of Chincona
cultivation in Java,
as requested by Mr
McLean.

L.B.

11 Copy to the Supt. Genl. Chin. Cult. Java
J. Broughton Esq.

Reported to England
D/ 4th August No. 43 of 1868 Mr

CP.

Pinchona Administration
Revenue 1868 Deptt
Pro of Govt for July

No 1901.

Pro of the Madras Govt
D/ 9th July 1868.

Dec

Letter C No 1734 of 1869

No. 155 @ 158