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GOVERNMENT OF MADRAS.
REVENUE DEPARTMENT.

29th August 1881, No. 1,280.

READ THE FOLLOWING PAPERS:—

No. 413. From Colonel R. H. BEDDOME, Conservator of Forests, Madras, to the Secretary to Government, Revenue Department, Madras, dated Ootacamund, 4th June 1881.

ADVERTING to the G.O., No. 1,670, dated 8th December 1880, I have the honor to inform you that I have lately thoroughly inspected all the Government Chinchona Plantations at Naduvatom, Pykara, and Ootacamund, and I herewith submit my report on the same. I have given my field notes on each plot in the different plantations as taken when going over them with the officers in charge: to these I have added general remarks on the condition of the three different plantations; notes on the coppicing, scraping and stripping systems of harvesting the bark; remarks on the different species grown, condition of buildings, nurseries, &c., together with other remarks and suggestions.

NADUVATOM CHINCHONA PLANTATION.

2. No. I Plot, 1862, A.—14.12 acres, east exposure, shola soil, steeper, stonier and not so rich as in the next plot of the same year's planting; growth good though not equal to plot B; planted originally with three-fifths Succirubra and two-fifths Officinalis, all of which have now been barked seven times; one block of about 5 acres of Officinalis is of poor growth, chiefly owing to wide planting.

In one spot 57 trees, Succirubra, were coppiced rather roughly in October 1873; no suckers were left when the trees were cut, and 22 out of the 57 stools have since died.

The following are measurements of ten of the living coppice:—

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Height ...	24'	22'	23'	23'	24'	17'	18'	19'	16'	18'
Girth ...	17"	15"	15"	12"	13"	12"	13"	19"	11"	12"
Number of Shoots ...	2	2	3	3	2	2	2	1	2	2

in the same place and standing in eight rows with the above, 58 trees were also coppiced in May 1873, the suckers being left when the trees were cut, only one stool is dead.

The following are measurements of ten:—

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Height ...	30'	21'	26'	24'	23'	26'	23'	24'	24'	23'
Girth ...	20"	20"	16"	15"	15"	17"	16"	16"	20"	19"
Number of Shoots ...	2	2	3	2	2	1	1	2	2	1

In another spot 200 Succirubra were coppiced in May 1871 when nine years old; suckers were left and only one stool died, the yield of the bark being 1,350 lb. green, drying to 453 lb.

These 199 were again coppiced in March 1881 when ten years old (all cut flush with the ground, no suckers left), the yield of the bark being 3,365 lb. green, drying to 1,312 lb.; none of these had commenced again to grow when I saw them on 1st of May, but there had not of course been time for this.

3. No. II Plot, 1862, B.—17.06 acres, shola soil, west exposure, but sheltered by a hill; nearly all Succirubra, but some Officinalis and Pubescens.

The following are measurements of six selected Succirubra:—

Height ...	35'	38'	32'	33'	36'	37'
Girth ...	31"	34"	29"	26"	33"	32"

All the Succirubra and Officinalis have been barked eight times.

Only about eight trees are left out of a quantity of *Micrantha* trees planted in one place; this species is reported always to die off; the blanks have been filled up with about 600 *Pubescens* trees (entered in Major Walker's report as supposed to be *Anglica*), which are growing well and luxuriantly.

In this plot 115 trees of poor growth, unbarked, were coppiced in May 1875, yielding only 248 lb. of green bark. Thirty-three stools died, the surviving 82 average 9 feet in height and $5\frac{1}{2}$ inches in girth, and the stools have from three to six shoots now growing (not barked).

4. No. III Plot, 1863.—5.41 acres, shola soil, the portion above the road sub-soil indifferent, growth fair, the portion below the road poor from wide planting and exposure to wind, nearly all *Succirubra* barked seven times.

5. No. IV Plot, 1864, A.—8.86 acres, above the road chiefly *Succirubra* with a few *Officinalis*, fair growth where the soil was shola, poor in places where it was originally grass; below the road *Succirubra* and *Officinalis* mixed, very poor growth from wide planting and exposure to the wind, the soil is also rather poor, all sized trees, barked seven times.

6. No. V Plot, 1864, B.—4.46 acres, shola soil, chiefly *Succirubra* with a few *Officinalis*, all barked seven times, poor growth owing to wide planting, a few trees dying out owing to a combination of poor soil and exposure to wind.

7. No. VI Plot, 1864, C.—7.87 acres, shola soil, planted with *Succirubra* and *Officinalis* in nearly equal proportions quite intermixed, growth good but thin in portions owing to the original wide planting, all barked five times. In this plot $\frac{1}{4}$ acre (adjoining coppice in next block) coppiced in May and June 1879, 56 four times barked trees cut, 43 stools have grown well and 13 died.

8. No. VII, 1864, D.—17.04 acres, shola soil, *Succirubra* and *Officinalis* in equal proportions, growth very good, trees barked five times.

In this plot a block of $4\frac{1}{2}$ acres of trees four times previously barked was coppiced in 1879 (from 31st of May to end of June), 2,263 trees were cut and 2,091 are now growing; the trees were sawn through about 3 inches above the ground and adzed over with a convex surface to nearly flush with the ground; they bled excessively owing to the lateness of the season; hence I think the failures. The present growth of the remainder is most healthy and all that could be desired; each stool has from 1 to 3 stems, 4 to 6 feet high; there is also a late growth of smaller stems which, I think, should be pruned off, but Mr. Rowson states that the Duke of Buckingham requested that these should be left.

9. No. VIII Plot, 1864, E.—11.58 acres, shola soil, *Succirubra* and *Officinalis*, the former in a greater proportion; growth of both very good and healthy; *Succirubra* barked twice, *Officinalis* barked five times.

10. No. IX Plot, 1864, F.—8.58 acres, shola soil, planted with *Succirubra* and *Officinalis* in nearly equal proportions; growth of both very good, trees barked three times.

11. No. X Plot, 1865, A.—18.32 acres, in two plots waste land intervening; first about 2 acres grass land planted with *Officinalis* and a very few *Succirubra*, very much exposed to the south-west monsoon; growth poor, trees barked five times.

Second portion shola soil (except a small corner of grass land with about 150 trees very poor growth) planted with *Succirubra*, wind-blown and growth poor except in a low protected portion where the growth is fair.

12. No. XI Plot, 1865, B.—12.95 acres, shola soil, about nine-tenths *Succirubra*, fair growth in portions, poor where wind-blown, one corner very exposed, trees very poor and dying out; about one-tenth *Officinalis*, very good growth; all the trees of both species barked four times. There are some *Pubescens* trees.

13. No. XII Plot, 1865, C.—12.43 acres, shola soil, *Succirubra* chiefly, *Officinalis* about 3 acres, all splendid growth, all barked six times; the plantation is too crowded in parts; the trees not being three feet apart; the thin girthed trees not reaching the light should be uprooted.

14. No. XIII Plot, 1866, A.—4.10 acres, shola soil, nearly all *Officinalis*, growth good but planted originally too far apart, barked three times.

15. No. XIV Plot, 1866, B.—14.34 acres, shola soil, all *Succirubra* of very fine growth, barked six times; there was a good deal of *Calisaya* in this plot, but it all died out some years ago.

16. No. XV Plot, 1866, C.—12.45 acres, shola soil, *Succirubra* except a small quantity of very fine old *Officinalis* and some young *Calisaya* and *Pubescens*, growth of *Succirubra* very fine, barked six times, about one acre formerly planted with *Calisaya*, all dying or dead, was uprooted, yield of bark 730 lb, sale proceeds unknown; this block has been replanted with 2,000 young *Calisaya* and 600 young *Pubescens*.

17. No. XVI Plot, 1868, A.—3.71 acres, all shola, planted chiefly with *Succirubra*, has been burnt over more than once, now poor and very thin, only about 300 trees remaining, soil poor and scarcely worth replanting.

18. No. XVII Plot, 1868, B.—8.13 acres, all shola, about one-third facing west very much blown, planted with *Succirubra*, condition bad; about two-thirds facing east, *Succirubra* and *Officinalis*, about alternate trees very fair growth, all barked twice.

19. No. XVIII Plot, 1869, A.—9.96 acres, grass land, nearly all *Succirubra*, growth fair, particularly in lower portion, trees not barked; 400 *Officinalis* barked twice.

20. No. XIX Plot, 1869, B.—11.83 acres, grass land, all *Succirubra*, upper portion exposed and growth very poor and thin and should be uprooted and replaced by *Officinalis*, lower portion fair growth of Red barks for grass land, trees not barked.

21. No. XX Plot, 1869, C.—13.69 acres, grass land, 2 acres *Officinalis*, good growth, all barked, balance *Succirubra* not barked, fair growth for the soil, but should all be uprooted and replaced by *Officinalis* which may be said of all grass land planted with *Succirubra* in these plantations.

22. *No. XXI Plot, 1869, D.—13.26 acres, grass land except a small patch of shola land, all *Succirubra* except a few supplies of *Officinalis*, not barked, except the small bit of shola soil all poor growth and very thin in the upper portions, should be uprooted and planted with *Officinalis*.

*Major Walker's remarks on these two plots are evidently reversed.

23. *No. XXII Plot, 1869, E.—12.18 acres, all shola land except a small corner of grass land (about 50 trees), all *Succirubra* except supplies of *Officinalis*, growth very good, not barked.

24. No. XXIII Plot, 1869, E.—11.54 acres, two-thirds shola, one-third grass land, all *Succirubra* except supplies of *Officinalis*, growth very good on the shola soil, fair on the grass land, trees not barked, 5 acres coppiced in 1879, balance scraped in 1880, 5 acres *Succirubra* coppiced in July 1879 (in the same manner as in Plot No. VII), 2,628 unbarked trees cut, all stools bled terribly, 973 dead and uprooted, 1,655 growth healthy, shoots 1 to 3 to each stool, 3 to 4 feet high, blanks from the uprootals to be planted with *Pubescens*.

Six acres 4,723 *Succirubra* trees scraped in September 1880 on the new Java principle, none were mossed or covered in any way as it was not supposed to be necessary, 1,978 trees have failed to renew their bark, and the bark and cambium being apparently all dead it is supposed the trees must die, and some have already died; the remainder are renewing their bark satisfactorily, and might probably be scraped again in 1882, but not before.

25. No. XXIV Plot, 1869, G.—20.19 acres, all shola land, all *Succirubra* and *Pubescens* except supplies of *Officinalis*, not barked, splendid growth, *Pubescens* about 20 per cent.

26. No. XXV Plot, 1869, H.—9.20 acres, all shola except a small bit of grass land; shola soil planted with *Succirubra*, not barked, growth very good; grass land planted with *Officinalis*, all barked.

case with "Teak" and "Babul." Again, it is noteworthy that the four-times barked trees have succeeded from coppice with a better percentage than the unbarked trees.

Both these data however are more or less valueless, as the 1869 planting was coppiced nearly a month later than that of 1864 the sap was therefore more up and the trees bled much more which may account for the extra failures.

The coppicing of both years was carried out too late, and I am inclined to attribute the failures to this cause as the stools bled terribly: if the coppice had been in April or early in May, it is probable there would have been no failures at least of healthy trees.

Of the old coppicing experiments carried out more roughly, where fifty-seven unbarked "Succirubra" trees of 1862 planting were clean coppiced in October 1873, all suckers removed, twenty-two have died, thirty-five have grown well and are about twenty feet high, and of fifty-eight trees of the same year coppiced in May 1873, but the suckers left standing, only one stool is dead; and of 200 "Succirubra" of the same year in another block coppiced in May 1871 (when nine years old) suckers left standing, only one stool died; the 199 again coppiced in March 1881 (when 10 years old) no regrowth yet, but sufficient time has not elapsed. The yield of green bark in 1871 was 1,350 lb., but in 1881 it was 3,365 lb., which is noteworthy; and of 115 "Succirubra" of the same year, but of poor growth and unbarked, coppiced in May 1875, thirty-three stools died, the surviving eighty-two about 9 feet high and 5½ inches in girth.

I do not think we should carry out any further coppicing in blocks, but only coppice trees showing signs of decay. I observed here and there dead trees in the different plantations. A tree should never be allowed to die, as its bark then yields no alkaloids; they should be coppiced or uprooted when the signs of decay are evident. It is an established fact that if a sucker or shoot is left when the tree is coppiced it never dies, and when trees have no shoots one can easily be produced by slightly injuring the bark close to the ground. It is also an established fact that if trees are coppiced in June or July, when the sap is well up, there must be many failures owing probably to the excessive bleeding that takes place. We have not sufficient data to say whether trees coppiced in April or early in May will all grow again without any failures.

40. *Uprooting*.—I do not think that this is to be thought of as a harvest-system, but I would uproot all "Succirubra" on grass land at Naduvatom and elsewhere, where it is advisable to replace it with "Officinalis" or "Pubescens." It is doubtful how far seedlings will succeed on land immediately after it is uprooted; it will probably be found necessary that it should remain fallow for a certain period.

41. *Scraping*.—As to the new Java method of scraping, we want, I think, more experience. This first attempt (*vide* paragraph 24) has, it will be seen, proved a failure with "Succirubra," and caused the loss of a great number of trees; it would probably not fail if the trees were mossed or grassed over after the scraping, but one of its advantages was the supposition that the expense of this would be unnecessary. I am inclined to think that the trees are much more likely to suffer from the complete scraping than from the partial barking in alternate strips; we have yet to learn if the scraped bark is more valuable in the market than the stripped bark.

42. *Grass, a substitute for Moss*.—For the last two years Mr. Rowson has employed the coarse Lemon grass of the hills (*Andropogon Martini* and *Schannanthus*) as a substitute for moss for covering the trees after stripping off the bark; it appears to answer in every way as well as moss, the bark never failing to renew; the grass of course lacks the hydrometric properties of moss, and it is possible that bark renewed under it may not be so replete with alkaloids, but I see no reason to fear this; the grass costs only about one-third what moss does, and moss might in time be exterminated; the moss must act like a sponge round the tree in wet weather when the bark is growing most rapidly, and considering how replete the bark itself is with moisture, this is, I think, more likely to be injurious than bene-

ficial; all that is probably required being protection from solar influences and from wind. The first report on bark renewed under grass however will be of great interest.

43. *Red Barks (Succirubra)*.—Although this tree is not adapted to grass land on the Nilgiris, it grows very well in shola soil at Naduvatom, and at lower elevations; Ootacamund is of course too high for it. The bark is not nearly so rich in quinine as the "Officinalis", "Calisaya", and some others; but it is perhaps the richest of all the species in the total yield of alkaloids, and on account of its easy culture, robust growth, and great yield of bark will probably always be the one most cultivated in the Wynad, Coorg, &c., at elevations of 2,500 feet and upwards. It will grow almost everywhere on our western mountains between 2,000 or 2,500 up to about 6,000 feet, if forest soil be selected and a sloping situation; it is however apt to die out on flats as it did in Travancore, unless the subsoil drainage is carefully attended to; and it has been proved that it is useless to attempt its cultivation in the drier climates in the eastern or central parts of this Presidency.

"Succirubra" should never again be planted on grass land at Naduvatom, and what there now is on this soil should be gradually uprooted and replaced by "Officinalis" or by "Pubescens."

44. *"Pubescens"*.—No one can visit the Naduvatom plantation or the "Hooker" at Pykara without being struck by the splendid growth on grass land of the species known as "Pubescens"; whilst "Succirubra" is always very stunted and with the leaves very much crimped and unhealthy looking in this soil, this species or variety is of sturdy fine growth far out-topping the Red barks and with very healthy darker green leaves; the difference in growth, however, is not so marked in the shola soil, as the "Succirubra" grows there equally or nearly equally robust. This "Pubescens" has generally been supposed to be an accidental hybrid of Nilgiri origin and is often known as Mr. McIvor's hybrid; it is, however,

* *Note*.—Hybrids between distinct species could scarcely occur without isolation, or without removing the anthers (of the flowers to be impregnated) at a very early stage, as I find the anthers burst before the valvate lobes of the corolla are fairly open. I find the flowers of *Officinalis* (and all the other species as far as I have observed) dimorphic; some trees have all the flowers with short included anthers and long exserted style, others with long anthers and short included style (this dimorphism occurs also commonly in species of *Hedyotis*—*Anotis* and other genera of this tribe (*Rubiaceae*) indigenous on the Nilgiris). Seeds of hybrids would be sterile except under certain conditions.

two distinct varieties; one he said called

† Nothing to do with the "Chin. magnifolia" *Rz* and *Pavon*, which is now placed in another genus "Cascarilla" differing from *Chinchona* in having a papillose instead of a hairy corolla and in the dehiscence of the capsules.

surface of the leaves, and the young shoots are very slightly pubescent; and I found that Mr. Rowson could not tell one from the other except by very close inspection, and that the difference in *Pubescens*, though sometimes much marked, was in other cases not apparent. The pubescent variety has also been called "Lanosa" and growing in shola soil with "Succirubra" might be passed by as that species by the uninitiated; the leaf however is never so rounded at the apex and it has a flatter surface, and never the crimped look that "Succirubra" always assumes more or less. I found a good many of "Magnifolia" and a few "Pubescens" in the

Dodabetta plantations, and there are some fine old trees of "Magnifolia" in the 1865 plantation which are certainly not supplies (which alone would prove that they could not be hybrids), but here I found them both known to the Superintendent (Narrainsawmy) as "Pubescens," the name "Magnifolia" not being known.

Mr. Rowson informed me that he considered them hybrids, as they had not appeared before the 1869 planting (it will be seen elsewhere that Mr. Cross detected them in the oldest planting); that they both generally came up true from seed, but that he had known many sown as these hybrids come up true "Succirubra" which he however attributed to careless gathering. He also stated that he had largely propagated "Pubescens" and not "Magnifolia" on the supposition that the bark of the former was much more valuable; the bark he also said both of "Pubescens" and "Magnifolia" had not been sent to market except from a few trees taken carelessly by coolies and mixed with other barks, but samples had been collected from one or two trees and sent home for analysis, and this analysis is given in G.O., No. 1,336, of 23rd June 1879, under "hybrid Pubescens," and is most favorable, though I am not inclined, as I have said elsewhere, to give too much reliance on the analysis from single individuals perhaps grown under very favorable circumstances. These specimens were taken from the glabrous "Magnifolia" and not from "Pubescens."

Narrainsawmy, the Dodabetta Superintendent, informed me that he did not consider "Pubescens" a hybrid, as there were large trees in the 1865 plantation which he had always been familiar with since he took charge in 1868; he also stated that if sown they sometimes come up true, but they often come up "Officinalis" (this must of course be due to careless gathering). I subsequently got Mr. Cross to make a careful examination of this species or variety both at Naduvatom and on Dodabetta. He informs me that "Magnifolia" and "Pubescens" are one and same species, and scarcely distinguishable, that he is quite familiar with the tree which he found himself in the Red bark region on the slopes of Chimborazo, but always at a higher elevation than "Succirubra", and that the Cascarilleros or bark collectors always distinguished it as the "Pàtà de Gallinazo" (or turkey buzzard's foot), whilst they called the "Succirubra" "teja" (or tile bark), but that the bark was not put up separately by these collectors. He also states that he believes this tree has never been figured or described although Weddell (Notes sur les Quinquinas) refers to no less than four species as the source of Pàtà de Gallinazo, whilst Mr. Spruce in his report includes the Pàtà de Gallinazo as bark collector's lore, evidently regarding it as an *alias* of "Succirubra," though he could never have seen the trees. Mr. Cross also states that he examined the very tree at Naduvatom, that the bark was taken from for analysis, and that it is typical "Pàtà de Gallinazo" (or the glabrous "Magnifolia" of Mr. Rowson), and that there can be no mistaking the strong growing varieties of both sorts on the grass land; but that in some cases true "Succirubra" has been pointed out to him as "Pubescens" in the Naduvatom plantations and the same mistake he says seems to have occurred at Darjeeling. There is evidently some confusion about the pubescent variety, and I fear that the officials do not always distinguish between some forms of "Succirubra" and "Pubescens" when growing in shola soil, and that awkward mistakes are liable to occur both in the supply of seed and collection of bark. Mr. Cross also informs me that he found trees of this "Pàtà de Gallinazo" in the oldest plantations at Naduvatom and that he has no doubt it was introduced here from the commencement, but that it was not distinguished from "Succirubra" till it grew up and flowered or till its robust growth became apparent.

I forward with this report carefully dried and mounted specimens of both "Magnifolia" and "Pubescens," so I trust that they may be compared with typical specimens of the various species in the Kew Herbarium. I also forward specimens of all other species referred to in this report for comparison, &c.

I examined the two trees in Dodabetta from which Narrainsawmy tells me the analysis of "Hybrid Pubescens" is given in G.O., No. 1,336, dated 23rd June 1879 (Nos. 10, 11 and 12); they are both the glabrous variety that Mr. Rowson

calls "Magnifolia" and Mr. Cross styles "Pàtà de Gallinazo." The results from the three specimens sent vary much in the percentage of the different alkaloids, and also the variations with the samples sent from Naduvatom are considerable; this is not satisfactory, though there is proof that we have in this plant a very valuable species.

The Dodabetta Superintendent informs me that this tree suffers less from frost than the "Officinalis."

Mr. Howard calls this tree "Officinalis" var. "Pubescens." It is in my opinion nearer "Succirubra" than "Pubescens," and it will be seen from some specimens that I forward that the leaves from shoots and suckers are nearly as large as those of "Succirubra" though more lanceolate in shape and more pointed. No varieties of "Officinalis" not even its largest leaved form "Uritusinga" ever produce leaves nearly as large as this.

I much fear that in some cases seed of true "Succirubra" may have been forwarded from Naduvatom to Ceylon, Darjeeling or elsewhere instead of true "Pubescens," and that unfortunate mistakes may thereby arise.

I have had long talks with Mr. Cross about this tree, and we have examined many together, and he now writes me: "the circumstance that this prolific and hardy sort has so long escaped notice, and the uncertainty that still exists as to which of the two sorts ('Succirubra' or the so-called 'Pubescens') is the richest in alkaloids is much to be wondered at."

* NOTE.—There is still some doubt as to "Magnifolia" and "Pubescens" being one and the same species or rather slight variations of the same species, though I myself feel fully convinced that they are. I trust, however, that the fact may be established from the dried specimens now forwarded. It is a fact that it is Magnifolia (true) which gave the favorable analysis in G.O., No. 1,336, of 23rd June 1879, as far as Dodabetta is concerned, whilst it is "Pubescens" that is being largely propagated at Naduvatom, the Naduvatom analysis was from trees growing in Ossington which I have not seen, but Mr. Cross states they are "Magnifolia."

It is I now think all important that the doubts about it should be cleared up, and that we should have a careful analysis from a considerable number of both the glabrous and pubescent varieties.* Narrainsawmy of Dodabetta informs me that he sent it home to market for the first time in December 1880, and that two bales were forwarded, viz., 111 lb. of mossed "Pubescens" (not renewed) and 138 lb. of natural "Pubescens;" the report on this is not yet to hand, and will be of the greatest interest. There is not a tree of "Succirubra" in Dodabetta fit to be barked, so it is doubtless all

from the true "Pubescens" or "Pàtà de Gallinazo" of Mr. Cross; it is besides nearly all from the glabrous variety as very few trees of the pubescent form exist in this plantation. No bark of these sorts has as yet gone to market from Naduvatom, so I think that some, both of the pubescent and glabrous varieties (from grass land and from forest soil separately), should be forwarded without further delay. If this species is really far more valuable in its yield than "Succirubra" Government have been losing enormously by the extensive propagation of the latter to the exclusion of the former. Mr. Cross states that it grows at a much higher elevation in its native country, and this is borne out by the fact that it is growing vigorously on Dodabetta above 7,000 feet elevation (where "Succirubra" is a complete failure) and by its more vigorous growth at Naduvatom in exposed situations.

This species is very strong growing, and will certainly yield far more bark in a given time than any other; it will also, I think, prove to be longer lived.

The questions, however; first, whether it is to oust "Succirubra" from the forest soil at Naduvatom, and second, to what extent it is to be planted on grass land to the exclusion of "Officinalis" must entirely depend on the report on the analysis of a sufficient quantity of its bark.

Mr. Rowson informs me that he has 5,000 "Magnifolia" on the Hooker plantation and 2,000 at Naduvatom, 5,000 "Pubescens" on the Hooker and 4,000 at Naduvatom, and there are about 1,000 at Dodabetta chiefly "Magnifolia."

In the 1869 planting at Naduvatam 20 per cent. of the trees are of this species.

45. *Unknown Species*.—I found five trees of a curious species in the 1865 plantation on Dodabetta. It has most curious rough bark like that of the Cork tree (*Millingtonia*) quite unlike any other *Chinchona*, and its leaves are exceedingly hairy on both sides, and it has hairy capsules; nothing is known of its origin except that it was received with the original seeds or plants. Mr. Cross thinks from the character of its bark that it may be of great value. Dried specimens of this species and fragments of the bark (to show its character) accompany this report with other specimens. "*Asperifolia*" Weddell is the only species I can find described at all like it in botanical works, but I have only DeCandolle and Walpers for reference, not all the later works, such as Weddell's. There are very few species known with the leaves hairy on the upper surface. The bark of this has never been analyzed.

46. *Crown Barks*.—*Officinalis* (Linn) (of which *Condaminea* (Lamb) is only a synonym) flourishes exceedingly well on grass land at Naduvatam, Pykara and Ootacamund as well as on shola land. It is a small tree of no great girth, but this is, I believe, also its characteristic in the Crown bark region in Loxa.

Uritusinga.—The tree known by this name in the Dodabetta and Naduvatam plantations and also called "strong-growing *Condaminea*" and "broad-leaved *Condaminea*" is evidently only a variety of "*Officinalis*." It is of much stronger growth with broader leaves and promises to be a much larger tree; but twigs can often be gathered from ordinary "*Officinalis*," particularly from suckers or young growth, in which the leaves are quite indistinguishable from this "*Uritusinga*." Mr. Cross believes our tree to be the same as the "*Uritusinga*" of Pavon, which takes its name from a hill near Loxa, where he himself collected it, and which is now quoted in botanical works as a synonym of "*Officinalis*;" but it should certainly be considered as a variety, and its bark should be kept distinct from that of "*Officinalis*." Our plant is exceedingly strong growing and healthy and I think it should be largely grown and receive more attention; at present there are about 1,000 of it in Dodabetta, but only about a dozen at Naduvatam. "*Uritusinga*" is a lofty tree in its native habitat.

Angustifolia.—Evidently only a variety of "*Officinalis*;" it sometimes looks very distinct, the leaves being narrower and deeper colored, but it is not always true to its characteristics, and broader leaves in no way distinguishable from "*Officinalis*" can often be gathered on it. There is none of this on the Naduvatam side; some 700 rooted plants sent out from Ooty to Pykara as this variety have turned out to be ordinary "*Officinalis*." There are a few planted out in the Dodabetta plantations, but they do not show good growth, or promise to be a success; it is supposed to yield a very large percentage of quinine and there are now 10,000 rooted cuttings in the Dodabetta nurseries propagated in the glass

houses from the few stock plants. Considering its poor growth I cannot recommend its extended planting until its treatment is better understood or a more favorable habitat is found for it.

Mr. Jamieson informs me that Mr. McIvor considered it hopeless to grow this variety; its growth being so slow and poor, it would be far less profitable than the ordinary variety of "*Officinalis*" notwithstanding the superiority in its yield in alkaloids. I can always distinguish this plant at the first glance, but Mr. Cross considers it not even a variety but only a condition of growth of "*Officinalis*," conduced by poverty of soil or some other condition. I cannot say that I quite agree with this, but there is the fact that some 700 plants, supposed to be this species, in the nurseries at the Ootacamund Gardens, and planted out in rich soil at Naduvatam, turned out to be ordinary "*Officinalis*." There is not sufficient evidence, however, as to what the original plants really were.

Var. Crispa? Mr. Cross informs me that he recognizes many plants of the "*Crispa*" var. of "*Officinalis*" (at least the one known in Ceylon as such) supposed to be very rich in quinine, scattered about with "*Officinalis*" in our Dodabetta plantations. I forward dried specimens of this form which Mr. Cross distinguishes by its rather smaller leaves, but I must say that I cannot distinguish it satisfactorily from ordinary "*Officinalis*," and it appears at any rate to run into it.

Var. with very narrow leaf.—There are a few plants of a very narrow-leaved form of "*Officinalis*" in the Dodabetta plantations, of which I also forward specimens. This variety is easily distinguished, and I believe it is the one Mr. McIvor considered as "*Crispa*;" it is only of shrubby growth and cannot, I think, be of much value. I am very disinclined to attach too much value to the fact of a very favorable analysis (as we find in reports) of single individuals of varieties like "*Angustifolia*" or "*Crispa*" grown perhaps under very favorable conditions, or to attempt their extended cultivation on such grounds. It is of course evident that they are valuable yielders under certain conditions, but it would require stronger evidence, I think, to establish the fact that they are far superior to the ordinary type of "*Officinalis*," as a very high percentage of alkaloids has sometimes been obtained from single specimens of that also. If a cultivator takes a fancy to any particular variety he can probably get a very flourishing report on its yield by the high cultivation of a few individuals, but this does not hold good in a large plantation, and I should be sorry to place faith in it with varieties like "*Angustifolia*" and "*Crispa*." *Uritusinga* is, I think, valuable on account of its very strong growth and much greater yield in bark; the analysis of this from Dodabetta is given in G.O., No. 1,336, of the 23rd June 1879, under the head of "*Condaminea*" as distinct from Crown barks.

47. *Cultivation of Crown Barks by Government should be kept up*.—Crown barks will only grow at a high elevation and there are few or no sites for them except on the Nilgiris, where only grass land and not shola is now available to the public. "*Succirubra*" and "*Calisaya*" on the other hand are spreading all over the Wynaad, Coorg, &c.; it is desirable therefore that Government should keep this in view, and, if possible, extend the cultivation of Crown barks, or at any rate work up their present estates without any stint as to expenditure.

48. *Yellow Barks*.—It is to be regretted that these are such a failure at Naduvatam; they all die out and the climate is evidently too cold and probably too dry for them; they grow at low elevations and in a very moist climate, in their native habitat in Bolivia and Southern Peru, and it is useless to make further attempts at the cultivation of "*Calisaya*" or its variety "*Ledgeriana*" at Naduvatam; but I would strongly recommend that a small garden should be opened out for experimenting on their growth at 1,000 or 2,000 feet below our present plantations; they are, I believe, growing well in parts of Wynaad and in the Ouchterlony Valley at about 3,000 feet elevation.

It is not easy to distinguish the variety "*Ledgeriana*" from ordinary "*Calisaya*" when in leaf only, but Mr. Rowson tells me he can always do so when they are in flower as the "*Ledger*" has white flowers, whilst those of the ordinary "*Calisaya*" are pinkish.

Anglica, supposed to be a sport or variety of "Calisaya," is represented by a few trees at Naduvatom; its bark is said to be of little or no value.

Javanica, said also to be a variety of "Calisaya," is also represented by a few plants at Naduvatom; it appears to be of no value and not to be worth growing, at least in the form it assumes at Naduvatom, which is a small very bushy shrub. I do not know whether this is the variety usually called "Josephiana."

49. *Grey Barks*.—"Micrantha," "Peruviana" and "Nitida" from the Grey bark region around Huanico in North Peru are all represented at Naduvatom and Pykara, but they do not succeed and are in fact all fast dying out; they yield no quinine but are valuable for their yield of Cinchonine and Cinchonidine; it is useless to grow them at Naduvatom, but it would be a pity that they should be lost to India, and I propose that another site at a lower elevation should be opened out for them. "Micrantha" and "Peruviana" grow at about 4,000 feet elevation and in a much moister climate than that of Naduvatom, and could hardly be expected to answer in their present situation; but "Nitida" grows at high elevations and might have been expected to thrive at Naduvatom.

50. *Columbian Barks*.—Pitayensis (Pitayo bark).—There are some few very healthy trees of this in the Dodabetta plantation, but the tree has not been propagated here as yet. Mr. Cross anticipates valuable results from its introduction, and informs me it grew to 70 and 80 feet high and 3 to 4 feet in diameter where he met with it at 9, to 10,000 feet in New Grenada. Samples of the bark of our Dodabetta trees have been sent by Mr. Cross to Mr. Howard for analysis and on this report the question of its extended cultivation must depend; it is supposed to yield much quinine.

Santa Fé.—Soft Columbian (C. Lancifolia).—The plants brought by Mr. Cross from New Grenada (7 to 10,000 feet elevation) are healthy and are being propagated, so it is hoped this valuable species may ere long be established on the Nilgiris. It is known to yield a very high percentage of quinine, and Mr. Cross anticipates great results from its introduction. It grows, he tells me, 70 feet high with a diameter of 3 feet in its native habitat; it may be expected to answer well at Naduvatom and perhaps also in sheltered places in Dodabetta.

Carthagena Bark.—(Chinchona Cordifolia).—The two plants brought lately by Mr. Cross from the Central Cordillera near Bogota (elevation 4 to 6,000 feet) are healthy and strong growing and are being propagated, and the prospects of establishing it on the Nilgiris are promising. It is supposed to be a strong growing large tree which its present appearance does not belie; its yield in quinine is much the same as that of Succirubra and it will probably succeed in the same localities as that species. Mr. Cross tells me that he believes the "China Cuprea," the seed of which is promised to this Government (*vide* G.O., No. 630, of the 8th April 1881) from Bogota is the same species.

51. *Pahudiana*.—There are a few of this very distinct species in the Dodabetta plantations; it is said to be quite valueless, and its extensive propagation in Java, owing to its robust and rapid growth, caused much loss and annoyance.

52. *Hybrids*.—I am inclined to disbelieve in any hybrids of Nilgiri origin; it has been stated that there are many hybrids amongst the "Officinalis" and "Calisaya" trees, but after most careful examination I can see no indication of such, nor have any of our trees the characteristics of hybrids, which I am sure would not seed so prolifically; individual twigs may be gathered from many "Officinalis" trees and also from "Calisaya," showing great difference in the shape and size of the leaves, but the same difference may be found on one and the same tree, and often on the same bough. We have varieties or sports of species, such as "Uritusinga" and "Angustifolia," varieties or sports of "Officinalis," sometimes looking very distinct but at other times running into the type and not to be distinguished; but of hybrids between distinct species I do not think we have any.

53. *Hybridizing experiments*.—Though I do not believe in accidental hybrids between different species on the Nilgiris, I have no doubt that the different species

could be crossed. I am not inclined, however, to recommend any experiments of this nature, as it would be useless to attempt it without the services of a scientific gardener, thoroughly trained in the art of hybridising, such as Mr. Dominey or Mr. Seden on the establishments of Messrs. Bull and Veitch, and such a man could only be procured on a very high salary, and other expenses connected with any experiments of this nature would be very costly. The experiments would be exceedingly interesting and of great scientific value, but practically perhaps of no value. We have now in cultivation all the finest-known species of the genus, and it is not likely that hybridising would improve the bark, or give us anything better than, or as good as, we now possess; so that we might be spending large sums to get some variations in leaf and flower, or perhaps in some cases sturdier growth.

54. *Analysis of the various Barks*.—I fear that too much reliance may hitherto have been placed on the analysis of the barks of single individuals of one species or variety, grown under unusually favorable conditions; soil, solar influences, shade, moisture, long droughts, exposure to wind, frost, &c., must probably exercise great influences on the bark and yield of alkaloids, and analysis should not be too much relied on, unless taken from a considerable number of trees subject to the varied conditions which they must experience in a plantation.

55. *Sites for Species requiring a Lower Elevation*.—A fine-sheltered shola in the "Silent Valley," elevation about 3,000 feet, has been reserved by the Collector of Malabar at the request of the Conservator, in case it should be required by this department for the growth of "Rubber trees," or any other products. I now recommend that this should be taken up by the Forest Department at Nilambúr, and that a small clearing should be at once made for experiments on the growth of "grey barks" and "yellow barks" at that elevation; if they grow well, there is ample room for opening out a considerable area; it may also be necessary to try "Carthagena" and "Santa Fé" at this lower elevation. A small pukka building should be erected, and the Chinchona budget should furnish the necessary funds; it is also desirable to try some of the rubber trees and the "Ipecacuanha" (Cephaelis) in the same locality.

56. *Renovating Pits*.—Mr. Rowson has much improved the health of the trees in the plantations under his charge (at Naduvatom and Pykara) by the renovating pits (2 feet cube). In many parts of the plantations the trees have a far more vigorous look than they had two years ago; it has been surmised that the lateral roots might be injured by this system, but this is not the case; where the lateral fibrils have been touched, they shoot out again with great vigor through the humus in these pits; in some cases cattle-manure has been put in the pits, but much of this not being available, they have generally been filled up with dead leaves, and decaying vegetation, such as the weeds, cleared off the plantations; they have, I consider, improved the condition of the plantations in a most marked manner.

57. *Perfect Drainage most necessary*.—All the varieties of Chinchona appear to grow much better on slopes than on flats, the tree being most impatient of anything like insufficient sub-soil drainage.

58. *Lichen*.—In wind blown situations the trunks and branches are often much covered with white lichen. Mr. Rowson assures me this in no way affects the health of the trees or bark; it is easily rubbed off.

59. *Diseases and Enemies*.—There is very little sign of canker at Naduvatom, and the Chinchona seems to have few or no insect enemies; sambur and wild animals are, of course, destructive, and fencing is most necessary in some parts if the plantations are to be worked up to their highest possible yield.

60. *Number of Trees in Naduvatom*.—Appendix A is a statement of the number of casualties amongst the trees in Naduvatom Plantation during the last three years (or since Major Walker's report), and the number of trees now existing based on Major Walker's enumeration.

61. Statement showing number of plants in the nurseries at Naduvattam, 28th May 1881:—

Botanical Names.	Plants in Nurseries and Hot House on 31st March 1880.	Plants raised during 1880-81.	Total.	Plants issued during 1880-81.	Plants planted out permanently during 1880-81.	Balance in Nurseries and Hot House on 31st March 1881.	Remarks.
C. Succirubra	216,000	585,950	801,950	489,950	12,000	300,000	
C. Officinalis	155,000	378,000	533,000	228,000	105,000	200,000	
C. Calisaya var. Ledgeriana ..	4,400	1,560	5,960	50	..	72,027	• Received from Doda-betta.
C. other varieties	4,000	1,305	5,305	..	2,305	3,000	† 3,383 seedlings have died.
C. Pubescens	..	20,010	20,010	1,000	8,010	11,000	
Total	379,400	986,825	1,366,225	719,000	127,315	516,027	•

PYKARA.

The Hooker Chinchona Plantation, Acreage 134.19.

62. No. I Plot, 1866, A.—Acreage 10.91, about half grass land and half shola land. The grass land chiefly Officinalis, only a few Succirubra; the crown barks have been planted too far apart, but the gaps are to be filled in this season.

The shola land all Succirubra, growth good (about 20 feet high) except a small bit on the upper portion, which is much wind blown and thin from failures, and in which supplies are to be put down this season.

All the plantation has been barked five times.

63. No. II Plot, 1866, B.—15.09 acres; about one-third grass land planted with Officinalis, about two-thirds shola land planted with Succirubra; growth good or fairly good; in portions there is a yellowish appearance in the foliage which is not noticeable at Neddivattam; it is probably due to the long drought and east wind, and will disappear with the monsoon.

All the plantation has been barked five times.

64. No. XIII Plot, 1873.—10.59 acres, all shola land, planted with Officinalis; a few Succirubra put in as supplies; there are about 20 Pitayensis; but 726 plants sent out from Ootacamund as Angustifolia have turned out ordinary Officinalis; growth of trees good, but the plantation is very patchy and the trees far apart caused by the inroads of sambur.

In addition to the 10½ planted acres, there are some 15 or 20 more of abandoned shola cleared in 1873, but now over-grown; it would be a good plan to fence in the plantation and to re-clear and re-plant this portion, and to plant up the vacancies in the 10½-acre plot, but it would be useless without fencing on account of wild animals.

This plantation has not been barked.

65. No. X Plot, 1869, A.—3.58 acres, grass land, Succirubra and Officinalis in nearly equal proportion; growth not good; soil poor, rocky, and gravelly. Has been barked four times.

66. No. VII Plot, 1868, A.—18.36 acres, chiefly shola land, good soil, planted with Succirubra; the growth of the trees is good, but the plantation is very patchy from many trees having died out; cause not known; the gaps are to be filled in with Officinalis, but I fear this will not answer unless the plantation is fenced in, as sambur are exceedingly troublesome in this plot, and destroy most of the young plants put out.

The above trees have all been barked four times.

Some grass land planted with Officinalis very far apart; growth short; pits have been dug for filling in more trees; the soil is good, and it would have shown far better results if it had been planted 4' × 4' instead of 8' × 8'.

All the trees have been barked four times.

67. No. III Plot, 1867, A.—14.21 Acres. Two-thirds grass land formerly very stunted Succirubra, only a few feet high, which has last season all been up-rooted, and the ground is now pitted for Officinalis which is to be planted out this season. One-third shola land Succirubra; fine growth and barked three times.

68. No. XI Plot, 1869, B.—9.35 acres, all shola land, planted originally with Succirubra, growth good, has all been barked four times; there are supplies of Officinalis; some grey barks were dying out, and have been all up-rooted.

Five acres coppiced in June 1879, the stools bled excessively; there are 1,379 failures out of 2,226 stools, but the 847 which succeeded have grown well, and are three to six feet high with one to three stems to each stool.

69. No. VIII Plot, 1868, B.—23.74 acres, chiefly shola land, planted with Succirubra; the plot is very patchy as very many trees were injured by the hail in 1879 and died out subsequently; growth of remainder good, now pitted for supplies of Officinalis. All barked four times. About two acres of grass land covered with very fair Officinalis; all barked four times.

70. No. XII Plot, 1869, C.—6.52 acres, about three-fourths shola land and one-fourth grass land, planted almost entirely with Succirubra which nearly all died out after the hail-storm in 1879, and has been up-rooted and the plot re-planted in 1880 with Officinalis, doing well; there is a sprinkling of good old Officinalis (scattered about the plot) which were put down at the same time with the red barks.

71. No. V Plot, 1867, C.—2.71 acres, chiefly shola land, originally planted with Succirubra which all died out after the hail-storm in 1879; it was afterwards up-rooted and re-planted with Officinalis in 1880 which is doing well.

72. No. VI Plot, 1867, D.—16.07 acres, all grass land, about two-thirds, formerly very stunted Succirubra which died out after the hail-storm in 1879, was up-rooted and the plot re-planted with Officinalis in 1880 which is doing well; about one-third covered with very good Officinalis which has been barked four times.

73. No. IX Plot, 1868, C.—16.04 acres, all grass land, about two-thirds covered with fine Officinalis; all barked four times; about one-third, originally covered with stunted Succirubra which mostly died out after the hail-storm in 1879, re-planted in 1880 with Officinalis, doing well; 1,020 old Succirubra still survive, and there are 1,100 old Officinalis.

74. No. IV Plot, 1867, B.—7.02 acres, about three-fourths grass land, planted with Officinalis, fair growth (12 feet high), but very patchy from wide planting, has been pitted for supplies which are to be put down this year; all barked four times.

About one quarter shola land planted with Succirubra and Officinalis, growth good but patchy, the plot being much wind blown, pitted for supplies to be put down this year. All barked four times.

75. *State of the Hooker Plantation.*—The growth here is far inferior to that at Naduvattam, considerable tracts of grass land being planted originally with "Succirubra," which was a perfect failure, only attaining a stunted growth of a few feet; this has lately been nearly all up-rooted, and has been, or is being, replaced with "Officinalis" which grows very fairly on the grass land soil; there are still some tracts where the Succirubra must give place to Officinalis or to Pubescens.

76. *Fencing.*—Plot No. XIII, 1873, must be fenced, and a portion of the shola, which has been abandoned and allowed to revert to rank coarse growth, should be re-cleared and planted. Fencing is also required in Plot VII, 1868, A.

77. *Coppicing.*—2,226 Succirubra trees in No. XI Plot of 1869, four times previously barked and of good growth, were coppiced in June 1879; 1,379 stools have died, 847 are growing fairly, height three to six feet.

78. *Number of Trees in Hooker Plantation.*—Appendix B is a statement of the number of casualties amongst the trees in the Hooker Plantation during the last three years, and the number of trees now existing based on Major Walker's enumeration.

PYKARA.

The Wood Chinchona Plantation, 72.18 acres.

79. No. V Plot, 1865, C.—8.80 acres, all shola land, planted with "Succirubra" and a very few "Officinalis;" trees a good height, often over 20 feet, but not healthy in appearance, and numbers of failures; sub-soil very inferior; sized trees barked six times.
80. No. II Plot, 1864.—10.87 acres, all shola land, "Succirubra" and "Officinalis;" growth all poor and spindly; many failures and many blank spaces, and trees still dying out; suffers much from the north-east wind; and the sub-soil bad. All barked five times.
81. No. VIII Plot, 1867, C.—10.87 acres, all shola land, all "Succirubra;" growth good, over 20 feet high. All barked five times. Five acres 2,500 trees coppiced in June 1879; 885 stools failed to grow, 1,655 have succeeded; growth good, height 4 to 7 feet and very healthy.
82. No. IX Plot, 1868.—6.12 acres, all shola land, all planted with "Succirubra," nearly all gone out, except about 100 trees; re-planting has been attempted more than once without success. Soil rocky and bad.
83. No. VII Plot, 1867, B.—9.62 acres all "Succirubra," except a few "Officinalis," shola land, chiefly a flat; drainage insufficient and sub-soil sour; nearly all the trees gone out. All barked five times.
84. No. VI Plot, 1867, A.—8.39 acres, all shola land, nearly all "Succirubra;" a portion sheltered on a slope, good; the greater portion very poor growth and thin from many failures, and the remaining trees apparently dying out. Sized trees barked five times.
85. No. I Plot, 1863.—2.55 acres, all shola land, "Succirubra" and "Officinalis," mixed in equal proportions; very poor growth and thin, more than half died out, and many still dying; soil rocky and poor. Sized trees barked six times.
86. No. IV Plot, 1865, B.—4.88 acres, lower avenue, all shola land, chiefly "Succirubra" with a few "Officinalis;" growth good in some places but patchy, as there are many blanks; casualties chiefly caused by insufficient drainage on flat portions, where there is percolation from the channel. Sized trees barked six times.
87. No. III Plot, 1865, A.—10.08 acres, upper avenue, "Succirubra" and "Officinalis;" about half and half, growth in some places fair, but not always healthy, in other parts very poor, and has been much injured by hail; many trees dead and many showing signs of dying out; upper portions very much exposed to the south-west monsoon. Sized trees barked six times.
88. *State of the Wood Plantation.*—The lower portion of this plantation exhibits very poor growth (all except Plot No. VIII, 1867, C, about 10 acres, may be pronounced a failure); it should, I think, be up-rooted and abandoned as the money required for its up-keep might be far better spent in keeping up the other plantations.
- I would keep up Plots Nos. III and IV, or the avenue down the ravine in which the Pykara falls are situated; and if Government should decide to sell the remainder, I do not think these two plots or any of the land in this ravine should be alienated, as it is much resorted to by the public on account of its beautiful scenery and for its water-falls; the other portion of the Wood Estate is over a saddle and in another ravine.
89. *Coppicing.*—2,500 Succirubra trees, previously four times barked in Plot No. VIII, 1867, C (the only good growth in this lower portion of the Wood Estate) were coppiced in June 1879; 885 stools have died; 1,655 are growing and very healthy; height 4 to 7 feet.
90. *Number of Trees in the Wood Plantation.*—Appendix C is a statement of the casualties amongst the trees in the Wood Plantation during the last three years; and the number of trees now existing based on Major Walker's enumeration.

DODABETTA PLANTATION.

Acres 320.47, elevation over 7,000 feet.

91. Ascending to the plantations from the Government Gardens the first thirteen plots, as follows, are on the slope looking down on to Ootacamund or with a south-west exposure.
92. No. XXI, 1868, A.—1.61 acres, chiefly grass land with a little shola at the bottom of ravine, all planted with Officinalis 7' x 7'; ground very steep and soil being gradually washed away; growth in fair condition and not many failures since the renewals were put down four years ago which are doing well; no late renewals, too steep for terracing, average height of the trees 15 feet; 714 trees barked once, 11 trees barked twice.
93. No. XXVI, 1869, B.—3.22 acres, nearly all grass land, very steep, soil gravelly, and being rapidly washed away, but too steep for terracing; all planted with Officinalis; trees healthy, but very far apart owing to the original wide planting, and many failures; many renewals were put down three years ago, which are doing well, but none since; average height 15 feet; 1,138 trees once barked, remaining trees small.
94. No. XXV, 1869, A.—4.68 acres, grass land, very steep; remarks the same as for No. XXVI. A portion was terraced in 1880; remainder too steep for terracing; 2,295 trees barked once, 70 trees barked twice.
95. No. I, 1863, A.—2.32 acres, all shola land, steep, and the soil has been subject to much wash, but the whole plot was terraced in 1880; all planted with Officinalis 8' x 8'; average height 20 feet, not in very good condition; very far apart owing to wide planting and subsequent failures; renewals about 10 per cent. put down three years ago, no later renewals; 967 trees barked four times, 161 trees barked once, remainder small and not barked.
96. No. II, 1863, B.—1.67 acres, all shola land, planted with Officinalis 7' x 7'; trees healthy; average height 22 feet, but there have been many failures; renewals one to four years of age; 1,221 trees barked five times, 47 trees once.
97. No. III, 1863, C.—3.57 acres, all shola land, planted with Officinalis; condition fair, but trees very far apart from very wide planting; average height of original trees 22 feet, many renewals one to four years of age; 1,959 trees barked five times, 65 trees once. There are a few "Pahudiana" not growing well; also one "Angustifolia" growing well.
98. No. VI, 1864, B.—7.28 acres, originally patches of shola dovetailing with grass land, very steep, and soil much washed away, but the whole was terraced in 1880, planted with "Officinalis," except some 50 Succirubra, condition bad; 6,000 seedlings planted out in alternate lines in 1880; 4,969 trees barked four times, 2,146 barked twice, 311 once.
99. No. V, 1864, A.—4.06 acres, all shola land, steep, terraced in 1880, all planted with Officinalis 8' x 8' and 7' x 7', condition fair; lately thicker planting has been attempted, 2,500 seedlings being put out in alternate lines doing fairly well; pits have also been dug for further planting; 1,900 trees barked three times, 167 barked once; 400 trees have lately been scraped on the Java principle, some are mossed and some left bare, all are renewing their bark, but those mossed more rapidly.
100. No. IV, 1863, D.—0.98 acre, all shola land, planted with Officinalis; trees fair growth, but very far apart; 900 late renewals, and now pitted for further planting. 556 trees barked five times, 58 trees once.
101. No. XVII, 1867, A.—5.62 acres, grass land, planted with Officinalis; condition good, but trees much branched from wide planting, intermediate planting between the old trees last year to an extent of 1,800 seedlings doing well; a small area where the ground is level nearly all gone out from frost; 2,853 trees barked twice, 830 trees once.

102. No. XX, 1867, D.—4.92 acres, grass land, *Officinalis*; condition fair, average height 14 feet; very few failures; original planting 6' x 6'; 2,572 barked twice, 644 trees once; 5 trees coppiced in June 1880 as dying, no re-growth.
103. No. XVIII, 1867, B.—6.24 acres, grass land; condition fair, but growth rather stunted; 8' to 10' in height only; originally planted 7' x 7'; no late renewals; 2,241 trees barked twice, 1,539 trees once.
104. No. XIX, 1867, C.—5.90 acres, grass land, growth stunted; 6' to 8' in height; trees gone out on a flat portion of about 1 acre said to be caused by frost; 1,692 trees barked twice, 1,314 trees once, 23 trees cut down, dead from frost.
105. The next plot, No. X, is chiefly on the ridge or saddle; all the remainder, 25 in number, are over the saddle, and have a north-east exposure, except small portions of Nos. IX and XXVII which over-top a grass hill and face south-west.
106. No. X, 1866, A.—7.44 acres, grass land, but a little shola in hollows, chiefly hill-top, much blown; growth stunted and many failures; growth better in hollows; 1,007 trees barked twice, 351 trees once.
107. No. XI, 1866, B.—12.18 acres, about two-thirds shola, one-third grass land, *Officinalis*; growth good; 4,627 trees barked three times, 2,615 trees twice, 1,859 trees once. 5 acres, twice barked trees, upper portion (shola land) coppiced in 1879; 3,350 trees cut, 157 have failed to sprout; growth good of remainder.
108. No. XXVIII, 1869, D.—15.33 acres grass land, *Officinalis*, planted 7' x 7'; condition fair but growth stunted; height 8 to 10 feet, not barked; no late renewals but now pitted for intermediate planting to an extent of about 35 per cent.; 5 acres coppiced in 1879; 2,493 unbarked trees cut, failures 400; coppice growth of the rest good; 400 seedlings planted to re-place the casualties, 100 unbarked trees scraped in October 1880, some mossed and some left bare, all are renewing their bark, but those mossed renew more rapidly.
109. No. XXIX, 1869, E.—8.05 acres, grass land, *Officinalis*; growth good, in the lower portion only a small area, rest very patchy from many failures; trees healthy but stunted; no renewals the last three years; 2,467 trees barked once, eight large dead trees felled.
110. No. XXIV, 1868, D.—13.37 acres, grass land and fern land, *Officinalis*; a rather flat portion of about 3 acres suffers from frost, and has gone out almost entirely; in the remainder growth stunted, but fairly healthy; many failures; no late renewals; 3,579 trees barked once. Five old dead trees cut down. Twenty-one *Angustifolia* trees not growing very well.
111. No. XIV, 1866, E.—4.33 acres, shola land, *Officinalis*; growth average, but a good many failures from frost; several spots quite bare; no renewals since four years; 715 trees barked three times, 672 trees barked once.
112. No. XXII, 1868, B.—6.04 acres, grass land, *Officinalis*, originally planted 7' x 7'; many failures, and trees far apart; growth generally stunted, but fairly healthy; no renewals since four years; 706 trees barked twice, 1,709 trees once.
113. No. XXIII, 1868, C.—11.76 acres, fern land, *Officinalis*; very poor growth with numerous gaps, the rank growth of the common Bracken (*Pteris aquilina*) is robbing the soil of much of its virtue; it should be thoroughly eradicated as far as possible, and this plot should be pitted and planted up; 1,895 trees barked twice, and 1,302 once, two old dead trees cut down.
114. No. XV, 1866, F.—3.24 acres, about 1 acre shola, the rest grass land, *Officinalis*; growth poor and stunted, and many failures; 1,412 trees barked three times, and 697 trees once.
115. No. XII, 1866, C.—11.16 acres, shola land, *Officinalis*; growth good but patchy in places from many failures; 3,573 trees barked three times, 1,771 trees once; no renewals since four years.
116. No. XXXIX, 1873.—1.81 acres, shola land, 44 large *Pitayensis* trees; growth good, 15 feet high, not barked, except four for analysis; 557 large *Officinalis* doing very well, not barked; 1,000 *Officinalis* put down in 1880.

117. No. XIII, 1868, D.—12.68 acres, shola land, and good soil, very steep in parts, and subject to much wash, but was terraced in 1880; trees have been pruned and the growth is good and promising, but does not cover the ground which is steep and rocky in places, originally planted 8' x 8' which has prevented straight growth of boll; height of trees 8 to 15 feet; there was a good deal of intermediate planting four years ago; 2,971 trees barked four times, 1,524 trees once.

118. No. VII, 1865, A.—10.20 acres, shola land, soil very good, ground terraced in 1880, chiefly *Officinalis*; growth very good, originally planted 7' x 7', but not very regularly, fairly covers the ground, trees 16 to 18 feet high; 6,601 trees barked four times, 816 trees once; there is a gap in one portion of about half an acre which has been re-planted twice, but has failed owing to frost.

About 100 *Calisaya* trees, growth thin and lanky.

A few *Pubescens* trees growing very luxuriantly; 26 *Micrantha* and *Succirubra*; growth very poor.

One of the best plots on the north-east side of the hill.

119. No. XVI, 1866, G.—9.57 acres, shola land, *Officinalis*, planted 7' x 7'; growth good, but suffers somewhat from frost, does not cover the ground and requires intermediate planting; renewals 15 per cent. four years ago, of which many have failed; 1,000 seedlings put out in 1880; 3,622 trees barked three times, 1,484 trees once.

120. No. XXXV, 1869, K.—6.40 acres, shola soil, a very steep ravine and very irregularly planted with *Officinalis*, all lately terraced; growth good on slopes, but trees generally very far apart; about lower portions of the ravines large gaps owing to failures from frost; 531 trees barked twice, 1,663 trees once; there is one *Micrantha* tree not showing good growth, and a few *Pubescens* with very fine growth.

121. No. XXXVIII, 1872.—8.36 acres, chiefly grass land, steep hill side, soil poor and gravelly, *Officinalis*; growth poor and many failures, suffers from frost and much blown; many renewals, amongst which there are failures, re-pitted in portions for intermediate planting; the extreme upper portion suffers much from frost and wind, and has almost entirely gone out; and it would be useless to re-plant this; the upper portion of the slope has been lately terraced, and should be planted up; the Bracken should be eradicated as it is robbing the soil; about one acre shola land in the lower portion of the plot exhibits good growth; trees not barked.

122. No. XXXIV, 1869, J.—7.28 acres, grass land, planted with *Officinalis*, steep, rocky, and gravelly, very poor growth, many failures; 567 trees barked twice, 1,746 trees once; six old trees cut down.

123. No. XXXIII, 1869, I.—12.33 acres, grass and fern land, *Officinalis*, except a few *Pubescens*; very steep, several small land-slips; trees far apart and very irregular, at least 25 per cent. failures; a very poor plot; 271 trees barked twice, 3,487 trees once.

124. No. XXXII, 1869, H.—12.82 acres, grass and fern land, steep with rocky, gravelly, poor soil, planted with *Officinalis*; growth very poor and numerous failures; 627 trees barked twice, 2,150 trees once; 300 seedlings planted out in 1880.

125. No. XXXI, 1869, G.—14.08 acres, grass and fern land, steep and gravelly, *Officinalis*; growth very poor and numerous failures; 707 trees barked twice, 2,242 trees once; four old dead trees cut down.

126. No. XXX, 1869, F.—17.62 acres, grass land and fern, steep and gravelly, *Officinalis*; very poor growth and thin from many failures; 2,643 trees barked twice, 2,113 trees once; 11 old dead trees cut down.

127. These last five plots of 1869 planting, viz., F, G, H, I, and J form the lower portion of the north-east side of the Dodabetta Plantation, and are by far the least successful, and the trees will never cover the ground, as there are considerable portions on which growth will always fail; there is, however, here and there much fern land, on which there is now a rank growth of Bracken robbing the

soil, and if money was expended in up-rooting this, the growth of the Chinchona might be much improved in these portions.

128. No. XXXVII, 1870.—8.92 acres, grass land, planted with Officinalis; much of the plot is hill top with poor rocky soil; the trees were originally put down at 7' x 7', but they are now very far apart from many failures, and the growth is poor and stunted, generally from 5' to 10' in height; intermediate planting up should be undertaken, but there are several perfectly bare spots on which perhaps planting would not succeed; 168 trees barked twice, 1,295 trees once.

129. No. XXXVI, 1869, L.—2.19 acres, grass land, planted with Officinalis; poor rocky soil; trees far apart and of stunted growth; height 5 to 10 feet; 176 trees barked twice, 100 trees once.

130. No. VIII, 1865, B.—17.54 acres, grass land, good loam, planted with Officinalis 7' x 7'; growth good; trees average 15 feet high; not many failures; renewals 10 per cent. some four years ago, none since; 7,567 trees barked four times, 2,347 trees once.

131. No. IX, 1865, C.—13.65 acres, grass land, good sub-soil, planted with Officinalis; growth good, but somewhat stunted; trees 10 to 13 feet high; rather too much exposed to the north-east monsoon; renewals 15 per cent. some four years ago, none since; not many failures; the trees covering the ground well; 7,602 trees barked four times, 3,605 trees once.

132. No. XXVII, 1869, C.—14.50 acres, grass land; little shola land in ravine; soil generally good, but situation high and exposed; planted with Officinalis; growth fair but stunted; some of the highest part gone out; growth good towards bottom of plot; 207 trees barked twice, 1,618 trees once.

133. Nurseries.—The nurseries are in good order; in the Dodabetta nursery there are 2 lakhs of Officinalis seedlings.

In the nursery near the old jail about 10,000 Officinalis seedlings; also 10,000 rooted cuttings of Angustifolia transferred from the propagating houses.

In the lower nursery (near the tea) there are 20,000 Officinalis seedlings.

134. Glass Houses.—In the glass propagating houses 12,000 *Calisaya Ledgeriana* seedlings (from Java), 100 *Pitayensis* seedlings from plantation trees, 400 *Pubescens* seedlings from plantation trees, 40 *Calisaya* seedlings from plantation trees, 100 stock plants of *Angustifolia*; also the "Santa Fè" and "Carthagena" plants brought lately by Mr. Cross.

135. State of Dodabetta Plantation.—This I consider on the whole promising, and there can be no doubt as to their paying well; the great mistake has been wide planting at the commencement, and every endeavour must now be made to plant up closer, and this is receiving every attention; the plantations have been much improved of late in places by terracing, but in some parts the land is too steep for this, and should never have been opened; there are besides large blocks where the soil is very poor, and where planting must be always more or less a failure, though it will pay at the present high prices of bark; the effects of frost and wind are also very evident in many places. The eradication of the bracken fern in some of the plots requires immediate attention, and would greatly improve the growth of the Chinchona.

136. Coppicing.—In Plot No. XI, 1866, 3,350 "Officinalis" trees (5 acres) which had been twice barked previously were coppiced during the first ten days in June 1879; the stools bled very much and 157 died; the coppice growth of the rest is good—

Yield in green bark = 13,762 lb.

Yield in dry bark = 5,400 lb.

In Plot XXVIII, 1869, 2,493 unbarked Officinalis trees (5 acres) were coppiced from 13th to 19th June 1879; they bled very much and 400 stools died; the coppice growth of the rest being good—

Yield in green bark = 4,853 lb.

Yield in dry bark = 1,700 lb.

I attribute the failures, to the coppice having been carried out too late in the season; it is noteworthy that here, as at Naduvatom, there are many more deaths amongst the stools of the unbarked trees than from those which had been barked, which is proof that the root system of the tree does not suffer in any way from the barking process.

137. Scraping.—In Plot XXVIII, 1869, 100 Officinalis trees were scraped on the new Java method on 3rd October 1880, yield of bark 246 lb. green and 100 lb. dry; and in Plot V, 1864, 400 trees were scraped during October 1880, yield of bark 856 lb. green and 400 lb. dry. Some of the trees have been mossed over and others left unprotected, but all are renewing their bark satisfactorily, though more rapidly where mossed; and there are no failures whatever as far as I can see.

138. Number of Trees in Dodabetta Plantation.—Appendix D is a statement of the number of casualties amongst the trees in the Dodabetta plantation during the last three years and the number of trees now existing based on Major Walker's enumeration.

139. Receipts and Expenditure.—I will not add to the bulk of this report by any statements of receipts and expenditure, as these have been given in full in the last annual report just reviewed by Government.

140. Dried Specimens.—The following dried and mounted specimens accompany this report:—

	Chinchona Succirubra (red bark) ...	From Naduvatom.
	Chinchona sp. Called Magnifolia at Naduvatom and Pata de Gallinazo by Mr. Cross; supposed to be a new species; was collected by Mr. Cross at high altitudes in the red bark region; called also Mr. McIvor's hybrid ...	Several specimens from Naduvatom and Dodabetta from forest soil and from grass land.
Red Barks	Chinchona. Called Pubescens at Naduvatom and also on Dodabetta, where it is not distinguished from the last, of which it is supposed to be only a slight variety ...	Do.
	Chinchona Officinalis, typical (crown bark) ...	Specimens from Naduvatom and Dodabetta.
	Chinchona Officinalis, var: Uritusinga (called broad-leaved or strong-growing Condaminea) ...	Specimens from Dodabetta.
Crown Barks	Chinchona Officinalis, var: Angustifolia ...	Do.
	Chinchona Officinalis, var: Crispa of Ceylon ...	Do.
	Chinchona Officinalis, var: with very narrow leaf, probably Crispa of Mr. McIvor. ...	Do.
	Chinchona Pitayensis ...	Do.
	Chinchona Calisaya ...	Specimens from Dodabetta and from Naduvatom.
	Chinchona Calisaya, var: Anglica ...	Specimens from Naduvatom.
Yellow Barks	Chinchona Calisaya, var: Javanica; so called at Naduvatom, probably "Josephiana," only a bushy shrub ...	Do.
	Chinchona Calisaya Ledgeriana ...	Do.
	Chinchona Micrantha ...	Specimens from Naduvatom and Dodabetta.
Grey Barks	Chinchona Nitida ...	Specimens from Naduvatom.
	Chinchona Peruviana ...	
	Chinchona Pahudiana ...	Specimens from Dodabetta.
	Chinchona. Unknown species with cork like bark; leaves hairy on both surfaces and hairy capsules; supposed by Mr. Cross to be the genuine "Crispa" of Loxa ...	Do.

141. It appears to me important that I should proceed to Darjeeling to see the large Chinchona plantations there, and the different species in cultivation, and take notes on the system of cultivation pursued and other matters which might be of use to the officers in charge of these plantations; so if Government wish it, I shall be prepared to proceed there shortly.

APPENDIX A.
NADUVATAM.

STATEMENT showing the Number of Chinchona Trees enumerated in 1878, and those that were cut since being dead, and the Balance existing on the Government Plantations, Naduvatam.

Plot.	NUMBER AS PER MAJOR WALKER'S REPORT.			CASUALTIES IN 1878-79.			CASUALTIES IN 1879-80.			CASUALTIES IN 1880-81.			TOTAL NUMBER OF DEAD TREES CUT.			BALANCE.			NUMBER OF PLANTS PLANTED IN 1880-81.			TOTAL NUMBER OF TREES EXISTING.		
	Red.	Crown.	Others.	Red.	Crown.	Others.	Red.	Crown.	Others.	Red.	Crown.	Others.	Red.	Crown.	Others.	Red.	Crown.	Others.	Red.	Crown.	Others.	Red.	Crown.	Others.
1	3,197	2,325	4	113	84	2	132	43	181	34	2	2	312	142	4	2,885	2,183	8	2,885	2,183	8	2,885	2,183	8
2	6,272	1,984	16	186	35	..	..	..	..	118	6	6	239	56	8	6,033	1,928	..	6,033	1,928	..	6,033	1,928	..
3	3,469	1,300	..	..	..	..	..	..	..	34	..	..	77	2	..	3,219	1,224	..	3,219	1,224	..	3,219	1,224	..
4	3,484	1,300	..	..	..	..	..	..	..	34	..	..	77	2	..	3,219	1,224	..	3,219	1,224	..	3,219	1,224	..
5	1,418	640	..	29	31	..	181	64	..	32	20	..	125	61	..	1,231	638	..	1,231	638	..	1,231	638	..
6	2,849	3,202	..	68	62	..	197	64	..	29	58	..	294	110	..	7,423	7,290	..	7,423	7,290	..	7,423	7,290	..
7	7,719	7,400	..	43	27	..	42	..	..	28	23	..	113	60	..	3,561	3,220	..	3,561	3,220	..	3,561	3,220	..
8	4,707	3,693	..	25	25	13	27	..	..	37	60	12	64	85	25	10,782	1,180	..	10,782	1,180	..	10,782	1,180	..
9	3,625	3,305	164	..	..	..	196	..	..	55	29	..	56	29	..	9,106	766	..	9,106	766	..	9,106	766	..
10	11,201	1,201	..	..	..	..	..	..	..	48	17	..	160	46	..	8,652	2,641	..	8,652	2,641	..	8,652	2,641	..
11	9,161	795	..	102	29	..	..	..	..	100	3	67	185	88	4	9,378	50	..	9,378	50	..	9,378	50	..
12	8,803	2,687	..	..	21	..	85	..	..	157	..	..	249	11	..	9,098	200	..	9,098	200	..	9,098	200	..
13	9,563	2,111	..	..	11	..	92	..	..	18	2	..	53	9	..	1,190	884	..	1,190	884	..	1,190	884	..
14	9,347	211	..	..	..	..	..	..	..	9	..	..	6	..	..	4,408	1,170	..	4,408	1,170	..	4,408	1,170	..
15	1,208	386	..	..	..	..	..	..	..	18	..	..	18	..	..	6,298	767	..	6,298	767	..	6,298	767	..
16	4,461	1,179	..	..	..	..	..	..	..	6	..	..	6	..	..	7,924	350	..	7,924	350	..	7,924	350	..
17	6,298	772	..	..	..	..	..	..	..	..	..	..	..	..	..	10,186	824	..	10,186	824	..	10,186	824	..
18	7,924	854	..	..	..	..	..	..	..	..	..	..	..	..	..	6,300	63	..	6,300	63	..	6,300	63	..
19	10,186	854	..	..	..	..	..	..	..	..	..	..	..	..	..	1,894	1,894	..	1,894	1,894	..	1,894	1,894	..
20	6,300	1,894	..	..	..	..	..	..	..	..	..	..	..	..	..	7,440	374	..	7,440	374	..	7,440	374	..
21	5,904	374	..	..	..	..	..	..	..	..	..	..	..	..	..	13,803	915	..	13,803	915	..	13,803	915	..
22	8,719	915	..	..	..	..	..	..	..	..	..	..	..	..	..	7,659	815	..	7,659	815	..	7,659	815	..
23	13,805	823	..	..	..	..	..	..	..	..	..	..	..	..	..	1,067	..	..	1,067	..	..	1,067	..	..
24	7,659	823	..	..	..	..	..	..	..	..	..	..	..	..	..	3,190	3,000	..	3,190	3,000	..	3,190	3,000	..
25	1,099	25	..	..	..	..	..	..	..	..	..	..	..	..	..	2,780	1,266	..	2,780	1,266	..	2,780	1,266	..
26	3,190	3,000	..	..	..	..	..	..	..	..	..	..	..	..	..	2,780	1,266	..	2,780	1,266	..	2,780	1,266	..
27	2,780	1,314	387	..	..	..	..	..	..	..	..	..	..	..	..	160,352	42,896	..	160,352	42,896	..	160,352	42,896	..
28	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
29	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Total	164,456	43,694	601	541	395	15	2,404	..	4	3,159	403	22	4,104	798	41	160,352	42,896	560	200	..	2,905	160,553	42,896	3,465

(Signed) W. ROWSON,
Assistant Superintendent.

NADUVATAM,
20th May 1881.

APPENDIX B.

HOOKER ESTATE.

STATEMENT showing the Number of Chinchona Trees enumerated in 1878, and those that were cut since being dead, and the Balance existing on the Government Plantations, Hooker Estate.

Plot.	NUMBER OF TREES AS PER MAJOR WALKER'S REPORT.			CASUALTIES IN 1878-79.			CASUALTIES IN 1879-80.			CASUALTIES IN 1880-81.			TOTAL NUMBER OF DEAD TREES CUT.			BALANCE.			NUMBER OF PLANTS PLANTED IN 1880-81.			TOTAL NUMBER OF TREES EXISTING.		
	Red.	Crown.	Others.	Red.	Crown.	Others.	Red.	Crown.	Others.	Red.	Crown.	Others.	Red.	Crown.	Others.	Red.	Crown.	Others.	Red.	Crown.	Others.	Red.	Crown.	Others.
1	4,789	2,876	..	..	..	..	42	..	..	130	36	..	217	78	..	4,572	2,798	..	..	..	..	4,572	2,798	..
2	6,735	2,036	..	198	36	..	36	..	..	416	81	..	903	117	..	5,832	1,919	..	..	..	..	5,832	1,919	..
3	7,639	196	..	..	..	..	..	..	..	6,114	..	..	6,114	..	..	1,425	196	..	..	..	..	1,425	196	..
4	390	3,357	..	..	..	..	121	..	..	..	172	..	84	293	..	306	3,064	..	..	..	..	306	3,064	..
5	1,542	207	..	..	..	..	9	..	..	..	11	..	*1,784	20	..	..	187	..	..	..	..	..	..	..
6	6,271	5,520	..	..	..	..	247	..	..	..	284	..	*5,636	631	..	..	4,989	..	..	..	..	..	38,989	2,000
7	4,961	3,910	1	64	89	..	84	..	..	83	179	..	147	268	..	4,814	3,642	1	..	..	..	4,814	3,642	1
8	10,569	2,223	72	..	..	..	43	..	..	144	84	..	6,597	127	..	3,972	2,996	72	..	..	..	3,972	2,996	72
9	7,448	1,152	..	..	..	..	24	..	..	108	28	..	6,428	52	..	1,020	1,100	..	..	..	..	1,020	29,050	..
10	1,320	1,096	..	17	13	..	..	..	..	23	43	..	40	66	..	1,280	1,040	..	..	..	..	1,280	1,040	..
11	4,225	390	777	..	..	..	10	..	..	152	11	..	1,551	21	..	2,674	369	777	..	..	..	2,674	369	777
12	3,429	446	..	..	..	..	14	..	..	..	15	..	*3,906	29	..	..	417	..	..	..	..	..	16,467	2,000
13	319	4,500	..	..	..	..	..	..	..	..	..	..	..	..	..	319	4,500	..	..	..	..	319	4,500	..
Total	58,537	27,909	850	279	648	..	648	..	..	7,170	944	..	33,407	1,592	..	26,214	26,317	850	150	105,000	7,410	26,364	131,317	8,260

* Excess 1,034 trees.

(Signed) W. ROWSON,
Assistant Superintendent.

NADUVATAM,
20th May 1881.

APPENDIX C.
WOOD ESTATE.

STATEMENT showing the Number of Chinchona Trees enumerated in 1873, and those that were cut since being dead, and the Balance existing on the Government Plantations, Wood Estate.

Plot.	NUMBER AS PER MAJOR WALKER'S REPORT.			CASUALTIES IN 1878-79.			CASUALTIES IN 1879-80.			CASUALTIES IN 1880-81.			TOTAL NUMBER OF DEAD TREES CUT.			BALANCE.			NUMBER OF PLANTS PLANTED IN 1880-81.			TOTAL NUMBER OF TREES EXISTING.		
	Red.	Crown.	Others.	Red.	Crown.	Others.	Red.	Crown.	Others.	Red.	Crown.	Others.	Red.	Crown.	Others.	Red.	Crown.	Others.	Red.	Crown.	Others.	Red.	Crown.	Others.
1	612	607	..	37	..	..	37	..	..	..	..	..	37	44	..	575	563	..	..	..	..	575	563	..
2	6,972	1,682	64	234	..	42	234	..	11	453	6,519	1,454	228	63	63	6,519	1,454	11	..	..	..	6,519	1,454	11
3	4,571	4,094	65	176	..	38	176	..	18	670	4,001	3,478	616	66	66	4,001	3,478	9	..	..	..	12,431	3,478	9
4	2,430	509	657	89	..	115	89	..	347	316	2,114	465	44	545	..	2,114	465	112	..	..	..	6,324	465	112
5	4,888	112	..	143	..	..	143	..	..	368	4,520	112	..	..	..	4,520	112	..	..	..	..	4,520	112	..
6	5,637	41	..	..	..	..	..	..	..	78	5,609	41	..	..	..	5,609	41	..	..	..	..	5,609	41	..
7	4,744	117	..	298	..	..	298	..	..	741	4,003	117	..	..	..	4,003	117	..	..	..	..	4,003	117	..
8	7,208	20	..	1,017	..	..	1,017	..	..	1,171	6,037	20	..	..	..	6,037	20	..	..	..	..	6,197	20	..
9	667	..	..	35	..	..	35	..	..	35	632	..	..	..	..	632	..	..	..	..	..	632	..	..
Total ..	37,719	7,182	786	2,029	..	195	2,029	..	1,376	713	34,010	6,250	932	654	654	34,010	6,250	132	..	..	..	45,810	6,250	132

(Signed) W. ROWSON,
Assistant Superintendent.NADUVARAM,
20th May 1881.

APPENDIX D.

STATEMENT showing the Number of Chinchona Trees on Dodabetta Government Chinchona Plantations, Number of Failures in the coppiced or uprooted, and Number of Plants planted.

Number of Plot.	Date of Planting.	NUMBER OF TREES AS IN MAJOR WALKER'S REPORT.		Number of Failures in the coppiced or uprooted since.	Remain- ing.	Planted since.	Now Existing.	Remarks.
		Crown Bark.	Other Species.					
I	1863 A.	1,478	3	..	1,481	..	1,481	
II	1863 B.	1,032	..	..	1,032	..	1,032	
III	1863 C.	1,930	17	..	1,947	1,700	3,647	
IV	1863 D.	662	2	..	664	900	1,564	
V	1864 A.	2,835	..	..	2,835	2,500	5,335	
VI	1864 B.	5,060	46	..	5,106	6,000	11,106	
VII	1865 A.	9,112	117	..	9,289	..	9,289	
VIII	1865 B.	11,282	..	..	11,282	..	11,282	
IX	1865 C.	12,423	..	..	12,423	..	12,423	
X	1866 A.	5,176	..	..	5,176	..	5,176	
XI	1866 B.	11,063	..	170	10,893	500	11,393	Coppiced and failed to grow.
XII	1866 C.	11,722	..	..	11,722	..	11,722	
XIII	1866 D.	10,523	..	..	10,523	..	10,523	
XIV	1866 E.	3,583	..	..	3,583	..	3,583	
XV	1866 F.	2,922	..	..	2,922	..	2,922	
XVI	1867 A.	4,038	..	..	4,038	1,800	5,838	
XVII	1867 B.	5,199	..	37	5,162	..	5,162	Dead trees cut down.
XVIII	1867 C.	4,333	..	28	4,305	..	4,305	Do.
XIX	1867 D.	4,258	..	6	4,253	..	4,253	Do.
XX	1868 A.	1,193	..	..	1,193	..	1,193	
XXI	1868 B.	4,739	..	..	4,739	..	4,739	
XXII	1868 C.	8,595	..	3	8,593	..	8,593	Do.
XXIII	1868 D.	8,755	..	6	8,750	..	8,750	Do.
XXIV	1869 A.	3,880	..	..	3,880	..	3,880	
XXV	1869 B.	2,633	..	..	2,633	..	2,633	
XXVI	1869 C.	10,467	..	..	10,467	..	10,467	
XXVII	1869 D.	11,532	..	400	11,132	400	11,532	Coppiced and failed to grow.
XXVIII	1869 E.	6,309	..	8	6,301	..	6,301	Dead trees cut down.
XXIX	1869 F.	10,184	..	11	10,173	..	10,173	Do.
XXX	1869 G.	8,485	..	4	8,481	..	8,481	Do.
XXXI	1869 H.	6,446	..	..	6,446	300	6,746	
XXXII	1869 I.	6,754	..	4	6,750	..	6,750	Do.
XXXIII	1869 J.	4,019	..	6	4,013	800	4,813	Do.
XXXIV	1869 K.	5,102	..	..	5,102	..	5,102	
XXXV	1870	4,864	..	4	4,860	..	4,860	
XXXVI	1871	3,949	..	..	3,949	..	3,949	
XXXVII	1872	601	..	..	601	400	1,001	Do.
XXXVIII	1873	657	44	..	..	..	..	
XXXIX	1873	657	44	..	..	..	..	
Total ..	..	226,647	289	684	226,252	16,300	242,552	

DODABETTA,
23rd May 1881.(Signed) T. NARRAINSAWMI NAIDU,
Head Overseer in charge.

No. 419. From Colonel R. H. BEDDOME, Conservator of Forests, to the Secretary to Government, Revenue Department, Ootacamund, dated Ootacamund, 6th June 1881, No. 207.

REFERRING to G.O., No. 781, of the 17th ultimo, I have the honor to inform you that I have just sent in a very long report on the Chinchona plantations after a careful inspection and study of them for about two months. I did not receive this Government order until after my report had been despatched, nor had I seen Mr. Cross's report before, but it will be seen that I had arrived at much the same conclusions as he had on the question of hybrids and various other matters.

I have treated in my report fully on the subjects of the cultivation of Pitayo, Calisaya and other species; necessity of coppicing or uprooting (as the case may be) trees the decay of which is evident; the ill-effects of the original wide planting, and the advisability now of intermediate planting as far as possible; and hybrids; so I need not add more here.

2. *Coppicing*.—Mr. Cross objects to such a large area having been coppiced, and states that the trees have been coppiced too low down and that four to five inches of the trunk or collar should have been left. There has always been a difference in opinion as to the height the collar should be, and I find in my letters to Mr. Barlow, the Commissioner at the time (*vide* also G.O., 1,161, of 27th May 1879), that I was anxious to restrict the area to about 3 acres and that I wished three systems tried as experiments for data: first, to adze the collar flush with the ground; second, to leave about six inches of collar; third, not to coppice without first establishing a shoot. The Commissioner was in charge of the plantations at the time, and I had only been ordered to select the area to be coppiced, and these suggestions of mine do not seem to have carried weight, as they were not acted up to and all the stools were adzed nearly flush to the ground. I have no reason to find fault with the result as will be seen from my report, and I think if coppicing were again ordered and in the absence of actual data, which I was anxious to obtain, I would rather give the preference to the flush collar than to a collar several inches high.

I do not think we shall have more coppicing as a system over given areas. I am much opposed to it for many reasons, and I think my report will go to prove that it is not desirable; but if we did again coppice, I should prefer the plan of first establishing a shoot. It will be seen by my report that when this plan is followed there is not a single failure, and that this is fully proved from several blocks of older experiments which I was quite ignorant of at the time that I made the proposition. Mr. Cross appears to think that the young coppice growth was thinned out prematurely, but I do not understand how he could give an opinion on this point without having seen the growth at the time it was thinned. It is very easy to tell the proper growth of these would then be seriously retarded and interfered with unless the rest were cut away, and it is then apparent whether it is advisable to leave two, three or four shoots. Adzing off with a rounded top is in my opinion preferable to a sloping cut or wedge form of coppice.

3. I do not agree with Mr. Cross's remarks as to the climate of the Nilgiris being unsuited for the "Pubescens" form of Red bark, and I think that he would now be inclined to modify these statements from his subsequent observation, as many of his letters to me quite contradict them. Mr. Cross calls this tree "Pata de Gallinazo," and he informs me that he found it at a much higher elevation than "tile" or Red bark. He now considers it a new and undescribed species, and I agree with him; but whether a new species or only a variety of the "Succirubra" it has evidently found its home on the plateau of the Nilgiris, and would probably not grow so well at lower elevations. It succeeds admirably on Dodabetta, over 7,000 feet, where "Succirubra" will make no growth, and on the higher exposed situations at Naduvatom and Pykara where "Succirubra" never grew more than three or four feet high, and is now being uprooted, and Mr. Cross has himself lately written to me on the subject of its hardy character and robust and splendid growth. I agree with Mr. Cross that the Nilgiri is too high and cold for "Succirubra," but still it is grown to a good profit in the forest soil of Naduvatom; and exhibits exceedingly healthy growth.

4. Mr. Cross is inclined to taboo "Succirubra" altogether on account of its inferior yield of quinine. Its growth is so rapid compared to Crown bark, and its yield in "bark" so far greater than that and several of the finer kinds, and its cultivation is so much easier, that I expect it will hold its own; its yield besides in other alkaloids is very great; it may have to be ousted in favor of its congener "Pubescens" or the "Uritusinga" var. of "Officinalis," but this is a question for further experience and research.

5. I cannot agree with Mr. Cross in his suggestions about forming a dense sort of underwood of Chinchona in the plantations; it would be opposed to every system of arboriculture and would be simply ruin to the plantations; the trees that did not get their heads to the light would come to nothing and interfere with the root room of others, and the result would be little or no bark of any value. We are not growing osiers or scrub firewood.

6. Regarding the remarks on "collection of seed" by Mr. Cross and the Collector, I cannot believe that this has not received attention. "This selection of the fittest" is the first aim of all florists and arboriculturists as well as breeders of animals, and was so long before Mr. Darwin's voluminous writings on the subject; a practical man, with the training Mr. McIvor had before he came to this country, must have been fully alive to the importance of this. During my inspection I observed muslin bags tied round the panicles of seed on some of the finest trees, which is proof that attention is paid to this subject. Regarding the cutting off of the panicles of flowers which the young trees produce so prolifically, I would observe that I strongly recommended, many years ago, when the trees first commenced to flower so profusely, that this should be done as an experiment over about an acre, as I thought it would favor the growth of the trees and perhaps the virtue of the bark, and at any rate be a very interesting experiment; but I was met by the statements that it would be too expensive to attempt it in large plantations, and that expensive tools would be necessary, otherwise the branches would be much broken and injured.

7. The Calisaya will never answer at Naduvatom, but I have written fully on this question in my report. There are four varieties only, "the ordinary Calisaya," "the Ledger," the "Anglica" and the "Javanica;" the two former are known to be most superior; they are scarcely distinguishable, and I shall be surprised if further research proves the "Ledger" so very superior. The very favorable reports on this variety are probably due to the high cultivation of a few individuals; however, I may be wrong. Mr. Rowson told me that "Anglica and Javanica" had been analysed and gave a very poor yield, and this has been found the case in Java, where their cultivation is given up; the last named is only a brushy shrub.

8. I quite agree with Mr. Cross that grafting could be of no value when the object is "bark;" and Mr. Cross agrees with me that the art of hybridizing would not be at all likely to increase the value of the bark.

9. Mr. Cross appears to be of opinion that the natural bark may be richer in alkaloid than renewed bark; this is opposed to all the experience hitherto gained. I believe I am right in saying that every analysis has hitherto proved the great superiority of the latter, and that it always fetches a much higher price. Mr. Cross is also wrong in saying that a tree once barked will always require to be wrought after the same manner as long as it lives, as it is a fact that trees which have been many times barked are now growing splendidly from coppice.

10. We must be careful not to be guided too much by any report on the analysis of Mr. Cross's thirty small selected specimens. I much fear more harm than good has been done by the analysis of only favored individuals, and that it is likely to be the result of much annoyance; I do not myself believe in the vaunted superiority of such varieties as "Angustifolia" or "Crispa" over ordinary "Officinalis" nor of "Ledgeriana" over ordinary "Calisaya." It is due probably only to high cultivation or to other favorable conditions appertaining to the selected individual; time only, however, can fully prove this.

11. The plantations have only lately been handed over to this Department and it is my intention to draw up a full memorandum of instructions for the officers in charge, but this would be premature till Government have reviewed my report and expressed their wishes as to various points.

No. 420. From Colonel R. H. BEDDOME, Conservator of Forests, to the Secretary to Government, Revenue Department, Ootacamund, dated Ootacamund, 6th June 1881, No. 208.

REFERRING to paragraph 4 of the G.O., No. 398, dated 4th March last, I have the honor to forward a letter* from Mr. Cross.

* Dated 23rd May 1881.

2. I quite agree with Mr. Cross as to the elevation required for "Calisaya" or its variety "Ledgeriana," and that there is no site on the plateau of the Nilgiris

adapted for it. I have fully treated on this question in my report on the plantations just submitted to Government, and I have recommended that ground should be taken up on the slopes below Naduvatam or in the Silent Valley.

ENCLOSURE.

Letter from ROBERT CROSS, Esq., to Colonel R. H. BEDDOME, Conservator of Forests, dated 23rd May 1881.

I BEG to acknowledge receipt of communication of 21st of this month respecting the Chinchona Ledgeriana. I have not the slightest doubt that both Naduvatam and Dodabetta are unsuited for this sort, the elevation of both places being far too high.

2. If the Forest Department possessed conveniently any good moist wooded ravine somewhere along the course of the Western Ghâts with an elevation of from 3,000 to 4,000 feet, the tree might be expected to thrive well in such a site. Planting in the ordinary manner, 4 feet apart each way, would suffice.

3. With a proper elevation and suitable climatic conditions the success of the experiment is further insured if the plants are *strong and healthy when put out and fairly cared for afterwards*.

4. The Ledgeriana is manifestly a rank-free, strong-growing species of much the same character as the Succirubra or Red bark.

No. 421. From Colonel R. H. BEDDOME, Conservator of Forests, to the Acting Secretary to Government, Revenue Department, Ootacamund, dated Ootacamund, 22nd June 1881, No. 293.

I HAVE the honor to inform you that I am this day in receipt of "particulars of bark sales," 5th and 10th May 1881. This document is of great interest as containing the prices realized by the two bales of "Pubescens" bark sent to England from Dodabetta, as noticed in paragraph 44 of my report on the Chinchona—the bale of *natural* "Pubescens" (138 lb.) sold for 7s. 1d. per lb., and the bale of *mossed* Pubescens (111 lb.) for 5s. per lb. In these two bales the trees we call "Pubescens" and "Magnifolia" were mixed* indiscriminately, and I think it very important that Government should ask for more information regarding them, if forthcoming, viz., what was the analysis? Did the quality justify the high price given? Was all the bark in each bale fairly equal in quality, or was any great difference detected?

2. In the same sale list it will be seen that the 128 bales of *natural* "Officinalis" (Crown bark) only realized 4s. 6d. to 5s. 7d. per lb., or very considerably less than "Pubescens." If "Pubescens" is to keep up this high price, and if the purchasers of these two bales can report that it has answered their expectations, we are losing much by propagating "Officinalis," a spindly, weak-growing tree, so largely, to the exclusion of "Pubescens," a tree of strong and vigorous growth. Looking also at the very small prices realized by "Succirubra" in this and other lists, there is not a doubt about the fact that we are enormous losers by propagating "Succirubra" so largely at Naduvatam to the exclusion of "Pubescens," and that "Succirubra" must in the future be relegated to the Wynaad and similar elevations, where probably "Pubescens" will not succeed so well, and that the sooner this is done the better.

3. The 35 bales of *renewed* "Officinalis" sold for 7s. to 9s. 5d. per lb. We have yet to learn what *renewed* "Pubescens" will realize; but judging by the analysis from a small quantity as given in G.O., No. 1,336, of the 23rd of June 1879, it will probably fetch a very high price.

4. These sale lists give us data of bark in the bulk, which is, I think, far more valuable than the analysis of picked specimens from one or two favored trees. In "Pubescens" and "Magnifolia" we evidently have most valuable trees, and

it is most important to learn all we can about them, and I trust that the copious specimens in flower and fruit, which I have forwarded, may lead to their identification at Kew. Mr. Cross assures me that he found "Magnifolia" on the Chimborazo at high elevations under the name of "Pâtà de Gallinazo," and that he believes it to be an undescribed species; but although "Pubescens" is to me only a slight variety of it, Mr. Cross's opinions regarding it, at different times, have been most contradictory, and I am very anxious to ascertain whether there is or is not any difference in the quality of the bark. It would also be interesting to have experiments on the growth of these two trees at lower elevations.

5. In all the lists *renewed* bark fetches a much higher price than *natural*; but it is to be noted that *mossed* "Pubescens" sells at 2s. per lb. less than *natural* "Pubescens," whereas in the different reports on Nilgiri Chinchonas *mossed* "Crown" ("Officinalis") and *mossed* "Red bark" ("Succirubra") always fetch more than *natural*, though much less than *renewed*; this may be a coincidence of no value and likely to be upset at other sales, but I should be glad of an explanation, should it be available.

6. The prices realized in these lists under notice, and the lists for March and April by the South American "Soft Columbian" and "Carthageana," the species we are going to so much expense in introducing, are not very encouraging.

No. 422. From Colonel R. H. BEDDOME, Conservator of Forests, to the Secretary to Government, Revenue Department, Ootacamund, dated Ootacamund, 10th August 1881, No. 498-A.

In accordance with G.O., No. 1,105, of the 25th July last, I have the honor to forward Mr. Cross's remarks* on the analysis of bark submitted by Mr. J. E.

* Enclosure No. 1.

Howard and recorded in the same Government order.

2. I must myself observe that Mr. Cross's samples go a very short way towards testing the relative excellence of all our different species—22 out of his 30 specimens (*i.e.*, 1 to 14, 16 and 17, 21 and 26 to 30) being all from ordinary "Officinalis" or "Crown bark." Of the other eight samples, No. 15 is the Pitayo, No. 18 the so-called "Magnifolia," Nos. 19, 20, 22, 23 and 24 "Succirubra" (or Red bark), and No. 25 "Calisaya;" so that only five out of our eighteen species or varieties were sent, and these were, I regret, not accompanied by botanical specimens.

3. Mr. Cross informs me that he could not now identify all the trees from which the different samples of Crown bark were sent; he identified No. 4, which gave the highest yield of natural bark (6.52 per cent.), and this is quite the ordinary "Officinalis;" he could not, however, identify No. 11, which gave the highest yield in renewed bark (7.69 per cent.)

4. From what Mr. Cross tells me the whole of these 22 specimens were from the ordinary "Officinalis," which forms the bulk of our Dodabetta plantation. It will be seen from the analysis how the yield in quinine differs in some of the individuals, the smallest yield of natural bark being 2.01 per cent. in quinine and the highest 6.32 per cent., and the renewed bark (of which only a few samples were sent) varying from 4.01 per cent. to 7.69 per cent., which, however, is easily accounted for by difference in soil, aspect, age, &c.; it goes, however, to prove what I have already said in my report on the plantations, that it is a great mistake to attach too much value to the analysis of single individuals. If, however, the average of the 22 samples were taken, it would, I consider, give fair data as to the yield of this species in our plantation.

5. "Uritusinga" was, as Mr. Cross states, not sent at all. I am not sure that what we know by this name is really this variety (it is called here "strong-growing Condaminea" and "broad-leaved Condaminea," as well as "Uritusinga"); the specimens, however, that I have forwarded with my report should settle this question; it is very like "Officinalis," only with much larger leaves and of stronger

and quicker growth, promising to be a large tree. There are only about 1,000 of it scattered in the Dodabetta plantation and about one dozen only at Naduvatam, so that there is some mistake in the supposition that Mr. McIvor planted 70 acres with it in 1875. There are many applications for the seed of this from various parts of the world, probably owing to reports of Mr. McIvor or Mr. Money; and, considering its healthy, strong growth and close affinity with "Officinalis," I should not be surprised if it turns out our most valuable species. I learn from Narrainsawmy that small samples of the bark were sent to England for analysis, and that these are the Nos. 18, 19 and 20 under "Condaminea" from Dodabetta given in the table of analysis in G.O., No. 1,336, dated 23rd June 1879; it is a species or variety, however, that we must learn more about.

6. The analysis of No. 15 "Pitayo" is a valuable addition to the chemical knowledge of our species—we have 44 good-sized trees of this species near the Dodabetta Jail, but it has not been further propagated. This analysis differs considerably from that given in G.O., No. 1,336, of 23rd June 1879, when it was much younger—this giving 3.98 per cent. of quinine, Mr. Paul's specimen only 1.50. Mr. Howard urges its propagation, partly because of its yield in quinidine which in his specimen is 2.01 per cent. (though in Mr. Paul's only 0.82). I observe the yield in quinidine is as high as 2.20 in some of Mr. Cross's samples of "Crown bark" now analysed by Mr. Howard, and in root bark of the same species it is as high as 3.45. The extended propagation, however, of "Pitayo" seems desirable, if only the yield of quinine is considered.

7. No. 18 is one of the two species or varieties confounded under the name of "McIvor's hybrid" or "Pubescens;" it is the so-called "Magnifolia" of my report (not "Pubescens") and the "Patà de Gallinazo" of Mr. Cross. Mr. Howard now says it is the "Chinchona coccinea" of Pavon; but he has only seen bark, no specimens of leaves or flowers having been forwarded. I regret such a small sample only of this was forwarded, as it is not a fair criterion; it is very similar, as far as the natural bark and the yield in quinine, to the analysis given by Mr. Paul in G.O., No. 1,336, of 23rd June 1879, under the head "Hybrid Pubescens,"

* Nos. 10 and 11 Naduvatam, and Nos. 10, 11 and 12, Dodabetta. Naduvatam* and Dodabetta, which samples were from the same variety (the glabrus "Magnifolia") not from "Pubescens," as Mr. Cross examined the trees from which Mr. Rowson stripped it at Naduvatam, and I examined them on Dodabetta. The yield in Chinchonine, however, in the specimens analysed by Mr. Paul differs enormously from the specimens sent by Mr. Cross, but a similar difference is observable between many of the Crown bark samples now analysed by Mr. Howard. As already reported two bales of the natural bark of this species went to England from Dodabetta last December, and sold at 7s. 1d. per lb. under the name of "hybrid Pubescens." Mr. Howard and Mr. Cross both advocate the propagation of "Succirubra" being given up in favor of this species. I quite agree with this, considering the healthy and splendid growth of this species which I have written about very fully in my late report.

8. I much regret that samples of the "Pubescens" bark were not forwarded.

9. Mr. Cross states that in the samples forwarded to Mr. Howard, Nos. 21 and 24 have evidently been changed.

10. If the samples 19 and 20 be compared with 22 and 23, it will be seen what a very poor yield in quinine the original bark of "Succirubra" gives compared with the renewed bark; this alone quite taboos the coppicing system of harvesting for this species at least. Nearly all the Red bark trees at Naduvatam are now yielding renewed bark, and the yield of these samples (viz., 3.08 and 2.04 per cent. of quinine) is very high for Red bark; but here, again, we have to be cautious as they are only small samples taken perhaps from exceptionally fine trees grown under favorable conditions; in any case the yield is inferior to that of the "Magnifolia."

11. Of the "Crown barks" only five samples of renewed bark were sent against sixteen of original bark; but the result is sufficient, I think, to show the great superiority of the former, and that coppicing is a mistake to be avoided, when I have

shown in my report that after most careful inspection the trees have not as yet suffered in the slightest degree from the stripping process.

12. Of No. 25 "Calisaya" I must write further later on. We have at Naduvatam of yellow barks "Calisaya," "Calisaya Ledgeriana," "Calisaya var. Anglica" and "Calisaya var. Javanica." Mr. Cross informs me that he looked upon all as the same, and that he does not know which No. 25 was taken from; but he thinks Mr. Rowson knows the exact tree, so I may be able to identify it, if from one of the few trees now alive of "Ledgeriana." I have no remarks to make, but the only shrubby variety at Naduvatam is the "Javanica."

13. At the present stage of our plantations when most of the species and varieties are of a good age and well developed and easily recognized, I consider that the employment of a competent chemical analyzer up at Ootacamund, if only for a few months, would result in the greatest possible benefits in the future both as regards the Government plantations and the wide field of private planting. In Mr. Broughton's days many of the species were young and not developed sufficiently in their characteristics, and there is most evident proof that the question of species and varieties was in a great jumble.

14. I attach the greatest importance to the careful collection of seeds from the healthiest and largest trees of "Officinalis" as well as from our other finer species or varieties, and I have already given very full directions on this point to the officers in charge.

15. I do not understand Mr. Howard's remark that the quantity of bark sent to England from Dodabetta seems disproportionate and exhaustive, or on what data he surmises this to be the case. We are not up-rooting or even coppicing; the "superior quality" of this Crown bark, which he alludes to himself, is proof I think that it is not harvested prematurely, and as long as this is guarded against the sooner the first stripping of the natural bark takes place the better, as the renewed bark is far more valuable in the market; the subsequent strippings can always be taken off every two years, and to delay removing it after maturity is of course a dead loss. On account of insufficient room for drying and storing our estimates this year at Naduvatam have calculated for a shorter crop than we ought to gather. I have, however, quite lately received Mr. Morris's interesting report for last year on the Jamaica gardens and plantations, which contains much valuable information on Chinchona, and he has proved that sun-dried Chinchona bark is more valuable than that dried by artificial heat. I hope, therefore, if we have any continuation of sunny weather this September or October, to try this system of drying, although it has hitherto been supposed here (I do not know from what experience) that bark dried in the sun loses in virtue.

ENCLOSURE

From ROBERT CROSS, Esq., to Colonel R. H. BEDDOME, Conservator of Forests, dated 10th August 1881.

I beg to acknowledge receipt of your communication with date of 9th of this month, enclosing a report from the Secretary of State for India of the analysis of 30 samples of bark by Mr. David Howard collected by me at the Government Plantations of Dodabetta and Naduvatam.

1st.—Mr. Howard's remark that an undue proportion of these samples were of Condaminea, when the aim was to ascertain the comparative value of each species, is no doubt correct, but the fact is that very few trees of the remaining good sorts such as Calisaya and Pitayo would have yielded sufficient bark for more numerous samples of these kinds.

2nd.—The samples of Condaminea, both of original and renewed bark, were collected in different parts throughout the plantation. Respecting the "Uritusinga" trees at the head of the ravine to some of which gauze seed-bags have been attached, an attempt was made to collect bark from these trees which was abandoned owing to the thinness of the bark and the difficulty experienced in getting it to rise. These "Uritusinga" trees, if distinct, form no feature in any part of the plantation, and the statement that 60,000 had been planted seems to me a mistake. Nor can I see any trace of the "22 varieties" of Crown bark reported to have

been recognized by the late Mr. McIvor. The plantation is indeed chiefly composed of the *Condaminea* or true *Loxa* bark, and the steady yield of the samples seem to me a good proof in this respect.

3rd.—The proposal to change the specific name of the *Loxa* bark from *Condaminea* to *Officinalis*, as recommended by Mr. Howard, is truly unnecessary. The term *Condaminea* bestowed on the tree by Humboldt, who visited the *Loxa* forests, has been adopted for the last 50 years by nearly all Professors of Botany in European Universities as well as by the majority of botanical writers.

4th.—The Red bark has proved even of less value than I expected, and the *Pàtà de Gallinazo* and *Carthagena* or *Columbian* may well take the place of this sort. The *Pàtà de Gallinazo* was obtained in the following manner: On packing up the *Succirubra* plants on *Chimborazo* for the journey I found one of the packages was not quite filled, so in company with two sons of a bark collector a hasty trip was made up to a ravine to a distance of three miles up the wooded slope of the mountain. In the bottom of the ravine at the base of a cliff a number of plants were found which were at once identified by the lads as the sort of bark alluded to. The package was afterwards filled up with these plants, and this is the way the *Pàtà de Gallinazo* came to India.

5th.—The samples of "Original bark" were, as suggested by Mr. David Howard, collected from the lower part of the stem of each tree immediately above the roots, owing to the renewing process having been performed on the upper portions of the trunks.

6th.—No. 21 was no doubt exchanged by mistake with No. 24.

7th.—It seems to me that cordial thanks are due to Mr. J. E. Howard and Mr. David Howard for the very interesting and practically useful analysis of these bark samples.

8th.—A further analysis at a future time might, I think, be made by some quinine manufacturer of renewed barks of different ages and also of "scraped" bark from the best species, likewise of barks obtained from varieties on individual trees considered to possess special excellence in order to meet the views for the dissemination of superior sorts as expressed by the Secretary of State for India.

No. 423.

ORDER THEREON, 29th August 1881, No. 1,280.

Miscellaneous.

The papers recorded above contain valuable information on the several points discussed relative to *Chinchona* cultivation. The series commences with the inspection report on the Government Plantations which Colonel Beddome was directed* to prepare on assuming charge of the Plantations. Next in order come the Conservator's remarks upon Mr. Cross's recent interesting account† of his impressions on visiting the different locations on the Hills where *Chinchona* is grown under Government superintendence. This is followed by Mr. Cross's remarks on the most appropriate elevation for the cultivation of the *Chinchona Calisaya* var. *Ledgeriana*, and his observations upon ‡ G.O., 25th July 1881, No. 1,105, R.D. Mr. Howard's analysis of samples of bark selected and sent‡ home by him during the spring. Finally, though not latest in point of date, come Colonel Beddome's remarks upon the results of recent *Chinchona* sales.

2. The Governor in Council proceeds to remark briefly on some of the more salient points brought to notice. He observes that on the whole the Conservator's report is favorable as regards the progress made since Captain Campbell Walker's detailed examination in 1878. The appendices to Colonel Beddome's report furnish particulars of the number and variety of trees existing in 1878 and at the present date.

3. Taking the plantations in the order in which they are dealt with, it is observed that while the bulk* of plants at *Naduvatom* are of the *Succirubra* variety, it is the Conservator's opinion that all of this kind which have been planted on grass land should be uprooted and replaced by *Officinalis* or *Pubescens*. He

states that though the elevation of *Naduvatom* is too high for *Succirubra* still it pays well to grow it on shola soil there. * Report printed with G.O., 17th May 1881, No. 781, R.D. Mr. Cross, it is noted, bears* testimony to the quality of the soil in the *Naduvatom* ravine which appeared equal "in fertility to the lower slopes of *Chimborazo*, the native habitat of the Red bark" and he remarks upon the growth and development of the plants which excelled even those he had seen growing in South America. With reference, however, to the inferiority of the Red bark for the purposes of the quinine manufacturer, he appears to deprecate any extension of its cultivation. Colonel Beddome† points

† Paragraph 4, letter dated 6th June 1881, No. 207. however to other reasons why this variety may be expected to hold its own.

On the whole it seems to Government that it is unnecessary to devote much further attention to this species and that the proposals advocated by the Conservator for replacing it in certain localities may be carried out.

4. The information furnished as to the mistake made in attempting to propagate the *Calisaya** varieties anywhere on the *Nilgiri* plateau leads the Government to consider favorably the recommendation in which Colonel Beddome and Mr. Cross concur,† as to the opening up at an elevation of from 3,000 to 4,000 feet of a small plantation where these "yellow barks" as well as "grey barks‡" may be tried with fair prospect of success. The proposal is (paragraph 55 of Colonel Beddome's report) that the Forest Department at *Nilambur* should clear part of a shola in the "Silent Valley" for this purpose and for experiments with rubber trees and the "*Ipecacuanah*." The Conservator will prepare an estimate of probable cost and will take the necessary preliminary steps to carry out his suggestions.

5. Adverting to the great number of casualties in the *Hooker* estate, and the suggestion to abandon the lower portion of the *Wood* plantation,* the Conservator will report separately and in detail on the question of retaining these estates after consulting the correspondence which has already taken place on the subject.

6. The state of the *Dodabetta* plantation is pronounced promising by the Conservator and Mr. Cross, though they do not agree on the question of terracing which Mr. Cross thinks unnecessary. The eradication of the bracken fern which is stated to be robbing the soil of its goodness will doubtless be taken in hand without delay.

7. Mr. Cross noticed the fact* that in this locality especially the plants at the beginning were placed far too wide apart. * Report in G.O., No. 781. From Colonel Beddome's report† it appears that the same mistake has been made elsewhere. The subject will doubtless receive attention in the full memorandum of instructions which the Conservator intends to prepare‡ for the use of the officers in charge of the plantations; a copy of this should be furnished for the information of Government. † Paragraph 11, letter, dated 6th June 1881, No. 207.

8. The Government are not prepared at present to express any decided opinion on the merits of *barking* as contrasted with the *coppicing* system. The latter has had but small trial as yet, and the present report shows that the *coppicing** carried out in 1879 resulted in failure to a large extent in consequence of the lateness of the season. There is no necessity at present to coppice any more blocks; but the Conservator will, of course, take care to coppice isolated trees which

may show signs of decay. As to the method to be observed in coppicing, it is observed that while Colonel Beddome* does not agree with Mr. Cross, he alludes to suggestions for trying three different systems of coppicing, one of which appears identical with that advocated by Mr. Cross.† However the plan finally adopted under the instructions of Government is now stated to be on the whole the best.

9. Some information is given as to the results, so far as the trees are concerned, of the plan of harvesting the bark by *scraping* reported to have been carried out on a small scale in 1879-80. A large proportion of some 5,000 *Succirubras* at Naduvatam failed to renew,† and Colonel Beddome is inclined to think that the system is likely to be more trying to trees generally than partial barking in alternate strips. No losses occurred at Dodabetta where a similar experiment was made. The question requires more study, and experiments should be carefully prosecuted. The Conservator will report when the first consignment of scraped bark was despatched to England. The result of the sale should be noted, as already directed in G.O., 4th March 1881, No. 398, paragraph 7.

10. The Conservator enters at considerable length into the history of the "Pubescens" variety which has, until lately, been looked upon as a hybrid. It is clearly shown however to be a distinct plant known in South America as the "Pata de Gallinazo" and is a narrow-leaved variety of the Red bark. There appears every probability of this species proving hardy and valuable. The first specimens sent home (in December last) have lately been sold, and the prices realized were 7s. 1d. per lb. for natural *Pubescens* and 5s. 0d. for renewed ditto. The Conservator is anxious for more information as to these particular bales; but it seems hardly likely that they can be followed at this date, and the only way will be to draw special attention to the next consignment. The Conservator will, in due course, specify the information which he requires to be obtained.

11. In forwarding to the Secretary of State the dried specimens referred to in paragraph 140 of the Conservator's Report, for the purpose of comparison with the various species in the Kew Herbarium, attention will be solicited to Colonel Beddome's request that the "*Magnifolia*" and "*Pubescens*" may be specially examined.

12. The Government agree with the Conservator that it is unnecessary at present to attempt hybridization in the plantations.

13. Colonel Beddome's proposal to proceed to Darjeeling to see the Government of Bengal will be addressed on the subject.

14. The remarks which Mr. Cross and the Conservator of Forests have recorded upon Mr. Howard's recent analysis of samples of *Chinchona* bark collected by Mr. Cross will be forwarded to the Secretary of State with reference to his recent despatch.

15. The first point to be noticed here is the extraordinary difference of opinion as to the extent to which the *Uritusinga* species of *Chinchona* *condaminea* has been propagated. Colonel Beddome reiterates the statement, which will be found at paragraph 46 of his detailed report, that there are but a thousand of this kind in the Dodabetta plantation and a few only at Naduvatam. Mr. Howard must therefore have been misinformed, and as it is clear that all the samples of Crown bark sent home by Mr. Cross were of the ordinary *Officialis* it is important that Mr. Howard should be made aware of this fact and that "*Uritusinga*" was not sent at all, no trace of the trees said to have been planted by Mr. McIvor prior to 1875 can be found in the Government Plantations. The analysis made by Dr. Paul of this species in 1879 shows the following results:—

See entries 18, 19 and 20, Dodabetta, C. *Condaminea*, in enclosure to Secretary of State's Despatch, dated 8th May 1879, No. 13 (Revenue), [G.O., 23rd June 1879, No. 1,336].

Samples.	PERCENTAGE AMOUNT OF					Crystallized Quinine Sulphate.
	Quinine.	Quinidine.	Chinchonidine.	Chinchonine.	Amorphous Alkaloid.	
Natural	1.20	..	1.50	0.18	0.10	1.62
Mossed	2.13	..	2.00	0.47	0.20	3.00
Renewed	3.40	..	1.48	0.14	0.20	4.58

It is desirable that further specimens of this species should be forwarded for analysis and the Conservator will issue the necessary instructions. The difference which he notices in the analysis of the *Pitayo* bark in 1879 and 1881 renders it probable that the yield of alkaloids in the *Uritusinga* will also be greater now the trees are older. Samples of the *Pubescens* and *Magnifolia* (Mr. Cross's *Pata de Gallinazo*) should also be transmitted to England for analysis—as well as specimens of bark of different sorts harvested by the *scraping* process—as suggested by Mr. Cross.

16. The Government agree with Colonel Beddome that the extended propagation of *Pitayo* is desirable. The necessary steps should be taken to this end.

17. The Conservator will report further on the *Calisaya* specimen transmitted by Mr. Cross.

18. The Conservator's suggestion to employ a competent Chemical Analyzer at Ootacamund will be referred to the Secretary of State for decision. By paragraph 27, G.O., 24th February 1879, No. 463, it was settled that reference could be made, when necessary, to "an European Chemist of repute."

19. The proposal to dry bark by the heat of the sun as an experiment is approved and should be reported upon in due course.

20. The Conservator's remarks in paragraphs 14 and 15 of his letter, No. 498A, will be brought to the notice of the Secretary of State and the thanks of the Governor in Council will at the same time be tendered to the Messrs. Howard for their careful analysis and interesting report.

(True Extract.)

Secretary to Government.

To the Conservator of Forests, with four key maps returned.

Commissioner, Nilgiris
Exd. W. H. French.
60 Copies.
P. Cross Esq.
see addition in the draft G.O.

Original
Govt. of 1881: Madras.

REVENUE.

To

THE CONSERVATOR OF FORESTS.

Dated 1 August 1881.

Revised 1 September 1881.

Recd.

Encl.

G.O., 29th August 1881, No. 1,490.

AUGUST.

Nos. 418—423.

SUBJECT.

Chinchona Cultivation in the Government Plantations, Nilgiris.—Passing orders on papers containing valuable information on several points relating to —.

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From Colonel R. H. BEDDOME, Conservator of Forests, Madras, to the Secretary to Government, Revenue Department, Madras, dated Ootacamund, 4th June 1881.

ADVERTING to the G.O., No. 1,670, dated 8th December 1880, I have the honor to inform you that I have lately thoroughly inspected all the Government *Chinchona* Plantations at Naduvatom, Pykara, and Ootacamund, and I herewith submit my report on the same. I have given my field notes on each plot in the different plantations as taken when going over them with the officers in charge: to these I have added general remarks on the condition of the three different plantations; notes on the coppicing, scraping and stripping systems of harvesting the bark; remarks on the different species grown, condition of buildings, nurseries, &c., together with other remarks and suggestions.

NADUVATOM CHINCHONA PLANTATION.

2. No. I Plot, 1862, A.—14.12 acres, east exposure, shola soil, steeper, stonier and not so rich as in the next plot of the same year's planting; growth good though not equal to plot B; planted originally with three-fifths *Succirubra* and two-fifths *Officinalis*, all of which have now been barked seven times; one block of about 5 acres of *Officinalis* is of poor growth, chiefly owing to wide planting.

In one spot 57 trees, *Succirubra*, were coppiced rather roughly in October 1873; no suckers were left when the trees were cut, and 22 out of the 57 stools have since died.

The following are measurements of ten of the living coppice:—

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Height ...	24'	22'	23½'	23'	24½'	17½'	18½'	19½'	16'	18½'
Girth ...	17"	15"	15"	12"	13"	12"	13"	19"	11"	12"
Number of Shoots ...	2	2	3	3	2	2	2	1	2	2

in the same place and standing in eight rows with the above, 58 trees were also coppiced in May 1873, the suckers being left when the trees were cut, only one stool is dead.

The following are measurements of ten:—

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Height ...	30½'	24½'	26½'	21½'	23'	26'	23'	24½'	24½'	23½'
Girth ...	20"	20"	16"	15"	15"	17"	16"	16"	20"	19"
Number of Shoots ...	2	2	3	2	2	1	1	2	2	1

In another spot 200 *Succirubra* were coppiced in May 1871 when nine years old; suckers were left and only one stool died, the yield of the bark being 1,350 lb. green, drying to 453 lb.

These 199 were again coppiced in March 1881 when ten years old (all cut flush with the ground, no suckers left), the yield of the bark being 3,365 lb. green, drying to 1,312 lb.; none of these had commenced again to grow when I saw them on 1st of May, but there had not of course been time for this.

3. No. II Plot, 1862, B.—17.06 acres, shola soil, west exposure, but sheltered by a hill; nearly all *Succirubra*, but some *Officinalis* and *Pubescens*.

The following are measurements of six selected *Succirubra*:—

Height ...	35'	38½'	32'	33'	36½'	37'
Girth ...	31"	34"	29"	26"	33"	32"

All the *Succirubra* and *Officinalis* have been barked eight times.

Only about eight trees are left out of a quantity of *Micrantha* trees planted in one place; this species is reported always to die off; the blanks have been filled up with about 600 *Pubescens* trees (entered in Major Walker's report as supposed to be *Anglica*), which are growing well and luxuriantly.

In this plot 115 trees of poor growth, unbarked, were coppiced in May 1875, yielding only 248 lb. of green bark. Thirty-three stools died, the surviving 82 average 9 feet in height and $5\frac{1}{2}$ inches in girth, and the stools have from three to six shoots now growing (not barked).

4. *No. III Plot, 1863.*—5.41 acres, shola soil, the portion above the road sub-soil indifferent, growth fair, the portion below the road poor from wide planting and exposure to wind, nearly all *Succirubra* barked seven times.

5. *No. IV Plot, 1864, A.*—8.86 acres, above the road chiefly *Succirubra* with a few *Officinalis*, fair growth where the soil was shola, poor in places where it was originally grass; below the road *Succirubra* and *Officinalis* mixed, very poor growth from wide planting and exposure to the wind, the soil is also rather poor, all sized trees, barked seven times.

6. *No. V. Plot, 1864, B.*—4.46 acres, shola soil, chiefly *Succirubra* with a few *Officinalis*, all barked seven times, poor growth owing to wide planting, a few trees dying out owing to a combination of poor soil and exposure to wind.

7. *No. VI Plot, 1864, C.*—7.87 acres, shola soil, planted with *Succirubra* and *Officinalis* in nearly equal proportions quite intermixed, growth good but thin in portions owing to the original wide planting, all barked five times. In this plot $\frac{1}{4}$ acre (adjoining coppice in next block) coppiced in May and June 1879, 56 four times barked, trees cut, 43 stools have grown well and 13 died.

8. *No. VII, 1864, D.*—17.04 acres, shola soil, *Succirubra* and *Officinalis* in equal proportions, growth very good, trees barked five times.

In this plot a block of $4\frac{3}{4}$ acres of trees four times previously barked was coppiced in 1879 (from 31st of May to end of June), 2,263 trees were cut and 2,091 are now growing; the trees were sawn through about 3 inches above the ground and adzed over with a convex surface to nearly flush with the ground; they bled excessively owing to the lateness of the season; hence I think the failures. The present growth of the remainder is most healthy and all that could be desired; each stool has from 1 to 3 stems, 4 to 6 feet high; there is also a late growth of smaller stems which, I think, should be pruned off, but Mr. Rowson states that the Duke of Buckingham requested that these should be left.

9. *No. VIII Plot, 1864, E.*—11.58 acres, shola soil, *Succirubra* and *Officinalis*, the former in a greater proportion; growth of both very good and healthy; *Succirubra* barked twice, *Officinalis* barked five times.

10. *No. IX Plot, 1864, F.*—8.58 acres, shola soil, planted with *Succirubra* and *Officinalis* in nearly equal proportions; growth of both very good, trees barked three times.

11. *No. X Plot, 1865, A.*—18.32 acres, in two plots waste land intervening; first about 2 acres grass land planted with *Officinalis* and a very few *Succirubra*, very much exposed to the south-west monsoon; growth poor; trees barked five times.

Second portion shola soil (except a small corner of grass land with about 150 trees very poor growth) planted with *Succirubra*, wind-blown and growth poor except in a low protected portion where the growth is fair.

12. *No. XI Plot, 1865, B.*—12.95 acres, shola soil, about nine-tenths *Succirubra*, fair growth in portions, poor where wind-blown, one corner very exposed, trees very poor and dying out; about one-tenth *Officinalis*, very good growth; all the trees of both species barked four times. There are some *Pubescens* trees.

13. *No. XII Plot, 1865, C.*—12.43 acres, shola soil, *Succirubra* chiefly, *Officinalis* about 3 acres, all splendid growth, all barked six times; the plantation is too crowded in parts; the trees not being three feet apart; the thin girthed trees not reaching the light should be uprooted.

14. No. XIII Plot, 1866, A.—4.10 acres, shola soil, nearly all *Officinalis*, growth good but planted originally too far apart, barked three times.

15. No. XIV Plot, 1866, B.—14.34 acres, shola soil, all *Succirubra* of very fine growth, barked six times; there was a good deal of *Calisaya* in this plot, but it all died out some years ago.

16. No. XV Plot, 1866, C.—12.45 acres, shola soil, *Succirubra* except a small quantity of very fine old *Officinalis* and some young *Calisaya* and *Pubescens*, growth of *Succirubra* very fine, barked six times, about one acre formerly planted with *Calisaya*, all dying or dead, was uprooted, yield of bark 730 lb; sale proceeds unknown; this block has been replanted with 2,000 young *Calisaya* and 600 young *Pubescens*.

17. No. XVI Plot, 1868, A.—3.71 acres, all shola, planted chiefly with *Succirubra*, has been burnt over more than once, now poor and very thin, only about 300 trees remaining, soil poor and scarcely worth replanting.

18. No. XVII Plot, 1868, B.—8.13 acres, all shola, about one-third facing west very much blown, planted with *Succirubra*, condition bad; about two-thirds facing east, *Succirubra* and *Officinalis*, about alternate trees very fair growth, all barked twice.

19. No. XVIII Plot, 1869, A.—9.96 acres, grass land, nearly all *Succirubra*, growth fair, particularly in lower portion, trees not barked; 400 *Officinalis* barked twice.

20. No. XIX Plot, 1869, B.—11.83 acres, grass land, all *Succirubra*, upper portion exposed and growth very poor and thin and should be uprooted and replaced by *Officinalis*, lower portion fair growth of Red barks for grass land, trees not barked.

21. No. XX Plot, 1869, C.—13.69 acres, grass land, 2 acres *Officinalis*, good growth, all barked, balance *Succirubra* not barked, fair growth for the soil, but should all be uprooted and replaced by *Officinalis* which may be said of all grass land planted with *Succirubra* in these plantations.

22. *No. XXI Plot, 1869, D.—13.26 acres, grass land except a small patch of shola land, all *Succirubra* except a few supplies of *Officinalis*, not barked, except the small bit of shola soil all poor growth and very thin in the upper portions, should be uprooted and planted with *Officinalis*.
*Major Walker's remarks on these two plots are evidently reversed.

23. *No. XXII Plot, 1869, E.—12.18 acres, all shola land except a small corner of grass land (about 50 trees), all *Succirubra* except supplies of *Officinalis*, growth very good, not barked.

24. No. XXIII Plot, 1869, E.—11.54 acres, two-thirds shola, one-third grass land, all *Succirubra* except supplies of *Officinalis*, growth very good on the shola soil, fair on the grass land, trees not barked, 5 acres coppiced in 1879, balance scraped in 1880, 5 acres *Succirubra* coppiced in July 1879 (in the same manner as in Plot No. VII), 2,628 unbarked trees cut, all stools bled terribly, 973 dead and uprooted, 1,655 growth healthy, shoots 1 to 3 to each stool, 3 to 4 feet high, blanks from the uprootals to be planted with *Pubescens*.

Six acres 4,723 *Succirubra* trees scraped in September 1880 on the new Java principle. Of the trees none were mossed or covered in any way as it was not supposed to be necessary, 1,978 trees have failed to renew their bark, and the bark and cambium being apparently all dead it is supposed the trees must die, and some have already died; the remainder are renewing their bark satisfactorily, and might probably be scraped again in 1882, but not before.

25. No. XXIV Plot, 1869, G.—20.19 acres, all shola land, all *Succirubra* and *Pubescens* except supplies of *Officinalis*, not barked, splendid growth, *Pubescens* about 20 per cent.

26. No. XXV Plot, 1869, H.—9.20 acres, all shola except a small bit of grass land; shola soil planted with *Succirubra*, not barked, growth very good; grass land planted with *Officinalis*, all barked.

27. No. XXVI Plot, 1869, I.—2.55 acres, shola land, all *Succirubra* of very good growth, barked four times.

28. No. XXVII Plot, 1870, A.—11.52 acres, grass land, now two-thirds *Officinalis* and one-third *Succirubra*, originally planted entirely with *Succirubra* which mostly died out and was replanted in 1872-73, the remainder of the *Succirubra* should be uprooted and replaced by *Officinalis* or *Pubescens*, the *Officinalis* growth is not good owing to exposure and poverty of soil, but it will pay, not barked.

29. No. XXVIII Plot, 1870, B.—16.37 acres, grass land, an entire failure, uprooted and abandoned, and now pitted for planting Australian acacias for fuel.

30. No. XXIX Plot, 1870, C.—4.30 acres in three separate blocks—

First block.—Grass land, *Officinalis*, growth good, but too widely planted, barked twice.

Second block.—All shola land, mixture of *Succirubra*, *Officinalis*, *Calisaya*, *Javanica* and *Anglica*, not barked, growth good, except the *Calisaya*. The *Anglica* and shrubby *Javanica* of no value.

Third block.—All shola, chiefly *Succirubra* with a few *Officinalis*, growth good, not barked.

31. *Naduvatom Buildings*.—A drying house and new store have been sanctioned at Naduvatom; the work is progressing very slowly, less than one lakh of bricks having been made; owing to the want of this building only a small crop can be collected this coming season.

The general condition of the buildings, other than the stores, is good; the lines for the coolies are also in good order; the house now occupied by the Overseer and the one occupied by the Clerk should have an iron roof substituted for the grass one.

32. *State of Naduvatom Plantations*.—The Naduvatom plantations certainly show very fine growth, and though I inspected them at the beginning of May after an unusually dry April and at the end of a long season of drought when all the grass hills were as brown as the roads, they were in splendid condition and healthy foliage; taking into consideration the mistake of too wide planting, I think they are all that could possibly be expected and in every way satisfactory: In planting up a large area like this site, it is of course impossible always to avoid too great exposure to wind, bad soil, bad drainage, &c., and there are here and there failures from these causes; but this could not be otherwise, and even in many places where the growth is poor it pays well at the prices bark is now realizing.

33. *Fencing*.—A considerable expenditure is necessary in fencing in several of the plots, if they are to be properly kept up; as the Sambur are most troublesome, it will well pay.

34. *Wide planting*.—The great mistake here as elsewhere has been the wide planting. It was probably supposed that the trees would grow to a far larger size than they now promise; but even supposing that this had occurred, there was the established fact that such large trees as Teak and Eucalyptus had to be planted 6'x6' and afterwards gradually thinned out, otherwise good growth could not be secured: wide planting causes crooked growth and often no fair boll and gives the wind an unfair advantage. The planting was originally 12'x12', but reduced gradually afterwards down to 8'x8' and 7'x7'. I am of opinion that the planting of "*Succirubra*" should always be 5'x5' or certainly not more than 6'x6' and that the first thinning (alternate lines having the trees 10'x5' or 12'x6') need not take place till there would be some yield from the bark, and that at the final thinning the trees may stand 10'x10' or 12'x12'. "*Officinalis*" should be planted 4'x4' or perhaps even closer; intermediate planting is always very precarious owing to the shade and drip of existing trees, and 25 or even 50 per cent. very often appear to fail. Throughout the plantations one sees evidence of the great mistake wide planting has been.

35. *Is barking injurious or not to the trees?*—There is certainly no proof that barking in any way affects the health of the trees. I was formerly of opinion that

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it did, and fancied I detected it in the appearance of the trees so I was prejudiced in a way, but I made most careful inspection of both barked and unbarked trees both from a distance and close, and could detect no difference in foliage or any way else, and it is a fact that the trees barked seven to eight times are some of the healthiest and finest in growth, foliage and every way in the plantation, and that they are now flowering and seeding less prolifically, and that the barked trees have grown quite as well, if not better, from coppice, which shows that their root system must be quite as healthy; this is also Mr. Rowson's opinion.

Mr. Rowson thinks that the trees appear to suffer somewhat for a month or six weeks after being stripped, getting somewhat yellowish in leaf, but that they rapidly recover, so that if inspected just after the barking a prejudice might easily be entertained against the system.

Trees that have been barked several times often bear fewer branches, but this is owing to the pruning and to branches having been broken off; the foliage is just as thick as in unbarked trees.

Some trees do fail to renew their bark after being stripped, but it is very uncommon, and it is very rare to find a really healthy tree die out from its effects.

The bark renews just as rapidly in the subsequent strippings as it does in the first, and there is no perceptible difference in its thickness, the renewal is always more rapid on rich soil than on poor. Carelessness in barking prevents immediate renewal and may cause the death of a tree.

36. *Elevation for "Succirubra."*—The "Succirubra" does not attain the same size at Naduvatom as it does in Wynaad and elsewhere at lower elevations; it grows to about 50 feet in Ecuador, and on the Tinnevely ghâts at 3,000 feet; it has been measured 52 feet in height; at Naduvatom no trees are quite 40 feet: 5,000 to 6,000 feet is probably too high an elevation for large growth, but it is said (I do not know how far correctly) that the bark at these higher elevations is more valuable; in any case "Succirubra" pays well on shola soil at Naduvatom.

37. *Longevity of "Succirubra."*—"Succirubra" is probably not a long-lived tree, but we cannot state the age it will attain when left unbarked, or when barked until we have actual data, and a good quantity of unbarked trees must be left for this purpose.

38. *Method of harvesting.*—With the established facts that the eight times barked trees are still perfectly healthy and that the renewed bark is far more valuable than the natural bark, it would not be advisable to adopt any other system than the present one, the credit of which entirely belongs to Mr. MacIvor; and it should, I certainly think, be pursued as long as the trees appear healthy, but trees showing signs of decay should be either coppiced or uprooted.

39. *Coppicing.*—The marginal paragraphs, if referred to, show the results of the coppicing at Naduvatom in 1879; the coppicing process was very well carried out, the stools being sawn through about 3 inches above the ground and adzed over with a convex surface to nearly flush with the ground; the growth is very healthy and promising wherever the coppice has succeeded.

In the 1864 planting, 2,319 "Succirubra" trees, all previously barked four times, were carefully coppiced early in June 1879; 185 stools have died, 2,134 are growing luxuriantly.

In the 1869 planting, 2,628 unbarked "Succirubra" trees coppiced in the same manner in July 1879; 973 stools died, 1,655 growing luxuriantly.

Here we have a great anomaly: trees fifteen years old have succeeded from coppice with a far better percentage than trees only ten years old; this is quite opposed to my experience in the coppice of any other trees, the growth being generally far more successful in the younger trees; old or even mature trees often failing altogether to make coppice growth beyond a few twigs which die off, when saplings or young trees of the same species grow most readily; this is always the

case with "Teak" and "Babul." Again, it is noteworthy that the four-times barked trees have succeeded from coppice with a better percentage than the unbarked trees.

Both these data however are more or less valueless, as the 1869 planting was coppiced nearly a month later than that of 1864 the sap was therefore more up and the trees bled much more which may account for the extra failures.

The coppicing of both years was carried out too late, and I am inclined to attribute the failures to this cause as the stools bled terribly: if the coppice had been in April or early in May, it is probable there would have been no failures at least of healthy trees.

Of the old coppicing experiments carried out more roughly, where fifty-seven unbarked "Succirubra" trees of 1862 planting were clean coppiced in October 1873, all suckers removed, twenty-two have died, thirty-five have grown well and are about twenty feet high, and of fifty-eight trees of the same year coppiced in May 1873, but the suckers left standing, only one stool is dead; and of 200 "Succirubra" of the same year in another block coppiced in May 1871 (when nine years old) suckers left standing, only one stool died; the 199 again coppiced in March 1881 (when 10 years old) no regrowth yet, but sufficient time has not elapsed. The yield of green bark in 1871 was 1,350 lb., but in 1881 it was 3,365 lb., which is noteworthy; and of 115 "Succirubra" of the same year, but of poor growth and unbarked, coppiced in May 1875, thirty-three stools died, the surviving eighty-two about 9 feet high and $5\frac{1}{2}$ inches in girth.

I do not think we should carry out any further coppicing in blocks, but only coppice trees showing signs of decay. I observed here and there dead trees in the different plantations. A tree should never be allowed to die, as its bark then yields no alkaloids; they should be coppiced or uprooted when the signs of decay are evident. It is an established fact that if a sucker or shoot is left when the tree is coppiced it never dies, and when trees have no shoots one can easily be produced by slightly injuring the bark close to the ground. It is also an established fact that if trees are coppiced in June or July, when the sap is well up, there must be many failures owing probably to the excessive bleeding that takes place. We have not sufficient data to say whether trees coppiced in April or early in May will all grow again without any failures.

40. *Uprooting*.—I do not think that this is to be thought of as a harvesting system, but I would uproot all "Succirubra" on grass land at Naduvatam and elsewhere, where it is advisable to replace it with "Officinalis" or "Pubescens." It is doubtful how far seedlings will succeed on land immediately after it is uprooted; it will probably be found necessary that it should remain fallow for a certain period.

41. *Scraping*.—As to the new Java method of scraping, we want, I think, more experience. This first attempt (*vide* paragraph 24) has, it will be seen, proved a failure with "Succirubra," and caused the loss of a great number of trees; it would probably not fail if the trees were mossed or grassed over after the scraping, but one of its advantages was the supposition that the expense of this would be unnecessary. I am inclined to think that the trees are much more likely to suffer from the complete scraping than from the partial barking in alternate strips; we have yet to learn if the scraped bark is more valuable in the market than the stripped bark.

42. *Grass, a substitute for Moss*.—For the last two years Mr. Rowson has employed the coarse Lemon grass of the hills (*Andropogon Martini* and *Schreanthus*) as a substitute for moss for covering the trees after stripping off the bark; it appears to answer in every way as well as moss, the bark never failing to renew; the grass of course lacks the hydrometric properties of moss, and it is possible that bark renewed under it may not be so replete with alkaloids. But I see no reason to fear this; the grass costs only about one-third what moss does, and moss might in time be exterminated; the moss must act like a sponge round the tree in wet weather when the bark is growing most rapidly, and considering how replete the bark itself is with moisture, this is, I think, more likely to be injurious than beneficial; all that is probably required being protection from solar influences and from

wind. The first report on bark renewed under grass however will be of great interest.

43. *Red Barks (Succirubra)*.—Although this tree is not adapted to grass land on the Nilgiris, it grows very well in shola soil at Naduvatom, and at lower elevations; Ootacamund is of course too high for it. The bark is not nearly so rich in quinine as the "Officinalis", "Calisaya", and some others; but it is perhaps the richest of all the species in the total yield of alkaloids, and on account of its easy culture, robust growth, and great yield of bark will probably always be the one most cultivated in the Wynaad, Coorg, &c., at elevations of 2,500 feet and upwards. It will grow almost everywhere on our western mountains between 2,000 or 2,500 up to about 6,000 feet, if forest soil be selected and a sloping situation; it is however apt to die out on flats as it did in Travancore, unless the subsoil drainage is carefully attended to; and it has been proved that it is useless to attempt its cultivation in the drier climates in the eastern or central parts of this Presidency.

"Succirubra" should never again be planted on grass land at Naduvatom, and what there now is on this soil should be gradually uprooted and replaced by "Officinalis" or by "Pubescens."

44. "*Pubescens*."—No one can visit the Naduvatom plantation or the "Hooker" at Pykara without being struck by the splendid growth on grass land of the species known as "*Pubescens*"; whilst "*Succirubra*" is always very stunted and with the leaves very much crimped and unhealthy looking in this soil. This species or variety is of sturdy fine growth for out-topping the Red barks and with very healthy darker green leaves; the difference in growth, however, is not so marked in the shola soil as the "*Succirubra*" grows there equally or nearly equally robust. This "*Pubescens*" has generally been supposed to be an accidental hybrid of Nilgiri origin and is often known

* *Note*.—Hybrids between distinct species could scarcely occur without isolation, or without removing the anthers (of the flowers to be impregnated) at a very early stage, as I find the anthers burst before the valvate lobes of the corolla are fairly open. I find the flowers of *Officinalis* (and all the other species as far as I have observed) dimorphic; some trees have all the flowers with short included anthers and long exserted style, others with long anthers and short included style (this dimorphism occurs also commonly in species of *Hedyotis*—*Anotis*) and other genera of this tribe (*Rubiaceae*) indigenous on the Nilgiris. Seeds of hybrids would be sterile except under certain conditions.

two distinct varieties; one he said called

† Nothing to do with the "*Cinmagnifolia*" *Rz* and *Pavon*, which is now placed in another genus "*Cascarilla*" differing from *Chinchona* in having a papillose instead of a hairy corolla and in the dehiscence of the capsules.

as Mr. McIvor's hybrid; it is, however, no hybrid* whatever, nor has it any of the characteristics of one, and it has evidently been in the Nilgiri plantations since their commencement, though not recognized as distinct from "*Succirubra*" in its young growth and before flowering. It differs from "*Succirubra*" (besides in its more robust growth at a higher elevation and in poorer soil) in its leaves being more pointed, more coriaceous, of a much darker green, and more shining, and in the primary veins being less at right angles with the midrib. Mr. Rowson pointed me out what he called "*Pubescens*" by Mr. McIvor and the other called "*Magnifolia*."† On careful examination however the only difference appeared to be a certain amount of *Pubescens* on the young shoots and under surface of the leaves in the former, whereas typical specimens of the latter are quite glabrous on the under

surface of the leaves and the young shoots are very slightly pubescent; and I found that Mr. Rowson could not tell one from the other except by very close inspection, and that the difference in *Pubescens*, though sometimes much marked, was in other cases not apparent. The pubescent variety has also been called "*Lanosa*" and growing in shola soil with "*Succirubra*" might be passed by as that species by the uninitiated; the leaf however is never so rounded at the apex and it has a flatter surface, and never the crimped look that "*Succirubra*" always assumes more or

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less. I found a good many of "Magnifolia" and a few "Pubescens" in the Dodabetta plantations, and there are some fine old trees of "Magnifolia" in the 1865 plantation which are certainly not supplies (which alone would prove that they could not be hybrids), but here I found them both known to the Superintendent (Narainsawmy) as "Pubescens," the name "Magnifolia" not being known.

Mr. Rowson informed me that he considered them hybrids, as they had not appeared before the 1869 planting (it will be seen elsewhere that Mr. Cross detected them in the oldest planting); that they both generally came up true from seed, but that he had known many sown as these hybrids come up true "Succirubra" which he however attributed to careless gathering. He also stated that he had largely propagated "Pubescens" and not "Magnifolia" on the supposition that the bark of the former was much more valuable; the bark he also said both of "Pubescens" and "Magnifolia" had not been sent to market except from a few trees taken carelessly by coolies and mixed with other barks, but samples had been collected from one or two trees and sent home for analysis, and this analysis is given in G.O., No. 1,336, of 23rd June 1879, under "hybrid Pubescens," and is most favorable, though I am not inclined, as I have said elsewhere, to give too much reliance on the analysis from single individuals perhaps grown under very favorable circumstances. These specimens were taken from the glabrous "Magnifolia" and not from "Pubescens."

Narainsawmy, the Dodabetta Superintendent, informed me that he did not consider "Pubescens" a hybrid, as there were large trees in the 1865 plantation which he had always been familiar with since he took charge in 1868; he also stated that if sown they sometimes come up true, but they often come up "Officinalis" (this must of course be due to careless gathering). I subsequently got Mr. Cross to make a careful examination of this species or variety both at Naduvatam and on Dodabetta. He informs me that "Magnifolia" and "Pubescens" are one and same species, and scarcely distinguishable, that he is quite familiar with the tree which he found himself in the Red bark region on the slopes of Chimborazo, but always at a higher elevation than "Succirubra", and that the Cascarilleros or bark collectors always distinguished it as the "Pàtà de Gallinazo" (or turkey buzzard's foot), whilst they called the "Succirubra" "teja" (or tile bark), but that the bark was not put up separately by their collectors. He also states that he believes this tree has never been figured or described although Weddell (Notes sur les Quinquinas) refers to no less than four species as the source of Pàtà de Gallinazo, whilst Mr. Spruce in his report includes the Pàtà de Gallinazo as bark collector's lore, evidently regarding it as an *alias* of "Succirubra," though he could never have seen the trees. Mr. Cross also states that he examined the very tree at Naduvatam, that the bark was taken from for analysis, and that it is typical "Pàtà de Gallinazo" (or the glabrous "Magnifolia" of Mr. Rowson); and that there can be no mistaking the strong growing varieties of both sorts on the grass land; but that in some cases true "Succirubra" has been pointed out to him as "Pubescens" in the Naduvatam plantations and the same mistake he says seems to have occurred at Darjeeling. There is evidently some confusion about the pubescent variety, and I fear that the officials do not always distinguish between some forms of "Succirubra" and "Pubescens" when growing in shola soil and that awkward mistakes are liable to occur both in the supply of seed and collection of bark. Mr. Cross also informs me that he found trees of this "Pàtà de Gallinazo" in the oldest plantations at Naduvatam and that he has no doubt it was introduced here from the commencement, but that it was not distinguished from "Succirubra" till it grew up and flowered or till its robust growth became apparent.

I forward with this report carefully dried and mounted specimens of both "Magnifolia" and "Pubescens," so I trust that they may be compared with typical specimens of the various species in the Kew Herbarium. I also forward species of all other species referred to in this report for comparison, &c.

I examined the two trees in Dodabetta from which Narainsawmy tells me the analysis of hybrid "Pubescens" is given in G.O., No. 1,336, dated 23rd June 1879 (Nos. 10, 11 and 12); they are both the glabrous variety that Mr. Rowson

calls "Magnifolia" and Mr. Cross styles "Pàtā de Gallinazo." The results from the three specimens sent vary much in the percentage of the different alkaloids, and also the variations with the samples sent from Naduvatom are considerable; this is not satisfactory, though there is proof that we have in this plant a very valuable species.

The Dodabetta Superintendent informs me that this tree suffers less from frost than the "Officinalis."

Mr. Howard calls this tree "Officinalis" var. "Pubescens." It is in my opinion nearer "Succirubra" than "Pubescens," and it will be seen from some specimens that I forward that the young leaves from shoots and suckers are nearly as large as those of "Succirubra," though more lanceolate in shape and more pointed. No varieties of "Officinalis" not even its longest leaved form "Uritusinga" ever produce leaves nearly as large as this.

I much fear that in some cases seed of true "Succirubra" may have been forwarded from Naduvatom to Ceylon, Darjeeling or elsewhere instead of true "Pubescens," and that unfortunate mistakes may thereby arise.

I have had long talks with Mr. Cross about this tree, and we have examined many together, and he now writes me: "the circumstance that this prolific and hardy sort has so long escaped notice, and the uncertainty that still exists as to which of the two sorts ('Succirubra' or the so-called 'Pubescens') are the richest in alkaloids is much to be wondered at."

* Note—There is still some doubt as to "Magnifolia" and "Pubescens" being one and the same species or rather slight variations of the same species, though I myself feel fully convinced that they are. I trust, however, that the fact may be established from the dried specimens now forwarded. It is a fact that it is Magnifolia (true) which gave the favorable analysis in G.O., No. 1,336, of 23rd June 1879, as far as Dodabetta is concerned, whilst it is "Pubescens" that is being largely propagated at Naduvatom, the Naduvatom analysis was from trees growing in Ossington which I have not seen, but Mr. Cross states they are "Magnifolia."

It is I now think all important that the doubts about it should be cleared up and that we should have a careful analysis from a considerable number of both the glabrous and pubescent varieties.* Narrainsawmy of Dodabetta informs me that he sent it home to market for the first time in December 1880, and that two bales were forwarded, viz., 111 lb. of mossed "Pubescens" (not renewed) and 138 lb. of natural "Pubescens;" the report on this is not yet to hand, and will be of the greatest interest. There is not a tree of "Succirubra" in Dodabetta fit to be barked, so it is doubtlessly all

from the true "Pubescens" or "Pàtā de Gallinazo" of Mr. Cross; it is besides nearly all from the glabrous variety as very few trees of the pubescent form exist in this plantation. No bark of these sorts has as yet gone to market from Naduvatom, so I think that some, both of the pubescent and glabrous varieties (from grass land and from forest soil separately), should be forwarded without further delay. If this species is really far more valuable in its yield than "Succirubra" Government have been losing enormously by the extensive propagation of the latter to the exclusion of the former. Mr. Cross states that it grows at a much higher elevation in its native country, and this is borne out by the fact that it is growing vigorously on Dodabetta above 7,000 feet elevation (where "Succirubra" is a complete failure) and by its more vigorous growth at Naduvatom in exposed situations.

This species is very strong growing, and will certainly yield far more bark in a given time than any other; it will also, I think, prove to be longer lived.

The questions, however, first whether it is to oust "Succirubra" from the forest soil at Naduvatom, and second to what extent it is to be planted on grass land to the exclusion of "Officinalis" must entirely depend on the report on the analysis of a sufficient quantity of its bark.

Mr. Rowson informs me that he has 5,000 "Magnifolia" on the Hooker plantation and 2,000 at Naduvatom, 5,000 "Pubescens" on the Hooker and 4,000 at Naduvatom, and there are about 1,000 at Dodabetta chiefly "Magnifolia."

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In the 1869 planting at Naduvatam 20 per cent. of the trees are of this species.

45. *Unknown Species*. *—I found five trees of a curious species in the 1865

* Since this report has been copied I got Mr. Cross to examine these trees. He writes: "great discovery! incredible fact!! the celebrated 'Chinchona Crispa' of the Loxa mountains, a packet of the seed of which we collected when collecting the *Officinalis*." He also tells me that it is a very valuable bark, that the plant is probably almost unknown and was only collected by himself, and that the seeds which were sent to the Nilgiris were said never to have germinated.

I can find no description of *C. "Crispa"*, and the nomenclature and synonym of the genus seems in a most confused state at present; it can, however, scarcely be the "*Crispa*" of Jafella mentioned in Triana's work without description, as that is said scarcely to differ from "*Officinalis*" and is made a variety of it by most authors which this very distinct species could never be. If Mr. Cross is correct the plants lately supposed to be "*Crispa*" are spurious, but I do not know where "*Crispa*" is originally described or by whom. Whatever this may be its bark should be analyzed at once; it has been in these plantations since 15 or 16 years without ever having been noticed; it is in flower and seed now and has probably been seeding for many years and might be propagated largely, if advisable; in its bark, leaves and fruit it is utterly unlike anything else in any of the plantations.

Mr. Cross says he found it at 10,000 feet elevation, and that it grows at a higher elevation than any other known species of the genus.

"broad-leaved *Condaminea*" is evidently only a variety of "*Officinalis*." It is of much stronger growth with broader leaves and promises to be a much larger tree; but twigs can often be gathered from ordinary "*Officinalis*," particularly from suckers or young growth, in which the leaves are quite indistinguishable from this "*Uritusinga*." Mr. Cross believes our tree to be the same as the "*Uritusinga*" of Pavon, which takes its name from a hill near Loxa, where he himself collected it, and which is now quoted in botanical works as a synonym of "*Officinalis*;" but it should certainly be considered as a variety, and its bark should be kept distinct from that of "*Officinalis*." Our plant is exceedingly strong growing and healthy and I think it should be largely grown and receive more attention; at present there are about 1,000 of it in Dodabetta, but only about a dozen at Naduvatam. "*Uritusinga*" is a lofty tree in its native habitat.

Angustifolia.—Evidently only a variety of "*Officinalis*;" it sometimes looks very distinct, the leaves being narrower and deeper colored, but it is not always true to its characteristics, and broader leaves in no way distinguishable from "*Officinalis*" can often be gathered on it. There is none of this in the Naduvatam side; some 700 rooted plants sent out from Ooty to Pykara as this variety have turned out to be ordinary "*Officinalis*." There are a few planted out in the Dodabetta plantations, but they do not show good growth, or promise to be a success; it is supposed to yield a very large percentage of quinine and there are now 10,000 rooted cuttings in the Dodabetta nurseries propagated in the glass

plantation on Dodabetta. It has most curious rough bark like that of the Cork tree (*Millingtonia*) quite unlike any other *Chinchona*, and its leaves are exceedingly hairy on both sides, and it has hairy capsules; nothing is known of its origin except that it was received with the original seeds or plants. Mr. Cross thinks from the character of its bark that it may be of great value. Dried specimens of this species and fragments of the bark (to show its character) accompany this report with other specimens. "*Asperifolia*" Weddell is the only species I can find described at all like it in botanical works, but I have only DeCondolle and Walpers for reference, not all the later works, such as Weddell's. There are very few species known with the leaves hairy on the upper surface. The bark of this has never been analyzed.

46. *Crown Barks*.—*Officinalis* Linn (of which *Condaminea* Lamb is only a synonym) flourishes exceedingly well on grass land at Naduvatam, Pykara and Ootacamund as well as on shola land. Is a small tree of no great girth, but this is, I believe, also its characteristic in the Crown bark region in Loxa.

Uritusinga.—The tree known by this name in the Dodabetta and Naduvatam plantations and also called "strong-growing *Condaminea*" and

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houses from the few stock plants. Considering its poor growth I cannot recommend its extended planting until its treatment is better understood or a more favorable habitat is found for it.

Mr. Jamieson informs me that Mr. McIvor considered it hopeless to grow this variety, its growth being so slow and poor; it would be far less profitable than the ordinary variety of "Officinalis" notwithstanding the superiority in its yield in alkaloids. I can always distinguish this plant at the first glance, but Mr. Cross considers it not even a variety but only a condition of growth of "Officinalis," conduced by poverty of soil or some other condition. I cannot say that I quite agree with this, but there is the fact that some 700 plants, supposed to be this species, in the nurseries at the Ootacamund Gardens, and planted out in rich soil at Naduvatam, turned out to be ordinary "Officinalis." There is not sufficient evidence, however, as to what the original plants really were.

Var. Crispa? Mr. Cross informs me that he recognizes many plants of the "Crispa" var. of "Officinalis" (at least the one known in Ceylon as such) supposed to be very rich in quinine, scattered about with "Officinalis" in our Dodabetta plantations. I forward dried specimens of this form which Mr. Cross distinguishes by its rather smaller leaves, but I must say that I cannot distinguish it satisfactorily from ordinary "Officinalis," and it appears at any rate to run into it.

Var. with very narrow leaf.—There are a few plants of a very narrow-leaved form of "Officinalis" in the Dodabetta plantations, of which I also forward specimens. This variety is easily distinguished, and I believe it is the one Mr. McIvor considered as "Crispa;" it is only of shrubby growth and cannot, I think, be of much value. I am very disinclined to attach too much value to the fact of a very favorable analysis (as we find in reports) of single individuals of varieties like "Angustifolia" or "Crispa" grown perhaps under very favorable conditions, or to attempt their extended cultivation on such grounds. It is of course evident that they are valuable yielders under certain conditions, but it would require stronger evidence, I think, to establish the fact that they are far superior to the ordinary type of "Officinalis," as a very high percentage of alkaloids has sometimes been obtained from single specimens of that also. If a cultivator takes a fancy to any particular variety he can probably get a very flourishing report on its yield by the high cultivation of a few individuals, but this does not hold good in a large plantation, and I should be sorry to place faith in it with varieties like "Angustifolia" and "Crispa." Uri-tusinga is, I think, valuable on account of its very strong growth and much greater yield in bark; the analysis of this from Dodabetta is given in G.O., No. 1,336, of the 23rd June 1879, under the head of "Condaminea" as distinct from Crown barks.

47. *Cultivation of Crown Barks by Government should be kept up.*—Crown barks will only grow at a high elevation and there are few or no sites for them except on the Nilgiris, where only grass land and not shola is now available to the public. "Succirubra" and "Calisaya" on the other hand are spreading all over the Wynnaad, Coorg, &c.; it is desirable therefore that Government should keep this in view and, if possible, extend the cultivation of Crown barks, or at any rate work up their present estates without any stint as to expenditure.

48. *Yellow Barks.*—It is to be regretted that these are such a failure at Naduvatam; they all die out and the climate is evidently too cold and probably too dry for them; they grow at low elevations and in a very moist climate in their native habitat in Bolivia and Southern Peru, and it is useless to make further attempts at the cultivation of "Calisaya" or its variety "Ledgeriana" at Naduvatam. But I would strongly recommend that a small garden should be opened out for experimenting on their growth at 1,000 or 2,000 feet below our present plantations; they are, I believe, growing well in parts of Wynnaad and in the Ouchterlony Valley at about 3,000 feet elevation.

It is not easy to distinguish the variety "Ledgeriana" from ordinary "Calisaya" when in leaf only, but Mr. Rowson tells me he can always do so when they are in flower as the "Ledger" has white flowers, whilst those of the ordinary "Calisaya" are pinkish.

Anglica, supposed to be a sport or variety of "*Calisaya*," is represented by a few trees at Naduvatam; its bark is said to be of little or no value.

Javanica, said also to be a variety of "*Calisaya*," is also represented by a few plants at Naduvatam; it appears to be of no value and not to be worth growing, at least in the form it assumes at Naduvatam, which is a small very bushy shrub. I do not know whether this is the variety usually called "*Josephiana*."

49. *Grey Barks*.—"Micrantha," "*Peruviana*" and "*Nitida*" from the Grey bark region around Huanico in North Peru are all represented at Naduvatam and Pykara, but they do not succeed and are in fact all fast dying out; they yield no quinine but are valuable for their yield of Cinchonine and Cinchonidine; it is useless to grow them at Naduvatam, but it would be a pity that they should be lost to India, and I propose that another site at a lower elevation should be opened out for them. "*Micrantha*" and "*Peruviana*" grow at about 4,000 feet elevation and in a much moister climate than that of Naduvatam, and could hardly be expected to answer in their present situation; but "*Nitida*" grows at high elevations and might have been expected to thrive at Naduvatam.

50. *Columbian Barks*—*Pitayensis* (Pitayo bark).—There are some few very healthy trees of this in the Dodabetta plantation, but the tree has not been propagated here as yet. Mr. Cross anticipates valuable results from its introduction, and informs me it grew to 70 and 80 feet high and 3 to 4 feet in diameter where he met with it at 9, to 10,000 feet in New Grenada. Samples of the bark of our Dodabetta trees have been sent by Mr. Cross to Mr. Howard for analysis and on this report the question of its extended cultivation must depend; it is supposed to yield much quinine.

Santa Fe—Soft Columbian (*C. Lancifolia*).—The plants brought by Mr. Cross from New Grenada (7 to 10,000 feet elevation) are healthy and are being propagated, so it is hoped this valuable species may ere long be established on the Nilgiris. It is known to yield a very high percentage of quinine, and Mr. Cross anticipates great results from its introduction. It grows, he tells me, 70 feet high with a diameter of 3 feet in its native habitat; it may be expected to answer well at Naduvatam and perhaps also in sheltered places in Dodabetta.

Carthagen Bark—(*Chinchona Cordifolia*).—The two plants brought lately by Mr. Cross from the Central Cordillera near Bogota (elevation 4 to 6,000 feet) are healthy and strong growing and are being propagated, and the prospects of establishing it on the Nilgiris are promising. It is supposed to be a strong growing large tree which its present appearance does not belie; its yield in quinine is much the same as that of *Succirubra* and it will probably succeed in the same localities as that species. Mr. Cross tells me that he believes the "*China Cuprea*," the seed of which is promised to this Government (*vide* G.O., No. 630, of the 8th April 1881) from Bogota is the same species.

51. *Pahudiana*.—There are a few of this very distinct species in the Dodabetta plantations; it is said to be quite valueless, and its extensive propagation in Java, owing to its robust and rapid growth, caused much loss and annoyance.

52. *Hybrids*.—I am inclined to disbelieve in any hybrids of Nilgiri origin; it has been stated that there are many hybrids amongst the "*Officinalis*" and "*Calisaya*" trees, but after most careful examination I can see no indication of such, nor have any of our trees the characteristics of hybrids, which I am sure would not seed so prolifically; individual twigs may be gathered from many "*Officinalis*" trees and also from "*Calisaya*," showing great difference in the shape and size of the leaves, but the same difference may be found on one and the same tree, and often on the same bough. We have varieties or sports of species, such as "*Uritusinga*" and "*Angustifolia*," varieties or sports of "*Officinalis*," sometimes looking very distinct but at other times running into the type and not to be distinguished; but of hybrids between distinct species I do not think we have any.

53. *Hybridizing experiments*.—Though I do not believe in accidental hybrids between different species on the Nilgiris, I have no doubt that the different species

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could be crossed. I am not inclined, however, to recommend any experiments of this nature, as it would be useless to attempt it without the services of a scientific gardener, thoroughly trained in the art of hybridising, such as Mr. Dominey or Mr. Seden on the establishments of Messrs. Bull and Vritch, and such a man could only be procured on a very high salary, and other expenses connected with any experiments of this nature would be very costly. The experiments would be exceedingly interesting and of great scientific value, but practically perhaps of no value. We have now in cultivation all the finest-known species of the genus, and it is not likely that hybridising would improve the bark, or give us anything better than, or as good as, we now possess; so that we might be spending large sums to get some variations in leaf and flower, or perhaps in some cases sturdier growth.

54. *Analysis of the various Barks.*—I fear that too much reliance may hitherto have been placed on the analysis of the barks of single individuals of one species or variety, grown under unusually favorable conditions; soil, solar influences, shade, moisture, long droughts, exposure to wind, frost, &c., must probably exercise great influences on the bark and yield of alkaloids, and analysis should not be too much relied on, unless taken from a considerable number of trees subject to the varied conditions which they must experience in a plantation.

55. *Sites for Species requiring a Lower Elevation.*—A fine-sheltered shola in the "Silent Valley," elevation about 3,000 feet, has been reserved by the Collector of Malabar at the request of the Conservator, in case it should be required by this department for the growth of "Rubber trees," or any other products. I now recommend that this should be taken up by the Forest Department at Nilambúr, and that a small clearing should be at once made for experiments on the growth of "grey barks" and "yellow barks" at that elevation; if they grow well, there is ample room for opening out a considerable area; it may also be necessary to try "Carthagena" and "Santa Fé" at this lower elevation. A small pukka building should be erected, and the Chinchona budget should furnish the necessary funds; it is also desirable to try some of the rubber trees and the "Ipecacuanha" (*Cephaelis*) in the same locality.

56. *Renovating Pits.*—Mr. Rowson has much improved the health of the trees in the plantations under his charge (at Neddivattam and Pykara) by the renovating pits (2 feet cube). In many parts of the plantations the trees have a far more vigorous look than they had two years ago; it has been surmised that the lateral roots might be injured by this system, but this is not the case; where the lateral fibrils have been touched, they shoot out again with great vigor through the humus in these pits; in some cases cattle-manure has been put in the pits, but much of this not being available, they have generally been filled up with dead leaves, and decaying vegetation, such as the weeds, cleared off the plantations; they have, I consider, improved the condition of the plantations in a most marked manner.

57. *Perfect Drainage most necessary.*—All the varieties of Chinchona appear to grow much better on slopes than on flats, the tree being most impatient of anything like insufficient sub-soil drainage.

58. *Lichen.*—In wind blown situations the trunks and branches are often much covered with white lichen. Mr. Rowson assures me this in no way affects the health of the trees or bark; it is easily rubbed off.

59. *Diseases and Enemies.*—There is very little sign of canker at Neddivattam, and the Chinchona seems to have few or no insect enemies; sambur and wild animals are, of course, destructive, and fencing is most necessary in some parts if the plantations are to be worked up to their highest possible yield.

60. *Number of Trees in Neddivattam.*—Appendix A is a statement of the number of casualties amongst the trees in Neddivattam Plantation during the last three years (or since Major Walker's report), and the number of trees now existing based on Major Walker's enumeration.

61. Statement showing number of plants in the nurseries at Neddivattam, 28th May 1881 :—

Botanical Names.	Plants in Nurseries and Hot House on 31st March 1880.	Plants raised during 1880-81.	Total.	Plants issued during 1880-81.	Plants planted out permanently during 1880-81.	Balance in Nurseries and Hot House on 31st March 1881.	Remarks.
C. Succirubra	216,000	585,950	801,950	489,950	12,000	300,000	* Received from Dabagutta. † 3,383 seedlings have died.
C. officinalis	155,000	378,000	533,000	228,000	105,000	200,000	
C. Calanva var. Ledgeriana.	4,400	*1,560	5,960	50	..	†2,027	
C. other varieties	4,000	1,305	5,305	..	2,305	3,000	
C. pubescens	..	20,010	20,010	1,000	8,010	11,000	
Total ..	379,400	986,825	1,366,225	719,000	127,315	516,027	

PYKARA.

The Hooker Chinchona Plantation, Acreage 134.19.

62. *No. I Plot, 1866, A.*—Acreage 10.91, about half grass land and half shola land. The grass land chiefly *Officinalis*, only a few *Succirubra*; the crown barks have been planted too far apart, but the gaps are to be filled in this season.

The shola land all *Succirubra*, growth good (about 20 feet high) except a small bit on the upper portion, which is much wind blown and thin from failures, and in which supplies are to be put down this season.

All the plantation has been barked five times.

63. *No. II Plot, 1866, B.*—15.09 acres; about one-third grass land planted with *Officinalis*, about two-thirds shola land planted with *Succirubra*; growth good or fairly good; in portions there is a yellowish appearance in the foliage which is not noticeable at Neddivattam; it is probably due to the long drought and east wind, and will disappear with the monsoon.

All the plantation has been barked five times.

64. *No. XIII Plot, 1873.*—10.59 acres, all shola land, planted with *Officinalis*; a few *Succirubra* put in as supplies; there are about 20 *Pitayensis*; but 726 plants sent out from Ootacamund as *Angustifolia* have turned out ordinary *Officinalis*; growth of trees good, but the plantation is very patchy and the trees far apart caused by the inroads of sambur.

In addition to the 10½ planted acres, there are some 15 or 20 more of abandoned shola cleared in 1873, but now over-grown; it would be a good plan to fence in the plantation and to re-clear and re-plant this portion, and to plant up the vacancies in the 10½-acre plot, but it would be useless without fencing on account of wild animals.

This plantation has not been barked.

65. *No. X Plot, 1869, A.*—3.58 acres, grass land, *Succirubra* and *Officinalis* in nearly equal proportion; growth not good; soil poor, rocky, and gravelly. Has been barked four times.

66. *No. VII Plot, 1868, A.*—18.36 acres, chiefly shola land, good soil, planted with *Succirubra*; the growth of the trees is good, but the plantation is very patchy from many trees having died out; cause not known; the gaps are to be filled in with *Officinalis*, but I fear this will not answer unless the plantation is fenced in, as sambur are exceedingly troublesome in this plot, and destroying most of the young plants put out.

The above trees have all been barked four times.

Some grass land planted with *Officinalis* very far apart; growth short; pits have been dug for filling in more trees; the soil is good, and it would have shown far better results if it had been planted 4' x 4' instead of 8' x 8'.

All the trees have been barked four times.

67. *No. III Plot, 1867, A.*—14.21 Acres. Two-thirds grass land formerly very stunted—*Succirubra*, only a few feet high, which has last season all been up-rooted, and the ground is now pitted for *Officinalis* which is to be planted out this season. One-third shola land *Succirubra*; fine growth and barked three times.

68. *No. XI Plot, 1869, B.*—9.35 acres, all shola land, planted originally with *Succirubra*, growth good, has all been barked four times; there are supplies of *Officinalis*; some grey barks were dying out, and have been all up-rooted.

Five acres coppiced in June 1879, the stools bled excessively; there are 1,379 failures out of 2,226 stools, but the 847 which succeeded have grown well, and are three to six feet high with one to three stems to each stool.

69. *No. VIII Plot, 1868, B.*—23.74 acres, chiefly shola land, planted with *Succirubra*; the plot is very patchy as very many trees were injured by the hail in 1879 and died out subsequently; growth of remainder good, now pitted for supplies of *Officinalis*. All barked four times. About two acres of grass land covered with very fair *Officinalis*; all barked four times.

70. *No. XII Plot, 1869, C.*—6.52 acres, about three-fourths shola land and one-fourth grass land, planted almost entirely with *Succirubra* which nearly all died out after the hail-storm in 1879, and has been up-rooted and the plot re-planted in 1880 with *Officinalis*, doing well; there is a sprinkling of good old *Officinalis* (scattered about the plot) which were put down at the same time with the red barks.

71. *No. V Plot, 1867, C.*—2.71 acres, chiefly shola land, originally planted with *Succirubra* which all died out after the hail-storm in 1879; it was afterwards up-rooted and re-planted with *Officinalis* in 1880 which is doing well.

72. *No. VI Plot, 1867, D.*—16.07 acres, all grass land, about two-thirds, formerly very stunted *Succirubra* which died out after the hail-storm in 1879, was up-rooted and the plot re-planted with *Officinalis* in 1880 which is doing well; about one-third covered with very good *Officinalis* which has been barked four times.

73. *No. IX Plot, 1868, C.*—16.04 acres, all grass land, about two-thirds covered with fine *Officinalis*; all barked four times; about one-third, originally covered with stunted *Succirubra* which mostly died out after the hail-storm in 1879, re-planted in 1880 with *Officinalis*, doing well; 1,020 old *Succirubra* still survive, and there are 1,100 old *Officinalis*.

74. *No. IV Plot, 1867, B.*—7.02 acres, about three-fourths grass land, planted with *Officinalis*, fair growth (12 feet high), but very patchy from wild planting, has been pitted for supplies which are to be put down this year; all barked four times.

About quarter shola land planted with *Succirubra* and *Officinalis*, growth good but patchy, the plot being much wind blown, pitted for supplies to be put down this year. All barked four times.

75. *State of the Hooker Plantation.*—The growth here is far inferior to that at Neddivattam, considerable tracts of grass land being planted originally with "*Succirubra*," which was a perfect failure, only attaining a stunted growth of a few feet; this has lately been nearly all up-rooted, and has been, or is being, replaced with "*Officinalis*" which grows very fairly on the grass land soil; there are still some tracts where the *Succirubra* must give place to *Officinalis* or to *Pubescens*.

76. *Fencing.*—Plot No. XIII, 1873, must be fenced, and a portion of the shola, which has been abandoned and allowed to revert to rank coarse growth, should be cleared and planted. Fencing is also required in Plot VII, 1868, A.

77. *Coppicing.*—2,226 *Succirubra* trees in No. XI Plot of 1869, four times previously barked and of good growth, were coppiced in June 1879; 1,379 stools have died, 847 are growing fairly, height three to six feet.

78. *Number of Trees in Hooker Plantation.*—Appendix B is a statement of the number of casualties amongst the trees in the Hooker Plantation during the last three years, and the number of trees now existing based on Major Walker's enumeration.

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PYKARA.

The Wood Chinchona Plantation, 72.18 acres.

79. *No. V Plot, 1865, C.*—8.80 acres, all shola land, planted with "Succirubra" and a very few "Officinalis;" trees a good height, often over 20 feet, but not healthy in appearance, and numbers of failures; sub-soil very inferior; sized trees barked six times.

80. *No. II Plot, 1864.*—10.87 acres, all shola land, "Succirubra" and "Officinalis;" growth all poor and spindly; many failures and many blank spaces, and trees still dying out; suffers much from the north-east wind; and the sub-soil bad. All barked five times.

81. *No. VIII Plot, 1867, C.*—10.87 acres, all shola land, all "Succirubra;" growth good, over 20 feet high. All barked five times. Five acres 2,500 trees coppiced in June 1879; 885 stools failed to grow, 1,655 have succeeded; growth good, height 4 to 7 feet and very healthy.

82. *No. IX Plot, 1868.*—6.12 acres, all shola land, all planted with "Succirubra," nearly all gone out, except about 100 trees; re-planting has been attempted more than once without success. Soil rocky and bad.

83. *No. VII Plot, 1867, B.*—9.62 acres all "Succirubra," except a few "Officinalis," shola land, chiefly a flat; drainage insufficient and sub-soil sour; nearly all the trees gone out. All barked five times.

84. *No. VI Plot, 1867, A.*—8.39 acres, all shola land, nearly all "Succirubra;" a portion sheltered on a slope good; the greater portion very poor growth and thin from many failures, and the remaining trees apparently dying out. Sized trees barked five times.

85. *No. I Plot, 1863.*—2.55 acres, all shola land, "Succirubra" and "Officinalis," mixed in equal proportions; very poor growth and thin, more than half died out, and many still dying; soil rocky and poor. Sized trees barked six times.

86. *No. IV Plot, 1865, B.*—4.88 acres, lower avenue, all shola land, chiefly "Succirubra" with a few "Officinalis;" growth good in some places but patchy, as there are many blanks; casualties chiefly caused by insufficient drainage on flat portions. Where there is percolation from the channel, sized trees barked six times.

87. *No. III Plot, 1865, A.*—10.08 acres, upper avenue, "Succirubra" and "Officinalis;" about half and half growth, in some places fair, but not always healthy; in other parts very poor, and has been much injured by hail; many trees died and many showing signs of dying out; upper portions very much exposed to the south-west monsoon. Sized trees barked six times.

88. *State of the Wood Plantation.*—The lower portion of this plantation exhibits very poor growth (all except Plot No. VIII, 1867, C, about 10 acres, may be pronounced a failure); it should, I think, be up-rooted and abandoned as the money required for its up-keep might be far better spent in keeping up the other plantations.

I would keep up Plots Nos. III and IV, or the avenue down the ravine in which the Pykara falls are situated; and if Government should decide to sell the remainder, I do not think these two plots or any of the land in this ravine should be alienated, as it is much resorted to by the public on account of its beautiful scenery and for its water-falls; the other portion of the Wood Estate is over a saddle and in another ravine.

89. *Coppicing.*—2,500 Succirubra trees, previously four times barked in Plot No. VIII, 1867, C (the only good growth in this lower portion of the Wood Estate) were coppiced in June 1879; 885 stools have died; 1,655 are growing and very healthy; height 4 to 7 feet.

90. *Number of Trees in the Wood Plantation.*—Appendix C is a statement of the casualties amongst the trees in the Wood Plantation during the last three years; and the number of trees now existing based on Major Walker's enumeration.

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DODABETTA PLANTATION.

Acres 320.47, elevation over 7,000 feet.

91. Ascending to the plantations from the Government Gardens the first thirteen plots as follows are on the slope looking down on to Ootacamund or with a south-west exposure.

92. No. XXI, 1868, A.—1.61 acres, chiefly grass land with a little shola at the bottom of ravine, all planted with *Officinalis* 7' x 7'; ground very steep and soil being gradually washed away; growth in fair condition and not many failures since the renewals were put down four years ago which are doing well; no late renewals, too steep for terracing, average height of the trees 15 feet; 714 trees barked once, 11 trees barked twice.

93. No. XXVI, 1869, B.—3.22 acres, nearly all grass land, very steep, soil gravelly, and being rapidly washed away, but too steep for terracing; all planted with *Officinalis*; trees healthy, but very far apart owing to the original wide planting, and many failures; many renewals were put down three years ago, which are doing well, but none since; average height 15 feet; 1,138 trees once barked, remaining trees small.

94. No. XXV, 1869, A.—4.68 acres, grass land, very steep; remarks the same as for No. XXVI. A portion was terraced in 1880; remainder too steep for terracing; 2,295 trees barked once, 70 trees barked twice.

95. No. I, 1863, A.—2.32 acres, all shola land, steep, and the soil has been subject to much wash, but the whole plot was terraced in 1880; all planted with *Officinalis* 8' x 8'; trees average height 20 feet, not in very good condition; trees very far apart owing to wide planting and subsequent failures; renewals about 10 per cent. put down three years ago, no later renewals; 967 trees barked four times, 161 trees barked once, remainder small and not barked.

96. No. II, 1863, A.—1.67 acres, all shola land, planted with *Officinalis* 7' x 7'; trees healthy; average height 22 feet, but there have been many failures; renewals one to four years of age; 1,221 trees barked five times, 47 trees once.

97. No. III, 1863, C.—3.57 acres, all shola land, planted with *Officinalis*; condition fair, but trees very far apart from very wide planting; average height of original trees 22 feet, many renewals one to four years of age; 1,959 trees barked five times, 65 trees once. There are a few "*Pahudiana*" not growing well; also one "*Angustifolia*" growing well.

98. No. VI, 1864, B.—7.28 acres, originally patches of shola dovetailing with grass land, very steep, and soil much washed away, but the whole was terraced in 1880, planted with "*Officinalis*," except some 50 *Succirubra*; condition bad; 6,000 seedlings planted out in alternate lines in 1880; 4,969 trees barked four times, 2,146 barked twice, 311 once.

99. No. V, 1864, A.—4.06 acres, all shola land, steep, terraced in 1880, all planted with *Officinalis* 8' x 8' and 7' x 7', condition fair; lately thicker planting has been attempted, 2,500 seedlings being put out in alternate lines doing fairly well; pits have also been dug for further planting; 1,900 trees barked three times, 167 barked once; 400 trees have lately been scraped on the Java principle, some are mossed and some left bare; all are renewing their bark, but those mossed more rapidly.

100. No. IV, 1863, D.—0.98 acre, all shola land, planted with *Officinalis*; trees fair growth, but very far apart; 900 late renewals, and now pitted for further planting. 556 trees barked five times, 58 trees once.

101. No. XVII, 1867, A.—5.62 acres, grass land, planted with *Officinalis*; condition good, but trees much branched from wide planting, intermediate planting between the old trees last year to an extent of 1,800 seedlings doing well; a small area where the ground is level nearly all gone out from frost; 2,853 trees barked twice, 830 trees once.

102. No. XX, 1867, D.—4.92 acres, grass land, *Officinalis*; condition fair, average height 14 feet; very few failures; original planting 6' x 6'; 2,572 barked twice, 644 trees once; 5 trees coppiced in June 1880 as dying; no re-growth.

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103. No. XVIII, 1867, B.—6.24 acres, grass land; condition fair, but growth rather stunted; 8' to 10' in height only; originally; planted 7' x 7'; no late renewals; 2,241 trees barked twice, 1,539 trees once.

104. No. XIX, 1867, C.—5.90 acres, grass land, growth stunted; 6' to 8' in height; trees gone out on a flat portion of about 1 acre said to be caused by frost; 1,692 trees barked twice, 1,314 trees once, 28 trees cut down dead from frost.

105. The next plot, No. X, is chiefly on the ridge or saddle; all the remainder, 25 in number, are over the saddle, and have a north-east exposure, except small portions of Nos. IX and XXVII which over-top a grass hill and face south-west.

106. No. X, 1866, A.—7.44 acres, grass land, but a little shola in hollows, chiefly hill-top, much blown; growth stunted and many failures; growth better in hollows; 1,007 trees barked twice, 351 trees once.

107. No. XI, 1866, B.—12.18 acres, about two-thirds shola, one-third grass land, Officinalis; growth good; 4,627 trees barked three times, 2,615 trees twice, 1,859 trees once. 5 acres, twice barked trees, upper portion (shola land) coppiced in 1879; 3,350 trees cut, 157 have failed to sprout; growth good of remainder.

108. No. XXVIII, 1869, D.—15.33 acres grass land, Officinalis, planted 7' x 7'; condition fair but growth stunted; height 8 to 10 feet, not barked; no late renewals but now pitted for intermediate planting to an extent of about 35 per cent.; 5 acres coppiced in 1879; 2,493 unbarked trees cut, failures 400; coppice growth of the rest good; 400 seedlings planted to re-place the casualties, 100 unbarked trees scraped in October 1880, some mossed and some left bare, all are renewing their bark, but those mossed renew more rapidly.

109. No. XXIX, 1869, E.—8.05 acres, grass land, Officinalis; growth good in the lower portion only a small area, rest very patchy from many failures; trees healthy but stunted; no renewals the last three years; 2,467 trees barked once, eight large dead trees felled.

110. No. XXIV, 1868, D.—13.37 acres, grass land and fern land, Officinalis; a rather flat portion of about 3 acres suffers from frost, and has gone out almost entirely; in the remainder growth stunted, but fairly healthy; many failures; no late renewals; 3,579 trees barked once. Five old dead trees cut down. Twenty-one *Angustifolia* trees not growing very well.

111. No. XIV, 1866, E.—4.33 acres, shola land, Officinalis; growth average, but a good many failures from frost; several spots quite bare; no renewals since four years; 715 trees barked three times, 672 trees barked once.

112. No. XXII, 1868, B.—6.04 acres, grass land, Officinalis, originally planted 7' x 7'; many failures, and trees far apart; growth generally stunted, but fairly healthy; no renewals since four years; 706 trees barked twice, 1,709 trees once.

113. No. XXIII, 1868, C.—11.76 acres, fern land, Officinalis; very poor growth with numerous gaps, the rank growth of the common Bracken (*Pteris aquilina*) is robbing the soil of much of its virtue; it should be thoroughly eradicated as far as possible, and this plot should be pitted and planted up; 1,895 trees barked twice, and 1,302 once, two old dead trees cut down.

114. No. XV, 1866, F.—3.24 acres, about 1 acre shola, the rest grass land, Officinalis; growth poor and stunted, and many failures; 1,412 trees barked three times, and 697 trees once.

115. No. XII, 1866, C.—11.16 acres, shola land, Officinalis; growth good but patchy in places from many failures; 3,573 trees barked three times, 1,771 trees once; no renewals since four years.

116. No. XXXIX, 1873.—1.81 acres, shola land, 44 large *Pitayensis* trees; growth good, 15 feet high, not barked, except four for analysis; 557 large Officinalis doing very well, not barked; 1,000 Officinalis put down in 1880.

117. No. XIII, 1868, D.—12.68 acres, shola land, and good soil, very steep in parts, and subject to much wash, but was terraced in 1880; trees have been pruned

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and the growth is good and promising, but does not cover the ground which is steep and rocky in places, originally planted 8' x 8' which has prevented straight growth of boll; height of trees 8 to 15 feet; there was a good deal of intermediate planting four years ago; 2,971 trees barked four times, 1,524 trees once.

118. No. VII, 1865, A.—10.20 acres, shola land, soil very good, ground terraced in 1880, chiefly *Officinalis*; growth very good, originally planted 7' x 7', but not very regularly, fairly covers the ground, trees 16 to 18 feet high; 6,601 trees barked four times, 816 trees once; there is a gap in one portion of about half an acre which has been re-planted twice, but has failed owing to frost.

About 100 *Calisaya* trees, growth thin and lanky.

A few *Pubescens* trees growing very luxuriantly; 26 *Micrantha* and *Succirubra*; growth very poor.

One of the best plots on the north-east side of the hill.

119. No. XVI, 1866, G.—9.57 acres, shola land, *Officinalis*, planted 7' x 7'; growth good, but suffers somewhat from frost, does not cover the ground and requires intermediate planting; renewals 15 per cent. four years ago, of which many have failed; 1,000 seedlings put out in 1880; 3,622 trees barked three times, 1,484 trees once.

120. No. XXXV, 1869, K.—6.40 acres, shola soil, a very steep ravine and very irregularly planted with *Officinalis*, all lately terraced; growth good on slopes, but trees generally very far apart; about lower portions of the ravines large gaps owing to failures from frost; 531 trees barked twice, 1,663 trees once; there is one *Micrantha* tree not showing good growth, and a few *Pubescens* with very fine growth.

121. No. XXXVIII, 1872.—8.36 acres, chiefly grass land, steep hill side, soil poor and gravelly, *Officinalis*; growth poor and many failures, suffers from frost and much blown; many renewals, amongst which there are failures, re-pitted in portions for intermediate planting; the extreme upper portion suffers much from frost and wind, and has almost entirely gone out; and it would be useless to re-plant this; the upper portion of the slope has been lately terraced, and should be planted up; the Bracken should be eradicated as it is robbing the soil; about one acre shola land in the lower portion of the plot exhibits good growth; trees not barked.

122. No. XXXIV, 1869, J.—7.28 acres, grass land, planted with *Officinalis*, steep, rocky, and gravelly, very poor growth, many failures; 567 trees barked twice, 1,746 trees once; six old trees cut down.

123. No. XXXIII, 1869, I.—12.33 acres, grass and fern land, *Officinalis*, except a few *Pubescens*; very steep, several small land-slips; trees far apart and very irregular, at least 25 per cent. failures; a very poor plot; 271 trees barked twice, 3,487 trees once.

124. No. XXXII, 1869, H.—12.82 acres, grass and fern land, steep with rocky, gravelly, poor soil, planted with *Officinalis*; growth very poor and numerous failures; 627 trees barked twice, 2,150 trees once; 300 seedlings planted out in 1880.

125. No. XXXI, 1869, G.—14.08 acres, grass and fern land, steep and gravelly, *Officinalis*; growth very poor and numerous failures; 707 trees barked twice, 2,242 trees once; four old dead trees cut down.

126. No. XXX, 1869, F.—17.62 acres, grass land and fern, steep and gravelly, *Officinalis*; very poor growth and thin from many failures; 2,643 trees barked twice, 2,113 trees once; 11 old dead trees cut down.

127. These last five plots of 1869 planting, viz., F, G, H, I, and J form the lower portion of the north-east side of the Dodabetta Plantation, and are by far the least successful, and the trees will never cover the ground, as there are considerable portions on which growth will always fail; there is, however, here and there much fern land, on which there is now a rank growth of Bracken robbing the soil; and if money was expended in up-rooting this, the growth of the *Chinchona* might be much improved in these portions.

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128. No. XXXVII, 1870.—8.92 acres, grass land, planted with *Officinalis*; much of the plot is hill top with poor rocky soil; the trees were originally put down at 7' x 7', but they are now very far apart from many failures, and the growth is poor and stunted, generally from 5' to 10' in height; intermediate planting up should be undertaken, but there are several perfectly bare spots on which perhaps planting would not succeed; 168 trees barked twice, 1,295 trees once.

129. No. XXXVI, 1869, L.—2.19 acres, grass land, planted with *Officinalis*; poor rocky soil; trees far apart and of stunted growth; height 5 to 10 feet; 176 trees barked twice, 100 trees once.

130. No. VIII, 1865, B.—17.54 acres, grass land, good loam, planted with *Officinalis* 7' x 7'; growth good; trees average 15 feet high; not many failures; renewals 10 per cent. some four years ago, none since; 7,567 trees barked four times, 2,347 trees once.

131. No. IX, 1865, C.—13.65 acres, grass land, good sub-soil, planted with *Officinalis*; growth good, but somewhat stunted; trees 10 to 13 feet high; rather too much exposed to the north-east monsoon; renewals 15 per cent. some four years ago, none since; not many failures; the trees covering the ground well; 7,602 trees barked four times, 3,605 trees once.

132. No. XXVII, 1869, C.—14.50 acres, grass land; little shola land in ravine; soil generally good, but situation high and exposed; planted with *Officinalis*; growth fair but stunted; some of the highest part gone out; growth good towards bottom of plot; 207 trees barked twice, 1,618 trees once.

133. Nurseries.—The nurseries are in good order; in the Dodabetta nursery there are 2 lakhs of *Officinalis* seedlings.

In the nursery near the jail about 10,000 *Officinalis* seedlings; also 10,000 rooted cuttings of *Angustifolia* transferred from the propagating houses.

In the lower nursery (near the tea) there are 20,000 *Officinalis* seedlings.

134. Glass Houses.—In the glass propagating houses 12,000 *Calisaya Ledgeriana* seedlings (from Java), 100 *Pitayensis* seedlings from plantation trees, 400 *Pubescens* seedlings from plantation trees, 40 *Calisaya* seedlings from plantation trees, 100 stock plants of *Angustifolia*; also the "Santa Fe" and "Carthagenia" plants brought lately by Mr. Cross.

135. State of Dodabetta Plantation.—This I consider on the whole promising, and there can be no doubt as to their paying well; the great mistake has been wide planting at the commencement, and every endeavour must now be made to plant up closer, but this is receiving every attention; the plantations have been much improved of late in places by terracing, but in some parts the land is too steep for this, and should never have been opened; there are besides large blocks where the soil is very poor, and where planting must be always more or less a failure, though it will pay at the present high prices of bark; the effects of frost and wind are also very evident in many places. The eradication of the bracken fern in some of the plots requires immediate attention, and would greatly improve the growth of the *Chinchona*.

136. Coppicing.—In Plot No. XI, 1866, 3,350 "*Officinalis*" trees (5 acres) which had been twice barked previously were coppiced during the first ten days in June 1879; the stools bled very much and 157 died; the coppice growth of the rest is good—

Yield in green bark = 13,762 lb.

Yield in dry bark = 5,400 lb.

In Plot XXVIII, 1869, 2,493 unbarked *Officinalis* trees (5 acres) were coppiced from 13th to 19th June 1879; they bled very much and 400 stools died; the coppice growth of the rest being good—

Yield in green bark = 4,853 lb.

Yield in dry bark = 1,700 lb.

I attribute the failures to the coppice having been carried out too late in the season; it is noteworthy that here, as at Naduvatam, there are many more deaths amongst the stools of the unbarked trees than from those which had been barked, which is proof that the root system of the tree does not suffer in any way from the barking process.

137. *Scraping*.—In Plot XXVIII, 1869, 100 *Officinalis* trees were scraped on the new Java method on 3rd October 1880, yield of bark 246 lb. green and 100 lb. dry; and in Plot V, 1864, 400 trees were scraped during October 1880, yield of bark 856 lb. green and 400 lb. dry. Some of the trees have been mossed over and others left unprotected, but all are renewing their bark satisfactorily, though more rapidly where mossed; and there are no failures whatever as far as I can see.

138. *Number of Trees in Dodabetta Plantation*.—Appendix D is a statement of the number of casualties amongst the trees in the Dodabetta plantation during the last three years and the number of trees now existing based on Major Walker's enumeration.

139. *Receipts and Expenditure*.—I will not add to the bulk of this report by any statements of receipts and expenditure, as these have been given in full in the last annual report just reviewed by Government.

140. *Dried Specimens*.—The following dried and mounted specimens accompany this report:—

Red Barks	Chinchona Succirubra (red bark) ...	From Naduvatam.
	Chinchona sp. Called Magnifolia at Naduvatam and Patà de Gallinazo by Mr. Cross; supposed to be a new species; was collected by Mr. Cross at high altitudes in the red bark region; called also Mr. McIvor's hybrid ...	Several specimens from Naduvatam and Dodabetta from forest soil and from grass land.
	Chinchona. Called Pubescens at Naduvatam and also on Dodabetta, where it is not distinguished from the last, of which it is supposed to be only a slight variety ...	Do.
	Chinchona Officinalis, typical (crown bark) ...	Specimens from Naduvatam and Dodabetta.
	Chinchona Officinalis, var: Uritusinga (called broad-leaved or strong-growing Condaminea) ...	Specimens from Dodabetta.
Crown Barks	Chinchona Officinalis, var: Angustifolia ...	Do.
	Chinchona Officinalis, var: Crispa of Ceylon ...	Do.
	Chinchona Officinalis, var: with very narrow leaf, probably Crispa of Mr. McIvor ...	Do.
	Chinchona Pitayensis ...	Do.
Yellow Barks	Chinchona Calisaya ...	Specimens from Dodabetta and from Naduvatam.
	Chinchona Calisaya, var: Anglica ...	Specimens from Naduvatam.
	Chinchona Calisaya, var: Javanica; so called at Naduvatam, probably "Josephiana," only a bushy shrub ...	Do.
	Chinchona Calisaya Ledgeriana ...	Do.
	Chinchona Micrantha ...	Specimens from Naduvatam and Dodabetta.
Grey Barks	Chinchona Nitida ...	Specimens from Naduvatam.
	Chinchona Peruviana ...	Specimens from Naduvatam.
	Chinchona Pahudiana ...	Specimens from Dodabetta.
	Chinchona. Unknown species with cork like bark; leaves hairy on both surfaces and hairy capsules; supposed by Mr. Cross to be the genuine "Crispa" of Loxa ...	Do.

141. It appears to me important that I should proceed to Darjeeling to see the large Chinchona plantations there, and the different species in cultivation, and take notes on the system of cultivation pursued and other matters which might be of use to the officers in charge of these plantations; so if Government wish it, I shall be prepared to proceed there shortly.

STATEMENT showing the Number of Chinchona Trees enumerated in 1878, and those that were cut since being dead, and the Balance existing on the Government Plantations, Neddivattam.

Plot.	NUMBER AS PER MAJOR WALKER'S REPORT.			CASUALTIES IN 1878-79.			CASUALTIES IN 1879-80.			CASUALTIES IN 1880-81.			TOTAL NUMBER OF DEAD TREES CUT.			BALANCE.			NUMBER OF PLANTS PLANTED IN 1880-81.			TOTAL NUMBER OF TREES EXISTING.		
	Red.	Crown.	Others.	Red.	Crown.	Others.	Red.	Crown.	Others.	Red.	Crown.	Others.	Red.	Crown.	Others.	Red.	Crown.	Others.	Red.	Crown.	Others.	Red.	Crown.	Others.
1	3,197	2,325	..	113	84	..	..	..	..	199	58	..	312	142	..	2,885	2,183	..	..	..	..	2,885	2,183	..
2	6,272	1,984	..	186	35	..	..	..	..	53	21	..	239	56	..	6,033	1,928	..	..	..	..	6,033	1,928	..
3	3,469	1,224	16	..	..	..	..	..	..	118	..	..	250	..	8	3,219	224	..	..	..	..	3,219	224	..
4	3,484	1,300	..	..	..	..	..	..	..	34	..	..	187	5	..	3,407	1,295	..	..	..	..	3,407	1,295	..
5	1,418	640	..	..	..	..	..	..	..	6	2	..	125	51	..	1,231	638	..	..	..	..	1,231	638	..
6	2,849	3,202	..	..	31	..	..	..	..	32	20	..	294	110	..	2,724	3,151	..	..	..	..	2,724	3,151	..
7	7,719	7,400	..	68	52	..	..	..	..	29	58	..	294	110	..	7,435	7,290	..	..	..	..	7,435	7,290	..
8	4,707	3,693	..	43	27	..	..	..	..	28	23	..	113	50	..	4,594	3,643	..	..	..	..	4,594	3,643	..
9	3,625	3,365	164	..	25	..	..	..	..	37	60	..	64	85	25	3,561	3,220	139	..	..	..	3,561	3,220	139
10	11,201	1,201	..	..	..	..	..	..	..	223	21	..	419	21	..	10,782	1,180	..	..	..	..	10,782	1,180	..
11	9,161	795	..	..	..	..	..	..	..	65	29	..	55	29	..	9,108	766	..	..	..	..	9,108	766	..
12	8,802	2,687	..	102	..	..	..	..	..	48	17	..	150	46	..	8,692	2,641	..	..	..	..	8,692	2,641	..
13	209	2,764	..	..	21	..	..	..	..	3	67	..	3	88	..	206	2,676	..	..	..	..	206	2,676	..
14	9,563	50	5	..	..	..	..	..	..	100	..	..	185	..	4	9,378	50	1	..	..	..	9,378	50	1
15	9,347	211	..	..	11	..	..	..	..	167	..	..	249	11	..	9,098	200	..	..	..	..	9,098	200	..
16	1,298	386	..	..	..	..	..	..	..	18	2	..	18	2	..	1,190	384	..	..	..	..	1,190	384	..
17	4,461	1,179	..	..	9	..	..	..	..	9	..	..	53	9	..	4,408	1,170	..	..	..	..	4,408	1,170	..
18	6,298	772	..	..	5	..	..	..	..	..	..	..	..	5	..	6,298	767	..	..	..	..	6,298	767	..
19	7,924	850	..	..	..	..	..	..	..	..	..	..	..	..	..	7,924	824	..	..	..	..	7,924	824	..
20	10,186	854	..	..	10	..	..	..	..	..	20	..	..	30	..	10,186	824	..	..	..	..	10,186	824	..
21	6,300	52	..	..	..	..	..	..	..	..	..	..	..	..	..	6,300	52	..	..	..	..	6,300	52	..
22	5,904	1,894	..	..	..	..	..	..	..	..	..	..	..	..	..	5,904	1,894	..	..	..	..	5,904	1,894	..
23	8,719	815	..	..	..	..	..	..	..	..	..	..	..	..	..	8,719	815	..	..	..	..	8,719	815	..
24	13,805	823	..	..	8	..	..	..	..	..	..	..	..	..	..	13,805	815	..	..	..	..	13,805	815	..
25	7,559	823	..	..	..	..	..	..	..	..	..	..	..	..	..	7,559	815	..	..	..	..	7,559	815	..
26	1,099	..	25	..	..	..	..	..	..	10	..	..	..	..	..	1,067	..	..	..	..	..	1,067	..	..
27	3,190	3,600	..	..	..	..	..	..	..	..	..	..	..	..	..	3,190	3,000	..	..	..	..	3,190	3,000	..
28	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
29	2,780	1,314	387	..	48	..	..	..	..	..	..	..	..	..	..	2,780	1,266	387	..	..	..	2,780	1,266	387
Total	164,456	43,694	601	541	395	15	2,404	..	4	1,159	403	22	4,104	798	41	160,352	42,896	560	200	2,905	..	160,352	42,896	560

(Signed) W. ROWSON,
Assistant Superintendent.

NADUVATTAM,
20th May 1881.

APPENDIX B.

HOOKER ESTATE.

STATEMENT showing the Number of Chinchona Trees enumerated in 1878, and those that were cut since being dead, and the Balance existing on the Government Plantations, Hooker Estate.

Plot.	NUMBER OF TREES AS PER MAJOR WALKER'S REPORT.			CASUALTIES IN 1878-79.			CASUALTIES IN 1879-80.			CASUALTIES IN 1880-81.			TOTAL NUMBER OF DEAD TREES CUT.			BALANCE.			NUMBER OF PLANTS PLANTED IN 1880-81.			TOTAL NUMBER OF TREES EXISTING.		
	Red.	Crown.	Others.	Red.	Crown.	Others.	Red.	Crown.	Others.	Red.	Crown.	Others.	Red.	Crown.	Others.	Red.	Crown.	Others.	Red.	Crown.	Others.	Red.	Crown.	Others.
1	4,789	2,376	..	..	..	..	87	..	..	130	36	..	217	78	..	4,572	2,798	..	..	..	..	4,572	2,798	..
2	6,735	2,036	..	198	36	..	289	..	..	416	81	..	903	117	..	5,832	1,919	..	..	..	..	5,832	1,919	..
3	7,539	196	..	..	..	..	..	..	..	6,114	..	..	6,114	..	..	1,425	196	..	..	..	..	1,425	196	..
4	390	3,357	..	..	121	..	84	..	..	..	172	..	84	293	..	306	3,064	..	..	..	..	306	3,064	..
5	1,542	207	..	..	9	..	1,784	..	..	..	11	..	*1,784	20	..	..	187	..	..	..	..	..	5,187	..
6	5,271	5,650	..	..	247	..	5,636	..	..	..	284	..	*5,636	531	..	..	4,989	..	..	..	..	..	38,989	2,000
7	4,901	3,910	1	64	89	..	..	..	..	83	179	..	147	268	..	4,814	3,642	1	..	..	..	4,814	3,642	1
8	10,569	2,223	72	..	43	..	6,453	..	..	144	84	..	6,597	127	..	3,972	2,906	72	..	..	..	3,972	24,096	3,482
9	7,418	1,162	..	..	24	..	6,320	..	..	108	28	..	6,428	52	..	1,020	1,100	..	..	..	..	1,020	29,050	..
10	1,320	1,006	..	17	13	..	..	..	..	23	43	..	40	56	..	1,280	1,040	..	..	..	..	1,280	1,040	..
11	4,235	390	777	..	10	..	1,399	..	..	152	11	..	1,551	21	..	2,674	309	777	150	..	..	2,824	369	777
12	3,429	446	..	..	14	..	3,906	..	..	..	15	..	*3,906	29	..	..	417	..	..	..	..	..	16,467	2,000
13	319	4,500	..	..	..	..	..	..	..	..	..	..	..	..	..	319	4,500	..	..	..	..	319	4,500	..
Total	38,537	27,909	850	279	648	..	25,958	..	..	7,170	944	..	33,407	1,592	..	26,214	26,317	850	150	105,000	7,410	26,361	131,317	8,260

* Excess 1,084 trees.

NADUVATAM,
20th May 1881.

(Signed) W. ROWSON,
Assistant Superintendent.

APPENDIX C.

WOOD ESTATE.

STATEMENT showing the Number of Chinchona Trees enumerated in 1878, and those that were cut since being dead, and the Balance existing on the Government Plantations, Wood Estate.

Plot.	NUMBER AS PER MAJOR WALKER'S REPORT.			CASUALTIES IN 1878-79.			CASUALTIES IN 1879-80.			CASUALTIES IN 1880-81.			TOTAL NUMBER OF DEAD TREES CUT.			BALANCE.			NUMBER OF PLANTS PLANTED IN 1880-81.			TOTAL NUMBER OF TREES EXISTING.		
	Red.	Crown.	Others.	Red.	Crown.	Others.	Red.	Crown.	Others.	Red.	Crown.	Others.	Red.	Crown.	Others.	Red.	Crown.	Others.	Red.	Crown.	Others.	Red.	Crown.	Others.
1	612	607	..	..	..	..	37	..	..	..	44	..	37	44	..	575	563	..	..	..	..	575	563	..
2	6,972	1,682	64	..	..	..	234	..	42	219	228	11	453	228	53	6,519	1,454	11	..	..	..	6,519	1,454	11
3	4,571	4,094	65	184	195	..	176	..	38	210	421	18	570	616	56	4,001	3,478	9	8,430	..	..	12,431	3,478	9
4	2,430	509	657	102	24	83	89	..	115	125	20	347	316	44	545	2,114	465	112	3,210	..	..	5,324	465	112
5	4,888	112	..	..	..	..	143	..	..	225	..	..	368	..	..	4,520	112	..	..	..	..	4,520	112	..
6	5,637	41	..	78	..	..	..	..	..	..	..	..	78	..	..	5,609	41	..	..	..	..	5,609	41	..
7	4,744	117	..	..	..	..	298	..	..	443	..	..	741	..	..	4,003	117	..	..	..	..	4,003	117	..
8	7,208	20	..	..	..	..	1,017	..	..	154	..	..	1,171	..	..	6,037	20	..	1	..	..	6,197	20	..
9	667	..	..	..	..	..	35	..	..	..	..	..	35	..	..	632	..	..	..	..	..	632	..	..
Total	37,779	7,182	786	364	219	83	2,029	..	195	1,376	713	376	3,769	932	654	31,010	6,250	132	11,800	..	..	42,810	6,250	132

NADUVATAM,
20th May 1881.

(Signed) W. ROWSON,
Assistant Superintendent.

83

APPENDIX D.

STATEMENT showing the Number of Chinchona Trees on Dodabetta Government Chinchona Plantations, Number of Failures in the coppiced or uprooted, and Number of Plants planted.

Number of Plot.	Date of Planting.	NUMBER OF TREES AS IN MAJOR WALKER'S REPORT.		Number of Failures in the coppiced or uprooted since.	Remain- ing.	Planted since.	Now Existing.	Remarks.
		Crown Bark.	Other Species.					
I ..	1863 A.	1,478	3	..	1,481	..	1,481	
II ..	1863 B.	1,032	..	..	..	1,032	1,032	
III ..	1863 C.	1,930	17	..	1,947	1,700	3,647	
IV ..	1863 D.	662	2	..	664	900	1,564	
V ..	1864 A.	2,835	..	..	2,835	2,500	5,335	
VI ..	1864 B.	5,060	46	..	5,106	6,000	11,106	
VII ..	1865 A.	9,112	117	..	9,289	..	9,289	
VIII ..	1865 B.	11,282	..	..	11,282	..	11,282	
IX ..	1865 C.	12,423	..	..	12,423	..	12,423	
X ..	1865 D.	5,176	..	..	5,176	..	5,176	
XI ..	1866 A.	11,063	..	170	10,893	500	11,393	Coppiced and failed to grow.
XII ..	1866 B.	11,722	..	..	11,722	..	11,722	
XIII ..	1866 C.	10,523	..	..	10,523	..	10,523	
XIV ..	1866 D.	3,583	..	..	3,583	..	3,583	
XV ..	1866 E.	2,922	..	..	2,922	..	2,922	
XVI ..	1866 F.	8,072	..	..	8,072	1,000	9,072	
XVII ..	1867 A.	4,038	..	..	4,038	1,800	5,838	
XVIII ..	1867 B.	5,199	..	37	5,162	..	5,162	Dead trees cut down.
XIX ..	1867 C.	4,333	..	28	4,305	..	4,305	Do.
XX ..	1867 D.	4,258	..	5	4,253	..	4,253	Do.
XXI ..	1868 A.	1,193	..	..	1,193	..	1,193	
XXII ..	1868 B.	4,739	..	..	4,739	..	4,739	
XXIII ..	1868 C.	8,595	..	2	8,593	..	8,593	Do.
XXIV ..	1868 D.	8,755	..	5	8,750	..	8,750	Do.
XXV ..	1869 A.	3,880	..	..	3,880	..	3,880	
XXVI ..	1869 B.	2,633	..	..	2,633	..	2,633	
XXVII ..	1869 C.	10,467	..	..	10,467	..	10,467	
XXVIII ..	1869 D.	11,532	..	400	11,132	400	11,532	Coppiced and failed to grow.
XXIX ..	1869 E.	6,309	..	8	6,301	..	6,301	Dead trees cut down.
XXX ..	1869 F.	10,184	..	11	10,173	..	10,173	Do.
XXXI ..	1869 G.	8,485	..	4	8,481	..	8,481	Do.
XXXII ..	1869 H.	6,446	..	..	6,446	300	6,746	
XXXIII ..	1869 I.	6,754	..	4	6,750	..	6,750	Do.
XXXIV ..	1869 J.	4,019	..	6	4,013	800	4,813	Do.
XXXV ..	1869 K.	5,102	..	..	5,102	..	5,102	
XXXVI ..	1869 L.	1,481	..	4	1,477	..	1,477	Do.
XXXVII ..	1870	4,864	..	..	4,864	..	4,864	
XXXVIII ..	1872	3,949	..	..	3,949	..	3,949	
XXXIX ..	1873	557	44	..	601	400	1,001	
Total ..	..	226,647	289	684	226,252	16,300	242,552	

DODABETTA,
23rd May 1881.

(Signed) T. NARRAINSAWMY NAIDU,
Head Overseer in charge.

REVENUE (ISS/) DEPARTMENT.

No. 2040.

From

Conservator of Forests

Dated

4. } June

Recd.

6.

No.

Enb.

SUBJECT.

Submitting his inspection
report on the Govt. Chinch-
na Plantations at Middle-
mum, Pyhara and Orta-
mand, with reference to G.O.
dated 8th December 1880 A.S. 1670.

W. W. W. W. W.

Jeddiahthun

9/89

Statement Showing the number of *Chinchona* trees enumerated in 1878 & those that were cut since being dead and the balance existing on the Govt Plantations - Jeddiahthun.

Number existing on the 1st of January 1881																									
No.	Number as per Major Walker's Report			Quantities in 1878-79			Casualties in 1879-80			Casualties in 1880-81			Total number of trees cut			Balance			Number of Plants planted in 1880-81			Total number of trees existing			
	Red	Crown	Other	Red	Crown	Other	Red	Crown	Other	Red	Crown	Other	Red	Crown	Other	Red	Crown	Other	Red	Crown	Other	Red	Crown	Other	
1	3197	2325											312	142		2885	2183					2885	2183		
2	6272	1984		113	51					199	58		239	56	4	6033	1928					6033	1928		
3	3469	224	4	186	35	2				53	21	2	250		8	3219	224	8				3219	224	8	
4	3484	1300	16							118		6	77	5		3407	1295					3407	1295		
5	1418	610								163	5		187	2		1231	638					1231	638		
6	2849	3202								181	2		125	51		2724	3151		7			2731	3151		
7	7719	7460		29	31					64	20		294	110		7425	7290		113			7538	7290		
8	4707	3693		68	52					197	58		113	50		4594	3643					4594	3643		
9	3625	3305	164	143	27					142	23		64	85	25	3561	3220	139				3561	3220	139	
10	11261	1201			25	13				27	60	12	419	21		10782	1180					10782	1180		
11	9161	795								196	21		55	29		9106	766					9106	766		
12	3802	2687								55	29		150	46		8652	2641					8652	2641		
13	209	2764		102	29					48	17		3	88		206	2676					206	2676		
14	9563	50			21					3	67		185		4	9378	50	1				9378	50	1	
15	9347	211	5							85		2	249	11		9098	200		2905			9098	200	2905	
16	1208	386			11				2	100			18	2		1190	384					1190	384		
17	4461	1179								157			53	9		4408	1170					4408	1170		
18	6298	772			9					18	2			5		6298	767					6298	767		
19	7924	350			5					9						7924	350					7924	350		
20	10186	854												30		10186	824					10186	824		
21	6300	52			10						20					6300	52					6300	52		
22	5904	1894														5904	1894					5904	1894		
23	8719	374														7440	374		80			7520	374		
24	13805	915								1279						13805	915					13805	915		
25	7559	823														7559	815					7559	815		
26	1099		25		8								8			1067		25				1067		25	
27	3190	3000								22			32			3190	3000					3190	3000		
28										10															
29	2780	1314	387													2780	1266	387				2780	1266	387	
30					48								48												
31	164456	43694	601	511	395	15	2404			4	1159	403	22	1104	798	141	160352	42896	560	200		2905	160552	42896	3465

Office of Asst. Superint.
South (Chichester) Pl.

10 R

Office of Asst. Superint.
Govt. Chinchona Plantations
Jeddiahthun June 20th May 1881

W. Morrison
Asst. Superint.

Appendix B.

Neelura Hume

Statement showing the
number of *Chinchona*
trees existing

Date 22nd } May 1881
Dec 2

Hooker Estate

93

Statement Showing the number of (Whickona) trees enumerated in 1878 & those that were cut since being dead and the balance existing on the Govt Plantations Hooker Estate

Plot	Hepburn's Report			Casualties in 1878-79			Casualties in 1879-80			Casualties in 1880-81			Total number of trees cut			Balance			Number of plants planted in 1880-81			Total number of trees existing		
	Red	Crown	Other	Red	Crown	Other	Red	Crown	Other	Red	Crown	Other	Red	Crown	Other	Red	Crown	Other	Red	Crown	Other	Red	Crown	Other
1	1759	2876	"	"	142	"	87	"	"	130	36	"	217	78	"	1572	2798	"	"	"	"	4572	2798	"
2	6735	2036	"	198	36	"	259	"	"	116	81	"	903	117	"	5832	1919	"	"	"	"	5832	1919	"
3	7539	196	"	"	"	"	"	"	"	6111	"	"	6111	"	"	1425	196	"	"	"	"	1425	196	"
4	390	3357	"	"	"	"	"	"	"	"	"	"	84	283	"	306	3064	"	"	"	"	306	3064	"
5	1542	207	"	"	121	"	81	"	"	"	172	"	"	"	"	"	187	"	"	5000	"	"	5187	"
6	5271	5520	"	"	9	"	174	"	"	"	11	"	"	1784	20	"	"	"	"	34000	2000	"	38989	2000
7	4961	3910	"	"	247	"	5636	"	"	"	284	"	"	5636	521	"	"	4989	"	"	"	4814	3642	1
8	10569	2223	72	64	89	"	"	"	"	83	179	"	117	263	"	4814	3642	1	"	"	"	3972	24096	3482
9	7148	1152	"	"	43	"	6453	"	"	114	81	"	6597	127	"	3972	2096	72	"	22000	3410	1020	29050	"
10	1320	1096	"	"	24	"	6320	"	"	108	28	"	6428	52	"	1020	1100	"	"	"	"	1280	1040	"
11	4225	390	777	17	13	"	"	"	"	23	43	"	40	56	"	1280	1040	"	"	"	"	2824	369	777
12	3429	1446	"	"	10	"	1399	"	"	152	11	"	1551	21	"	2674	369	777	150	"	"	"	16467	2000
13	319	4506	"	"	11	"	3906	"	"	"	15	"	"	3906	29	"	"	417	"	16050	2000	319	4500	"
				"	"	"	"	"	"	"	"	"	"	"	"	319	4500	"	"	"	"	"	"	"
Total	58537	27909	850	279	648	"	5955	"	"	7170	944	"	53407	1592	"	26214	26317	850	150	105000	7410	26364	131317	8260

x Excess 1084 trees

Office of Assistant Superintendent
Govt (Whickona) Plantations
Kodiak Alaska, 20 May 1881

W Rowson
Asst. Supt.

Appendix C

10

Appendix B

Worcester & State

Statement showing the
Handicraft (Huishana)
free society

8 Feb 20 ~ 3 May 1881
No. 2

Wood Estate

79

Statement showing the number of (huichona trees enumerated in 1878 & those that were cut since being dead & the balance existing on the Govt Plantation Wood Estate)

Plot	Number as per Major Walker's report			Casualties in 1878-79			Casualties in 1879-80			Casualties in 1880-81			Total number of dead trees cut			Balance			Number of plants planted in 1880-81			Total number of trees existing		
	Red	Crown	Other	Red	Crown	Other	Red	Crown	Other	Red	Crown	Other	Red	Crown	Other	Red	Crown	Other	Red	Crown	Other	Red	Crown	Other
1	612	607	"	"	"	"	37	"	"	"	44	"	37	44	"	575	563	"	"	"	"	575	563	"
2	6972	1682	64	"	"	"	234	"	12	219	228	11	453	228	53	6519	1454	11	"	"	"	6519	1454	11
3	4571	4094	65	184	195	"	176	"	38	210	421	18	570	616	56	4001	3478	9	8430	"	"	12431	3478	9
4	2420	509	657	102	24	83	89	"	115	125	20	347	316	44	545	2114	165	112	3210	"	"	5324	465	112
5	1888	112	"	"	"	"	113	"	"	225	"	"	368	"	"	4520	112	"	"	"	"	4520	112	"
6	5687	41	"	78	"	"	"	"	"	"	"	"	78	"	"	5609	41	"	"	"	"	5609	41	"
7	4744	117	"	"	"	"	298	"	"	443	"	"	741	"	"	4003	117	"	"	"	"	4003	117	"
8	7208	20	"	"	"	"	1017	"	"	154	"	"	1171	"	"	6037	20	"	160	"	"	6197	20	"
9	667	"	"	"	"	"	35	"	"	"	"	"	35	"	"	632	"	"	"	"	"	632	"	"
5	4	"	"	"	"	"	"	"	"	"	"	"	3	41	4	2	3	4	2	3	4	4	2	3
Total	37779	7182	786	364	219	83	2029	"	195	1376	713	376	3769	932	654	34010	6250	132	11800	"	"	45810	6250	132

Office of Asst. Superint.
Govt Huichona Plantation
Medina Luna, 20 May
1881

W. Rorson
Asst. Superint.

Statement showing the No. of C. trees on Dadabulla Govt. Station.
Planting No. of failures in the coppice, or uprooted & No. of plants to be planted in.

Date of	Planting	Crane	Other	Report	Remaining	Planted	Since	Now	Remarks
		Bark	Spurs	in the				existing	
I 1863. A	1478	3	..	1481	..	1481			
II 1863. B	1032	..	..	..	1032	1032			
III 1863. C	1930	17	..	1947	1700	3647			
IV 1863. D	662	2	..	664	900	1564			
V 1864. A	2835	..	..	2835	2500	5335			
VI 1864. B	5060	46	..	5106	6000	11106			
VII 1865. A	9112	117	..	9289	..	9289			
VIII 1865. B	11282	..	..	11282	..	11282			
IX 1865. C	12423	..	..	12423	..	12423			
X 1866. A	5176	..	..	5176	..	5176			
XI 1866. B	11063	..	170	10893	500	11393			Copied - failed -
XII 1866. C	11722	..	..	11722	..	11722			
XIII 1866. D	10523	..	..	10523	..	10523			
XIV 1866. E	3583	..	..	3583	..	3583			
XV 1866. F	2922	..	..	2922	..	2922			
XVI 1866. G	8072	..	..	8072	1000	9072			
XVII 1867. A	4038	..	..	4038	1800	5838			
XVIII 1867. B	5199	..	37	5162	..	5162			Dead trunk down
XIX 1867. C	4333	..	28	4305	..	4305			Do
XX 1867. D	4258	..	5	4253	..	4253			
XXI 1868. A	1193	..	..	1193	..	1193			

Memorandum
The Will Estate
Shall be a 1. Among the
number of (husbands) have
existing

Adms 20 " 2 May 1881
McC?

the Coppicing, Scrapping, and stripping systems of harvesting the bark, remarks on the different species grown, Condition of build-ings, nurseries &c, together with other remarks and suggestions.

Neddivattam Cinchona Plantation

2. N. I. Plot 1862A. 14.12.1880. East exposure, Shola soil. 1/2 acre, 1/20-
-nier and not so picked in the
next plot of the same species, plant-
-ing, growth good though not equal
to plot B; planted originally with
5 trees Succimbra, and 20 trees Offici-
-nalis all of which have now been
barked 7 times; the direct growth
5 acres of Officinalis, 1/20 of Succim-
-bra growth chiefly owing to wide
planting.

In one spot 5 trees, 1/20-
-pubra, were Coppiced, rather
roughly in October 1870, no suckers
were left when the trees were
cut, and 22 out of the 57 trees
have since died.

105 ✓
The following are measurements
of 10 of the living Coppice.

	1	2	3	4	5	6	7	8	9	10
Height...	24'	22'	23½'	23'	24½'	17½'	18½'	19½'	16'	18½'
Girth....	17"	15"	15"	12"	13"	12"	13"	19"	11"	12"
No. of shoots.	2	2	3	3	2	2	2	1	2	2

in the same place, and standing in
8 rows with the above, 58 trees were
also Coppiced in May 1873, the
suckers being left when the trees were
cut, only 1 stool is dead.

The following are measurements
of 10.

	1	2	3	4	5	6	7	8	9	10
Height...	20½'	24½'	26½'	24½'	23'	26'	23'	24½'	24½'	23½'
Girth...	20"	20"	16"	15"	15"	17"	16"	18"	20"	19"
No. of shoots.	2	2	3	2	2	1	1	2	2	1

In another spot 200 Succimbra
were Coppiced in May 1871, when 9 years
old, suckers were left, and only one
stool died, the yield of the bark
being 1350 lbs green drying to 453 lbs.

These 199 were again Coppiced
in March 81, when 10 years old, (all
cut flush with the ground, no suckers
left), the yield of the bark being
3365 lbs green drying to 1312 lbs, none
of these had commenced again to
grow when I saw them on 1st of May,
but there had not of course been
time for this.

No.

3. No II Plot 1862 B. 17.06 acres,
shola soil, west exposure, and
sheltered by a hill nearly all
succumbra, but some Officinalis,
and pubescens.

The following are measure-
ments of 6 selected succumbra.

Height...	35'	38 1/2'	32'	33'	36 1/2'	37'
Girth...	31"	34"	29"	26"	33"	35"

All the succumbra, and
Officinalis have been barked 8 times.

Only about 8 trees are left
out of a quantity of micrantha
trees planted in one place, this
species is reported always to
die off; the blanks have been fil-
led up with about 600 pubescens
trees (entered in Major Walker's re-
port as supposed to be anglica),
which are growing well, and luxu-
riantly.

In this plot 115 trees of
poor growth, unbarked, were Cop-
piced in May 1875 yielding only
248 lbs of green bark. 35 stools
died, the surviving 82, average
9 feet in height and 5 1/2 inches
in girth, and the stools have
from 3 to 6 shoots now growing
(not barked).

4. No III Plot 1863. 5.41 acres,
shola soil the portion above the road
sub soil indifferent growth fair, the
portion below the road poor from
wide planting and exposure to wind,
nearly all succumbra barked 7
times.

5. No IV Plot 1864 A. 8.86 acres,
above the road chiefly succumbra
with a few Officinalis, fair growth
where the soil was shola, poor in
places where it was originally
grass; below the road succumbra
and Officinalis mixed very poor
growth from wide planting, and
exposure to the wind, the soil is
also rather poor, all sized trees,
barked 7 times.

6. No V Plot 1864 B. 4.46 acres
shola soil, chiefly succumbra with a
few Officinalis, all barked 7 times,
poor growth owing to wide planting,
a few trees dying out owing to a
combination of poor soil, and
exposure to wind.

7. No VI Plot 1864 C. 7.87 acres
shola soil, planted with succum-
bra and Officinalis in nearly
equal proportions quite intermixed,
growth good but thin in portions
owing

3. ¹⁰⁹ ⁴ coming to the original with plant-
ing, all barked 5 times. In
this plot 7/8 acre (adjoining coffee
in next block) coppiced in May
and June 1879, 56 four times barked
trees cut, 103 stools have grown well
and 13 died.

8. No. VII 1864 D. 17.04 acres,
shola soil, *Succirubra* and *Officinalis* -
this in equal proportions, growth
very good, trees barked 5 times.

In this plot a block of 1 1/2
acres of trees 4 times previously
barked, was coppiced in 1879 (from
31st of May to end of June), 2263
trees were cut, and 2091 are now
growing, the trees were felled through
about 3 inches above the ground
and adzed over with a convex sur-
face to nearly flush with the
ground, they bled excessively
owing to the lateness of the sea-
son hence I think the failure of
the present growth of the re-
mainder is most healthy
and all that could be desired,
each stool has from 1 to 3, 5 times

4 to 6 feet high, there is also a
late growth of smaller stems which
I think should be pruned off, but
Mr. Rowson states that the Duke
of Buckingham requested that these
should be left.

9. No. VIII Plot 1864 E 11.58 acres
shola soil, *Succirubra* and *Officinalis*,
the former in a greater proportion,
growth of both very good and healthy,
Succirubra barked twice, *Officinalis*
barked 5 times.

10. No. IX Plot 1864 F 8.58 acres,
shola soil, planted with *Succirubra*
and *Officinalis* in nearly equal pro-
portions growth of both very good,
trees barked 3 times.

11. No. X Plot 1865 A. 18.32 acres,
in two plots waste land intervening,
1st about 2 acres grass land planted
with *Officinalis*, and a very few *Suc-
cirubra*, very much exposed to the
S. W. monsoon, growth poor, trees
barked 5 times.

2nd Portion shola soil (except
a small corner of grass land with
about 150 trees very poor growth),
planted

3. planted with *Succirubra*, wind blown and growth poor except in a low protected portion where the growth is fair.

12. No. II Plot 1865 B. 12.95 acres shola soil, about $\frac{9}{10}$ tho. *Succirubra* fair growth in portions, poor where wind blown, one corner very exposed, trees very poor and dying out, about $\frac{1}{10}$ *officinalis*, very good growth, all the trees of both species barked 4 times. There are some *pubescens* trees.

13. No. VII Plot 1865 C. 12.43 acres, shola soil, *Succirubra* chiefly, *officinalis* about 3 acres, all splendid growth, all barked 6 times, the plantation is too crowded in parts, the trees not being 3 feet apart, the thin girthed trees, not reaching the light should be uprooted.

14. No. VIII Plot 1866 A. 4.10 acres, shola soil, nearly all *officinalis*, growth good but planted originally too far apart, barked 3 times.

etc.

15. No. XIV Plot 1866 B. 14.31 acres, shola soil, all *Succirubra* of very fine growth barked 6 times, there was a good deal of *Calivaya* in this plot, but it all died out some years ago.

16. No. XV Plot 1866 C. 12.45 acres, shola soil, *Succirubra* except a small quantity of very fine old *officinalis*, and some young *Calivaya*, and *pubescens*, growth of *Succirubra* very fine, barked 6 times, about 1 acre formerly planted with *Calivaya*, all dying or dead, was uprooted, yield of bark 730 lbs, sale proceeds unknown; this block has been replanted with 2000 young *Calivaya* and 600 young *pubescens*.

17. No. XVI Plot 1866 A. 3.71 acres, all shola, planted chiefly with *Succirubra*, has been burnt over more than once, now poor and very thin, only about 300 trees remaining, soil poor and scarcely worth replanting.

18. No. XVII Plot 1866 B. 8.13 acres, all shola, about $\frac{1}{3}$ facing west very much blown, planted with *Succirubra*, condition bad; about $\frac{2}{3}$ facing

facing East, Succirubra and
Officinalis, about alternate trees
very fair growth, all barked twice.

19. No. XVIII Plot 1869A. 9.96
acres, grass land, nearly all suc-
-cirubra, growth fair, particularly
in lower portion, trees not barked.
400 Officinalis barked twice.

20. No. XIX Plot 1869B. 11.83 acres
grass land, all Succirubra, upper
portion exposed and growth very
poor and thin, and should be
uprooted and replaced by Of-
-ficinalis, lower portion fair growth
of red barked for grass land, trees
not barked.

21. No. XX Plot 1869C. 13.69 acres
grass land, 2 acres Officinalis, good
growth all barked, balance suc-
-cirubra not barked, fair growth
for the soil, but should all be
uprooted and replaced by Of-
-ficinalis which may be said of
all grass land planted with suc-
-cirubra in these plantations.

No.

Major, Lal Kori, remarks on these
two plots are evidently correct.

22. No. XXI Plot 1869D. 13.26 acres, ^{113 1/2}
grass land except a small patch of
shola land. all Succirubra except a
few supplies of Officinalis, not
barked, except the small bit of
shola soil all poor growth, and
very thin in the upper portions
should be uprooted and planted
with Officinalis.

23. No. XXII Plot 1869E. 12.18 acres,
all shola land except a small cor-
-ner of grass land (about 50 trees)
all Succirubra except supplies of
Officinalis, growth very good, not
barked.

24. No. XXIII Plot 1869F. 14.54 acres,
2/3 shola, 1/3 grass land, all succi-
-rubra except supplies of Officinalis,
growth very good on the shola soil,
fair on the grass land, trees not barked.
5 acres Coppiced in 1879, balance scraped
in 1880. 5 acres Succirubra Coppiced
in July 1879 (in the same manner as
in plot No. VII), 2628 unbarked
trees cut, all stools bled terribly,
973 dead and uprooted, 1655 growth
healthy, shoots 1 to 3 to each stool,
3 to 4 feet high, blanks from the up-
-rootals

3 - roots to be planted with pubes.
-Cens.

6 acres 4723 Succinbra trees
scraped in September '80 on the new
Java principle, of the trees none
were mossed or covered in any
way as it was not supposed to be
necessary, 1978 trees have failed
to renew their bark, and the bark
and Cambium being
apparently all dead it is supposed
the trees must die, and some have
already died, the remainder are
renewing their bark satisfac-
torily, and might probably be
scraped again in 1882 but not
before.

25. No. XXIV Plot 1869 A. 20.19
acres, all shola land, all suc-
-cinbra, and pubescens except
supplies of Officinalis, not barked,
splendid growth; pubescens
about 20 percent.

26. No. XXV Plot 1869 H.
9.20 acres, all shola except a
small bit of grassland, shola
soil planted with Succinbra

not

1157
not barked, growth very good, grass
land planted with Officinalis all
barked.

27. No. XXVI Plot 1869 I. 2.55 acres
shola land, all succinbra of very
good growth barked 4 times.

28. No. XXVII Plot 1870 A. 11.52 acres
grassland, now $\frac{2}{3}$ Officinalis, and $\frac{1}{3}$
succinbra, originally planted entirely
with succinbra which mostly
died out and was replanted in 1872-73,
the remainder of the succinbra should
be uprooted and replaced by Offi-
-cinalis or pubescens, the Officina-
-lis growth is not good owing to ex-
-posure and poverty of soil but
it will pay, not barked.

29. No. XXVIII Plot 1870 B. 16.37 acres
grassland, an entire failure, up-
rooted and abandoned and now
fitted for planting Australian
acacias for fuel.

30. No. XXIX Plot 1870 C. 4.30 acres
in 3 separate blocks.

1st block grassland, Offi-
-cinalis, growth good, but too
widely planted, barked twice

2nd

2nd block, all shola land,
mixture of *Succumbra*, *Offici-*
-nalis, *Calisaya*, *Javanica*, and
anglica, not planted, growth good
except the *Calisaya*. The *anglica*
and shrubby *Javanica* of no
value.

3rd block, all shola chiefly
Succumbra with a few *Officinalis*,
growth good, not planted.

17 18 8
31. Neddivattam Buildings.

A drying House and new
store have been sanctioned at Ned-
divattam, the work is progressing
very slowly, less than 1 lakh of
bricks having been made; owing to
the want of this building, only a
small crop can be collected this
coming season.

The general condition of the
buildings other than the store is
good, the lines for the Coolies are
also in good order, the house now
occupied by the Overseer and the
one occupied by the Clerk should
have an iron roof substituted
for the grass one.

32. State of Neddivattam Plantations.

The Neddivattam plantations
certainly show very fine growth, and
though I misperceived them at the
beginning of May after an unusually
dry April, and at the end of a
long season of drought when, all
the grass hills were as brown as
the roads, they were in splendid con-
dition, and healthy foliage; taking
into consideration the mistake
of

3 of too wide planting. I think they are, all that could possibly be expected, and in every way satisfactory. In planting up a large area like this site, it is of course impossible always to avoid too great exposure to wind, bad soil, bad drainage &c., and there are here and there failures from these causes, but this could not be otherwise, and even in many places where the growth is poor it pays well at the price that is now realizing.

33. Fencing.

A considerable expenditure is necessary in fencing in several of the plots, if they are to be properly kept up, and the barriers are most troublesome, it will well pay.

34. Wide planting.

The great mistake here, as elsewhere has been the wide-planting, it was probably supposed that the trees would grow to a far larger size than they now promise, but even supposing that

this

47 919
this had occurred, there was the established fact that such large trees, as Oak, and Eucalyptus had to be planted 6' x 6' and, afterwards gradually thinned out otherwise good growth could not be secured, wide planting causes crooked growth and often no fair bole and gives the wind an unfair advantage. The

planting was originally 12' x 12', but reduced gradually, afterwards down to 8' x 8' and 7' x 7'. I am of opinion that the planting of "Succumbra" should always be 5' x 5' or certainly not more than 6' x 6' and that the first thinning (alternate lines having the trees 10' x 5' or 12' x 6) need not take place till there would be some yield from the bark, and that, at the final thinning, the trees may stand 10' x 10' or 12' x 12'. "Officinalis" should be planted 6' x 6' or perhaps even closer; --- intermediate planting is, always very precarious owing to the shade, and drip of existing trees, and 25, or even 50 per cent very often, appear to fail. Throughout the plantations. One

One piece of evidence of the great success of the wide planting had been.

35 I barking injurious or not to the trees. There is certainly no proof that barking in any way affects the health of the trees. I was formerly of opinion that it did and fancied I detected it in the appearance of the trees. I was prejudiced in a way, but I made most careful inspection of both barked and unbarked trees both from a distance and close, and could detect no difference in foliage or any way else, and it is a fact that the trees barked 7 to 8 times, are some of the healthiest and finest in growth, foliage, and every way, near in the plantation, and that they are now flowering, and shedding leaves prolifically, and that the barked trees have grown quite as well, if not better, from Coppice, which shows that their root system must be quite as healthy; this is also Mr. Rowson's opinion.

Mr. Rowson thinks that the trees appear to suffer somewhat for a

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a month or 6 weeks after being stripped, getting somewhat yellowish in leaf, but that they rapidly recover, so that if inspected just after the barking, a prejudice might easily be entertained against the system.

Trees that have been barked several times often bear fewer branches, but this is owing to the forming and to branches having been broken off, the foliage is just as thick as in unbarked trees.

Some trees do fail to renew their bark after being stripped, but it is very uncommon, and it is very rare to find a really healthy tree die out from its effects.

The bark renews just as rapidly in the subsequent stripplings as it does in the first, and there is no perceptible difference in its thickness, the renewal is always more rapid on rich soil than on poor. Carelessness in barking prevents immediate renewal, and may cause the death of a tree.

Elevation

36. Elevation for "Succirubra". The "Succirubra" does not attain the same size, at Keddavattam, as it does in Wyznad and elsewhere, at lower elevations, it grows to a height of 50 feet in Ecuador, and on the Chimborazo Mts, at 3000 feet, it has been measured 52 feet in height, at Keddavattam no trees are quite 40 feet. 5000 to 6000 feet is probably too high an elevation for large growth, but it is difficult (as we do not know how far correct) that the bark at these higher elevations is more valuable; in any case "Succirubra" grows well on Shola soil at Keddavattam.

37. Longevity of "Succirubra". "Succirubra" is probably not a long lived tree, but we cannot state this as it will attain when left unharmed or when barked until we have actual data, and a good number of unbarked trees must be left for this purpose.

Method

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38. Method of harvesting. With the established facts, that the 8 times barked trees are still perfectly healthy, and that the renewed bark is far more valuable than the natural bark, it would not be advisable to adopt any other system than the present one, the credit of which entirely belongs to Mr. MacDor, and it should certainly be continued as long as the trees appear healthy, but trees showing signs of decay should be either coppiced or uprooted.

39. Coppicing.

The marginal paras if referred to, show the results of the coppicing
* Para 7, No. V, Plot 1864 C. at Keddavattam
" 8, No. VII, " 1864 D.
" 24, No. XXIII, 1869 F. in 1879; the
coppicing process was very well carried out, the stools being
sawn through about 3 inches above the
the

the ground, and adged over with a convex surface to nearly flush with the ground; the growth is very healthy and promising wherever the Coppice has succeeded.

In the 1864 planting, 2319 "succirubra" trees, all previously barked 4 times were carefully Coppiced early in June 1879; 185 stools have died, 2134 are growing luxuriantly.

In the 1869 planting 2628 unbarked "succirubra" trees Coppiced in the same manner in July 1879; 973 stools died, 1655 growing luxuriantly.

Here we have a great anomaly, trees 15 years old have succeeded from Coppice with a far better percentage than trees only 10 years old, this is quite opposed to my experience in the Coppice of any other trees, the growth being generally far more successful the younger the tree, old or even mature trees often failing altogether to

1312
to make Coppice growth beyond a few twigs which die off, when saplings or young trees of the same species grow most readily, this is always the case with "Oak" and "Babul"; again it is noteworthy that the 4 times barked trees have succeeded from Coppice with a better percentage than the unbarked trees.

Both these data however are more or less valueless, as the 69 planting was Coppiced nearly a month later than that of 64, the sap was therefore more up, and the trees bled much more, which may account for the extra failures.

The Coppicing of both years was carried out too late, and I am inclined to attribute the failures to this cause, as the stools bled terribly, if the Coppice had been in April or early in May it is probable there would have been no failures, at least of healthy trees.

Of the old Coppicing experiments carried out more roughly, where.

where 57 unbarbed *Succirubra* trees of 1862 planting were clean Coppiced in October '73 all suckers removed, 22 have died, 35 have grown well and are about 26 feet high, and of 58 trees of the same year Coppiced in May '73, but the suckers left standing, only 1 stool is dead, and of 200 *Succirubra* of the same year in another block Coppiced in May '71 (when 9 years old) suckers left standing only 1 stool died, the 199 again Coppiced in March '81 (when 10 years old) no regrowth yet but sufficient time has not elapsed, the yield of green bark in '71 was 1350 lbs, but in '81 it was 3365 lbs which is noteworthy; and of 115 *Succirubra* of the same year, but of poor growth, and unbarbed, Coppiced in May '75. 33 stools died, the surviving 82 about 9 feet high and 5 1/2 inches in girth.

I do not think we should carry out any further Coppicing in

13
in blocks, but only Coppice trees showing signs of decay. I observed here and there dead trees in the different plantations, a tree should never be allowed to die, as its bark then yields no alkaloids, they should be Coppiced or uprooted when the signs of decay are evident. It is an established fact that if a sucker or shoot is left when the tree is Coppiced it never dies, and when trees have no shoots one can easily be produced by slightly injuring the bark close to the ground; it is also an established fact that if trees are Coppiced in June or July, when the sap is well up there must be many failures owing probably to the excessive bleeding that takes place; we have not sufficient data to say whether trees Coppiced in April or early in May will all grow again without any failures.

40. Uprooting. I do not think that this is to be thought of as a harvesting system, but I would uproot

uproot all "Succirubra" on grass
land at Reddittam and else-
where, where it is advisable to
replace it with "Officinalis" or
"pubescens", it is doubtful how
far seedlings will succeed on
land immediately after it is
uprooted, it will probably be
found necessary that it should
remain fallow for a certain period.

41 Scraping - As to the new Java
method of Scraping, we wanted
think more experience, this first
attempt (vide para 24) has it
will be seen, proved a failure
with "Succirubra", and caused the
loss of a great number of trees,
it would probably not fail if
the trees were mossed, or grassed
over, after the Scraping, but one
of its advantages was the sup-
position that the expense of
this would be unnecessary. I am
inclined to think that the
trees are much more likely
to suffer from the complete
Scraping.

Scraping than from the partial
barking in alternate strips; we
have yet to learn if the scraped
bark is more valuable in the
market than the stripped bark.

42 Grass a substitute for Moss.

For the last two years Mr.
Roxon has employed the coarse
Lemon grass of the hills (An-
dropogon Martini, and Schenan-
thus), as a substitute for moss
for covering the trees after strip-
ping off the bark, it appears to
answer in every way, as well as
moss, the bark never failing
to renew, the grass of course lacks
the hygroscopic properties of
moss, and it is possible that
bark renewed under it may not
be so replete with alkaloids,
but I see no reason to fear this,
the grass costs only about one
third what moss does, and
moss might in time be ex-
hausted, the moss must act
like a sponge round the tree in
wet weather when the bark is
growing most rapidly, and consider-
ing

ing how replete the bark itself
is with moisture, this is I
think more likely to be injurious
than beneficial, all that is
probably required being pro-
tection from solar influences
and from wind; the first re-
port on bark renewed, under
grass however will be of great
interest.

Red

131 15
43. Red Barks. *Succimbra* - Al.
- though this tree is not adapted to
grass land, on the Nilgiris it grows
very well, in shola soil at Keddawat-
tam, and at lower elevations, Ootaca-
mund is of course too high for it.
The bark is not nearly so rich in
quinine as the *Officinalis*, *Baliaya*,
and some others, but it is perhaps
the richest of all the species in
the total yield of alkaloids, and
on account of its easy culture, pro-
- fast growth, and great yield of
bark will probably always be the
one most cultivated in the region,
Coorg &c. at elevations of 2500 feet
and upwards, it will grow almost
everywhere on our Western mountains,
between 2000 or 2500 up to about
6000 feet if forest soil be selected and
a sloping situation, it is however
apt to die out on flats, as it did in
Travancore, unless the subsoil drain-
age is carefully attended to, and it
has been proved that it is useless
to attempt its cultivation in the
drier

their climates in the Eastern or Central parts of this Presidency.

"Euccinbra" should never again be planted on grassland at Adirattam, and what there now is on this soil should be gradually uprooted, and replaced by "Officinalis" or by "Pubescens".

44. "Pubescens". To one can visit the Adirattam plantation or the "Hooker" at Pykara without being struck by the splendid growth on grassland of the species known as "pubescens"; whilst "Euccinbra" is, always, very stunted, and with the leaves very much crimped and unhealthy looking in this soil, this species or variety is of sturdy fine growth for out-topping the red banks and with very healthy darker green leaves, the difference in growth however is not so marked in the shola soil, as the "Euccinbra" grows there equally or nearly equally robust. This "Pubescens" has generally been supposed to be

an accidental hybrid of Nilgiri
* Note:- Hybrids between distinct species could scarcely occur without isolation, or without removing the anthers (of the flowers the impregnated), at a very early stage, as I find the anthers burst before the valvate lobes of the corolla are fairly open. I find the flowers of officinalis (and all the other species, as far as I have observed) dimorphic, some trees have all the flowers with short included anthers, and long exserted style, others with long anthers and short included style - (this dimorphism occurs also commonly in species of Hedysotis, Aristida) and other genera of this tribe (Rubiaceae) indigenous on the Nilgiris. Seeds of hybrids would be sterile except under certain conditions.

origin, and is often known as Mr. Macdonald's hybrid, it is however not a hybrid whatever, nor has it any of the characteristics of one, and it has evidently been in the Nilgiri plantations since their commencement though not recognized as distinct from "Euccinbra" in its young growth and before flowering; it differs from "Euccinbra" (besides in its more robust growth at a higher elevation, and in poorer soil), in its leaves being more pointed more coriaceous of a much darker green, and more shining, and in the primary veins being less, at right angles with the midrib, Mr. Rowson pointed me out what he called 2 distinct varieties, one he said called "pubescens" by

Mr.

Mr. Mac Ivor and the other called
"magnifolia", on nothing to do with the *Ci.*
Careful exami- magnifolia, and even,
nation however another genus *Cassia*
the only difference differing from *Cassia*
appeared to be in having a papillose
a certain amount and in the absence
of pubescence on the of the capsule.

Young shoots, and under surface of the
leaves in the former, whereas typi-
cal specimens of the latter are
quite glabrous on the under surface
of the leaves, and the young shoots
are very slightly pubescent, and
I found that Mr. Rawson could
not tell one from the other except
by very close inspection and that
the difference in pubescence though
sometimes much marked was in other
cases not apparent; the pubes-
cent variety has also been called
"lanosa" and growing in shola soil
with "succirubra" might be passed
by as that species by the un-
initiated, the leaf however is
never so rounded at the apex
and it has a flatter surface,
and never the crumpled look that
"succirubra" always assumes more
or less. I found a good many of
"magnifolia"

137 17
"magnifolia" and a few "pubescens"
in the Rodabetta plantations, and
there are some fine old trees "magni-
folia" in the 1865 plantation which
are certainly not supplies (which
alone would prove that they could
not be hybrids) but here I found
them both known to the Superinten-
dent (Naraindram) as "pubes-
cens" the name "magnifolia" not
being known.

Mr. Rawson informed me
that he considered them hybrids
as they had not appeared before
the 1869 planting (it will be seen
elsewhere that Mr. Cross detected
them in the oldest planting) that
they both generally came up true
from seed, but that he had known
many grow as these hybrids come
up true "succirubra" which he how-
ever attributed to careless gathering
he also stated that he had largely
propagated "pubescens" and not
"magnifolia" on the supposition
that the bark of the former was
much more valuable, the bark
he also said both of "pubescens"
and "magnifolia" had not been sent
to market except from a few trees
taken

taken, carelessly by Coolies and mixed
with other barks, but samples had
been collected from one, or, two, trees
and sent home for analysis, and
this analysis is given in G.O. 10
1336 of 23rd June 1879 under hybrid
pubescens, and is most favorable,
though I am not inclined, as I
have said elsewhere, to give too much
reliance on the analysis from
single individuals *Pinha* grown
under very favorable circumstances.
These specimens were taken from the
glabrous "*magnifolia*" and not from
pubescens.

Varanasingam, the Doda Botta
Superintendent, informed me that
he did not consider "*pubescens*" a
hybrid, as there were large trees
in the '65 plantation which he had
always been familiar with. Since
he took charge in 1868, he also
stated that if it were they some-
times come up true, but they often
come up "*officinalis*" (this must
of course be due to careless gathering).
I subsequently got Mr. Cross to make
a careful examination of this species

or variety, both at Neddivattam
and on Doda Botta, he informs me
that "*magnifolia*" and "*pubescens*" are
one, and the same species, and scarcely
distinguishable, that he is quite
familiar with the tree which he found
himself in the Red bark region on
the slopes of Chimborazo, but al-
ways at a higher elevation than
Succumbra, and that the Carcarilleros
or bark collectors always distinguish-
ed it as the "*Pata de Gallinazo*" (or
turkey buzzard's foot) whilst they
called the "*Succumbra teja*" (or tile
bark), but that the bark was not
put up separately by their collectors,
he also states that he believes this
tree has never been figured or de-
scribed although Weddell (Notes
sur les quinquinas) refers to no
less than 4 species, as the source
of *Pata de Gallinazo*, whilst Mr.
Spruce in his report includes the
Pata de Gallinazo as bark Col-
lector's lore, evidently regarding it as
an alias of "*Succumbra*" though he
could never have seen the tree. Mr.
Cross also states that he examined
the very tree at Neddivattam that

the bark was taken from for
analysis, and that it is typical
"Pata de gallinazo" (or the glabrous
"magnifolia" of Mr. Rowson), and
that there can be no mistaking
the strong growing varieties of both
sorts on the grassland, but, that
in some cases true "succinbra"
has been pointed out to him, as
"pubescens" in the Meddivattam
plantations and the same mistake
he says seems to have occurred at
Darjeeling; there is evidently some
confusion about the pubescent variety,
and I fear that the officials do
not always distinguish between
some forms of "succinbra" and
"pubescens" when growing in sterile
soil, and that awkward mistakes
are liable to occur both in the
supply of seed, and collection
of bark. Mr. Cross also informs
me that he found trees of this
"Pata de gallinazo" in the oldest
plantations at Meddivattam, and
that he has no doubt it was
introduced here from the Comman-
ment but that it was not distin-
guished from "succinbra" till it
grew up, and flowered, or till it's

Robuster

141 12
robuster growth became apparent.
I forward with this report care-
fully dried and mounted specimens
of both "magnifolia" and "pubescens"
so I trust, that they may be compared
with typical specimens of the
various species in the Herbarium.
I also forward species of all the other
species referred to in this report for
comparison &c.

I examined the two trees in
Dodabetta from which Martin Sawney
tells me the analysis of Hybrid "pu-
bescent" is given in G.O. No. 1336 dated
23rd June 1877 (Nos. 10, 11 and 12). They are
both the glabrous variety that Mr.
Rowson calls "magnifolia" and Mr. Cross
styles "Pata de gallinazo". The re-
sults from the 3 specimens sent vary
much in the percentage of the dif-
ferent alkaloids, and also the va-
riations with the samples sent
from Meddivattam are considerable,
and this is not satisfactory, though
there is proof that we have in this
plant a very valuable species.

The Dodabetta Superintendent
informs me that this tree suffers
less from frost than the "Officialis".

Mr. Howard calls this tree
"Officialis".

"*Officinalis*" var "*pubescens*" it is in my opinion nearer "*Succumbra*" than "*pubescens*"; and it will be seen from some specimens that I forward that the young leaves from shoots and suckers are nearly as large as those of "*Succumbra*" though more lanceolate in shape and more pointed, no varieties of "*Officinalis*"; not even its longest leaved form "*Uristungia*" ever produced leaves nearly as large as this.

I much fear that in some cases seed of true "*Succumbra*" may have been forwarded from Keddiveattam to Ceylon, Darjeeling or elsewhere instead of true "*pubescens*" and that unfortunate mistakes may thereby arise.

I have had long talks with Mr. Craze about this tree, and we have examined many together, and he now writes me "the circumstance that this prolific and hardy tree has so long escaped notice, and the uncertainty that still exists as to which of the 2 sorts ("*Succumbra*" or the so called "*pubescens*")

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"are the richest in alkaloids" is much to be wondered at." It is still some doubt as to "*Magnifolia*" now think, all important that the and "*pubescens*" the doubts about it should be cleared up, and the same species or rather slight variations. Careful analysis from a considerable number of both the glabrous though dwarf self and pubescent varieties. I am fully convinced that they are, and sawing of Dodabetta informs me, that trust however that he sent it home to market for the first time in December '80, and that the fact may be established from the dried specimens two bales were forwarded viz: 111 lbs of mossed "*pubescens*" (not renewed) and 138 lbs of natural "*pubescens*"; ~~is also important~~ and 138 lbs of natural "*pubescens*"; ~~that a considerable portion of the bark of each should be sent home separately~~ the report on this is not yet to hand, and will be of the greatest interest, there is not a tree of "*Succumbra*" in Dodabetta fit to be barked, so it is, doubtlessly, all from the true "*pubescens*" or "*Pata de Gallanalia*" (true) which gave the favor of Mr. Crois, it is besides a valuable analysis nearly all from the glabrous variety in G.O.N. 1336 of 23 June 1879, as very few trees of the pubescent form exist in this Plantation. No bark of these sorts has been sent home as yet gone to market from Keddiveattam, so I think that some both of the pubescent and glabrous varieties were from (from grass land and from forest trees growing in Ossington Soil

soil, separately) should be forwarded without further delay. If this species is really far more valuable in its yield than "Succin-pubra" Government have been losing enormously by the extensive

propagation of the latter to the exclusion of the former. Mr. Cross states that it grows at a much higher elevation in its native country and this is borne out by the fact that it is growing vigorously on Dodabetta above 7000 feet elevation (where "Succin-pubra" is a complete failure) and by its more vigorous growth, at Neddivattam in exposed situations.

This species is very strong growing, and will certainly yield far more bark in a given time than any other, it will also I think prove to be longer lived.

The questions however
1st whether it is to oust "Succin-pubra" from the forest soil at Neddivattam, and 2nd to what extent it is to be planted on grassland to the exclusion of "Officialis"

Ossington which I have not seen but Mr. Cross states they are "Magnifolia".

Since this report has been copied I got Mr. Cross to examine these trees, he writes "Great discovery! the celebrated Cinchona 'crispata' of the Lora mountains a packet of the seed of which we collected when collecting the 'Officialis' seeds on the Hooker, and 4,000 at Neddivattam, and there are about 1,000 at Dodabetta chiefly 'Magnifolia'. In the 1869 planting at Neddivattam 20 per cent of the trees are of this species.

115. Unknown Species. I have found no description of C. 'crispata' and the name is a mere synonym of the genus. It has most curious rough bark in a most confused state at present, it is like that of the Cork tree (Quercus) but the 'crispata' of (Loria) quite unlike any other Cinchona mentioned in Triana's work without description, as that is said scarcely to differ from 'Officialis' and is made a variety of it by most authors which this very distinct species could never be. If Mr. Cross is correct the plants lately exposed to be 'crispata' are of great value. Dried specimens are obvious, but I do not know where the character of bark (to show its character) is described or by whom. I have

accompany

accompany this Report with other specimens. "Asperifolia" Weddell is the only species I can find, described at all like it in botanical works, but I have only DeCandolle and Walpers for reference, not all the later works, such as Weddell's. There are very few species known with the leaves hairy on the upper surface. The bark of this has never been analyzed.

whatever the name be, its bark should be analyzed, at once. it has been in three plantations since 15 or 16 years without ever having been noticed, it is now and has probably been seedling for many years and might be propagated by cuttings, in its hardiness and fruit it is entirely unlike anything else in any of the plantations. It is a tree of 10000 feet elevation and at a higher elevation than any other known species of the genus.

Crown

46. Crown bark.

147 22

Officinalis Linn (of which Condaminea Loub is only a synonym) flourishes exceedingly well on grassland at Veddivattam, Pykarrak and Ootacamund as well as on shola land, it is a small tree of no great girth, but this is a belief, also its characteristic in the Crown bark region in Loxa.

Writusinga. The tree known by this name in the Dodabetta and Veddivattam plantations and also called "strong growing Condaminea" and "broad leaved Condaminea" is evidently only a variety of "Officinalis", it is of much stronger growth with broader leaves and promises to be a much larger tree, but twigs can often be gathered from ordinary "Officinalis", particularly from suckers or young growth, in which the leaves are quite indistinguishable from this "Writusinga"; Mr. Cross believes our tree to be the same as the "Writusinga" of Lawon, which takes its name from a hill near Loxa.

Loxa, where he himself collected it, and which is now quoted in botanical works as a synonym of "Officinalis", but it should certainly be considered as a variety, and its bark should be kept distinct from that of "Officinalis". Our plant is exceedingly strong growing and healthy and I think it should be largely grown and receive more attention, at present there are about 1000 of it in Dodabetta, but only about a dozen at Keddivatam, "Urukunga" is a lofty tree in its native habitat.

angustifolia - evidently only a variety of "Officinalis", it sometimes looks very distinct, the leaves being narrower, and deeper colored, but it is not always true to its characteristics, and broader leaved in no way distinguishable from "Officinalis" can often be gathered on it. There is none of this in the Keddivatam side, some 700 rooted plants sent

149 23
sent out from Ooty to Koda-
as this variety have turned out to be ordinary "Officinalis", there are a few planted out in the Dodabetta plantations, but they do not show good growth, or promise to be a success, it is supposed to yield a very large percentage of Quinine and there are now 10000 rooted cuttings in the Dodabetta nurseries propagated in the glass houses from the few stock plants. Considering its poor growth I cannot recommend its extended planting until its treatment is better understood or a more favorable habitat is found for it.

Mr. Jamieson informs me that Mr. MacDor considered it hopeless to grow this variety, its growth being so slow and poor, it would be far less profitable than the ordinary variety of "Officinalis", notwithstanding the superiority in its yield in alkaloids. I can always distinguish this plant at the first glance, but

but Mr. Croft considers it not
even a variety but only a condition
of growth of "Officinalis" produced
by poverty of soil or some other
condition, I cannot say that I
quite agree with this, but there
is the fact that some 700
plants supposed to be this
species in the nurseries at the
Ootacamund gardens and planted
out in rich soil at Neddiattam
turned out to be ordinary "Officinalis";
there is not sufficient evidence
however, as to what the original
plants really were.

Var. *Crispa*? Mr. Croft in-
forms me that he recognizes many
plants of the *Crispa* var. of
"Officinalis" (at least the one
known in Ceylon as such) sup-
posed to be very rich in quinine,
scattered about with "Officinalis"
in our Dodabatta plantations. I
forward dried specimens of the
form which Mr. Croft distinguish-
es by its rather smaller leaves,
but I must say that I cannot
distinguish

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distinguish it satisfactorily from
ordinary "Officinalis"; and it ap-
pears at any rate to run into it.

Var. with very narrow leaf-
There are a few plants of a very narrow
leaved form of "Officinalis" in the
Dodabatta plantations of which
I also forward specimens, this
variety is easily distinguished,
and I believe it is the one Mr.
Mac Ivor considered as "*Crispa*";
it is only of shrubby growth and
cannot I think be of much value.
I am very disinclined to attach
too much value to the fact of
a very favorable analysis (as
we find in reports) of single in-
dividuals of varieties like "*an-
gustifolia*" or "*Crispa*"; grown
perhaps under very favorable con-
ditions, or to attempt their ex-
tended cultivation on such grounds;
it is of course evidence that they
are valuable yielders under cer-
tain conditions, but it would re-
quire stronger evidence I think
to establish the fact that they
are.

are far superior to the ordinary
type of "Officinalis"; as a very high
percentage of alkaloids has
sometimes been obtained from
single specimens of that also.
If a cultivator takes a fancy
to any particular variety, he
can probably get a very
flourishing report on its yield
by the high cultivation of
a few individuals, but this
does not hold good in a large
plantation and I should be
sorry to place faith in it with
varieties like "angustifolia" and
"Crispa". "Uridsinga" is I think
valuable on account of its
very strong growth, and much
greater yield in bark. The analysis
of this from Doda Balla
is given in G.O. No. 1336 of the
23rd June 1879 under the head of
"Condaminea" is distinct from
Crown Barks.

47. Cultivation of Crown Barks
by Government should be kept up.
Crown Barks will only grow
at

at a high elevation, and there
are few or no sites for them
except on the hillsides, where
only grass land, and not shola,
is now available to the public.
"Succumbra" and "Calisaya" on
the other hand, are spreading
all over the Wynad, Coorg &c;
it is desirable therefore that
Government should keep this
in view, and if possible extend
the cultivation of Crown Barks,
or at any rate work up their
present estates without any
staid out expenditure.

48. Yellow Barks. It is to be
regretted that these are such
a failure at Koddivattam,
they all die out, and the climate
is evidently too cold and pro-
bably too dry for them; they
grow at low elevations, and in
a very moist climate in their
native habitat in Bolivia
and Southern Peru, and it

it is useless to make further attempts at the cultivation of "Calisaya" or its variety "Lodgeriana" at Neddivattam, but I would strongly recommend that a small garden should be opened out for experimenting on their growth at 1,000 or 2,000 feet below our present plantations; they are believed growing well in parts of Udyanad, and in the Ochterlony Valley at about 3,000 feet elevation.

It is not easy to distinguish the variety "Lodgeriana" from ordinary "Calisaya" when in leaf only, but Mr. Rowson tells me he can always do so when they are in flower, as the "Lodger" has white flowers, whilst those

105 26
those of the ordinary "Calisaya" are pinkish.

"Anglica" supposed to be a sport or variety of "Calisaya" is represented by a few trees at Neddivattam, its bark is said to be of little or no value.

"Javanica" said also to be a variety of "Calisaya" is also represented by a few plants at Neddivattam; it appears to be of no value and not to be worth growing, at least in the form it assumes at Neddivattam, which is a small very bushy shrub; I do not know whether this is the variety usually called "Josephiana" 49 Grey Bark; "ellivantha", "Peruviana" and "nitida" from the grey bark region around Huancayo in North Peru are all represented at Neddivattam and Papharad, but they do not succeed and are in fact all fast dying out; they yield no Quinine, but are valuable for their yield of Cinchon and Cinchonidine, it is useless to grow them at Neddivattam, but it would be a pity that they should be lost to India and I propose

propose that another side at our
lower elevation should be opened
out for them, "Micrantha" and
"Peruviana" grow at about 1000
feet elevation and in much
moister climate than that of
Neddiwallam, and could hardly
be expected to answer in their
present situation, but "Mili'da" grows
at high elevations and might
have been expected to thrive at
Neddiwallam.

50. Columbian bark -

Pitayensis (Pitayo bark)
there are some few very healthy
trees of this in the Dodabetta
plantations, but the trees have
not been propagated here as yet;
Mr. Cross anticipates valuable
results from its introduction and
informs me it grows to 40 & 50 feet
high and 3 to 4 feet in diameter
where he met with it at 9 to 10000
feet in New Grenada. Samples
of the bark of our Dodabetta trees
have been sent by Mr. Cross to
Mr. Howard for analysis and
on this report the question of its
extensive cultivation must
depend; it is supposed to yield
much Quinine.

Santa Fe,

15/ 27

Santa Fe. Soft Columbian.
(C. lanceifolia) The plants brought
by Mr. Cross from New Grenada
(7 to 10000 feet elevation) are healthy
and are being propagated, so
it is hoped this valuable species
may ere long be established on
the Chiriquis. It is known to yield
a very high percentage of Quinine
and Mr. Cross anticipates great
results from its introduction, it
grows, he tells me, 40 feet high
with a diameter of 3 feet in its
native habitat; it may be
expected to answer well at
Neddiwallam and perhaps
also in sheltered places in Dodab-
etta.

Carthagena bark. (Cinchona
cordifolia) the two plants brought
lately by Mr. Cross from the central
Cordillera near Bogota (elevation
4 to 6000 feet) are healthy and
strong growing and are being
propagated, and the prospects of
establishing

establishing it on the *etilgiri*
are promising, it is supposed
to be a strong growing large-
tree which its present appearance
does not belie; its yield in
quinine is much the same as
that of *Succubra* and it will
probably succeed in the same
localities as that species. Mr
Cross tells me that he believes
the "China Cuprea" the seed of
which is promised to this Govern-
ment (vide No. 630 of the 8th
April 1881) from Bogota is the
same species.

51 *Pahudiana*, *Dist. a. r.*
a few of this very distinct species
in the (Dodaabatta plantation,
it is said to be quite valuable,
and its extensive propagation
in Java owing to its robust and
rapid growth, caused much
loss and annoyance.

15928
52. *Hybrids*. I am inclined to
doubt in any hybrids of
etilgiri origin; it has been
stated that there are many
hybrids amongst the "Officialis"
and "Calisaya" trees, but after
most careful examination I
can see no indication of such,
nor have any of our trees the
characteristics of hybrids, which
I am sure would not seed so
prolifically; in individual trees
may be gathered from many
"Officialis" trees and also from
"Calisaya" showing great difference
in the shape and size of the leaves,
but the same difference may be
found on one and the same tree
and often on the same bough;
we have varieties or sports of
species, such as "Uritsinga" and
"Augustifolia", varieties or sports of
"Officialis", sometimes looking very
distinct

distinct, but at other times running into the type and not to be distinguished, but of hybrids between distinct species I do not think we have any.

53. Hybridizing experiments. Though

I do not believe in accidental hybrids between different species on the *Chilgiris*, I have no doubt that the different species could be crossed, I am not inclined however to recommend any experiments of this nature, as it would be useless to attempt it without the services of a scientific gardener thoroughly trained in the art of hybridizing, such as Mr. Dominey or Mr. Soden on the establishment of Messrs. Bull and Birch, and as such a man could only be procured on a very high salary, and other expenses connected with any experiments of this nature would be very costly; the experiments would be

bespectively interesting and of great scientific value, but practically perhaps of no value, we have now in cultivation all the finest known species of the genus and it is not likely that hybridizing would improve the bark, or give us anything better than, or as good as, we now possess, so that we might be spending large sums to get some variations in leaf and flower, or perhaps in some cases sturdier growth.

54. Analysis of the various barks. I fear that too much reliance may hitherto have been placed on the analysis of the barks of single individuals of one species or variety, grown under unusually favorable conditions; Soil, solar influences, shade, moisture, long droughts, exposure to wind, frost &c. must probably exercise great influences on the bark

bark, and yield of alkaloids; and
Analysis should not be too much
relied on unless taken from
a considerable number of trees
subject to the varied conditions
which they must experience in a
plantation.

55. Sites for species requiring
a lower elevation. A fine sheltered
spot in the "Silent valley", elevation
about 3000 feet, has been reserved
by the Collector of Malabar at
the request of the Conservator in
case it should be required by
this Department for the growth
of "Rubber trees" or any other species;
I now recommend that this should
be taken up by the Forest Depart-
ment at Telambore and that
a small clearing should be at-
once made for experiments on the
growth of "Fry bark" and "Yellow
bark" at that elevation; if they
grow well, there is ample room
for opening out a considerable
area; it may also be necessary

to try "Carthagenä" and "Santa Fe" at
this lower elevation. A small pukka
building should be erected, and
the Cinchona Budget should
furnish the necessary funds;
it is also desirable to try some of
the Rubber trees and the "Epécacantha"
(Cephaelis) in the same locality.

56. Renovating pits. Mr. Rowson
has much improved the health
of the trees in the plantations under
his charge (at Cheddurattam and
Pykara) by the renovating pits:
(2 ft cubes) In many parts of
the plantations the trees have
a far more vigorous look than they
had two years ago, it has been sur-
mised that the lateral roots might
be injured by this system, but
this is not the case, where the lateral
fibres have been touched they shoot
out again with great vigor through
the humus in these pits; in some cases
cattle manure has been put in
the pits, but much of this not being
available they have generally
been

been filled up with dead leaves, & decaying vegetation such as the weeds cleared off the plantations. they have, I consider improved the condition of the plantations in a most marked manner.

57 Perfect drainage most necessary - All the varieties of Cinchona appear to grow much better on slopes than on flats, the tree being most impatient of anything like insufficient sub soil drainage.

58. Lichen. In wind blown situations the trunks and branches are often much covered with white lichen, Mr Rowson assures me that in no way affects the health of the trees or bark, it is easily rubbed off.

59. Diseases and Enemies. There is very little sign of Canker at Neddivattam, and the Cinchona seems to have few or no insect enemies; Sambar and wild animals are of course destructive, and fencing is most necessary in some parts, if the plantations are to be worked up to their highest possible

Possible yield.

60. Number of trees in Neddivattam. Appendix A is a statement of the number of Casualties amongst the trees in Neddivattam plantation during the last three years; (or since Major Walker's report), and the number of trees now existing based on Major Walker's enumeration.

61. Statement showing number of plants in the nurseries at Neddivattam, 28th May 1881

Botanical Names.	Plants in nurseries at Neddivattam 28 th May 1881	Plants in nurseries during 1880-81	Total.	Plants in nurseries at Neddivattam 28 th May 1881	Plants in nurseries at Neddivattam 28 th May 1881	Balance in nurseries at Neddivattam 28 th May 1881	Remarks.
C. Euccumbra.	216,000	58,950	801,950	489,950	120,000	300,000	* Received from do. at better. © 3383 seedlings have died.
C. Officinalis	15,500	37,800	53,300	228,000	105,000	200,000	
C. Calisaya var. Ledgeriana.	1,400	1,560	5,960	50	.	2027	
Other varieties	4,000	1,305	5,305	.	2,305	3,000	
C. Pubescens.	"	20,010	20,010	10,000	8,010	11,000	
Total	379,400	98,625	368,025	719,000	127,315	516,027	

Pykarra. 16732
The Hooker Cinchona Plantation
Acres 134.19

62. No. I Plot 1866 A. Acreage 10.91
about $\frac{1}{2}$ grass land and $\frac{1}{2}$ shola
land. The grass land chiefly *officinalis*
only a few *succirubra*. the crown
barkis have been planted too far apart
but the gaps are to be filled in this
season.

The shola land all *succirubra*,
growth good (about 20 feet high)
except a small bit on the upper por-
tion which is much wind blown and
thin from failures and in which sup-
plies are to be put down this season.

All the plantation has been bark-
ed 5 times.

3. No. II Plot 1866 B. 15.09 acres
about $\frac{2}{3}$ grass land planted with
officinalis, about $\frac{1}{3}$ shola land
planted with *succirubra*. growth
good or fairly good, in portions
there

there is a yellowish appearance in the foliage which is not noticeable at Maddisuttum it is probably due to the long drought and east wind and will disappear with the monsoon.

All the plantation has been barbed 5 times.

64. No. XIII Plot 1873. 10.59 acres.

all shola land planted with *officinalis*. a few *Succirubra* put in as supplies. there are about 20 *Pitayensis*. out of 26 plants sent out from Co. as *angustifolia* have turned out ordinary *officinalis*. growth of trees good but the plantation is very patchy and the trees far apart caused by the inroads of Sambar

In addition to the 10½ plant-
ed acres, there are some 15 or
20 more of abandoned shola

cleared.

169 83
cleared in 1873 but now over-
grown; it would be a good plan
to fence in the plantation and
to re-clear and replant this
portion and to plant up the
vacancies in the 10½ acre
plot; but it would be useless
without fencing on account of
wild animals

This plantation has not
been barbed.

65. No. X Plot 1869A 3.58 acres.

grass land *Succirubra* and
officinalis in nearly equal
proportion, ^{growth not good} soil poor rocky and
gravelly

Has been barbed 4 times.

66. No. VII Plot 1868.A. 18.36 acres.

Chiefly shola land. good soil.
Planted with *Succirubra*. the
growth of the trees is good but
the plantation is very patchy from
many trees having died out, cause
not known. the gaps are to be filled
in.

in with officinalis, but I fear this will not answer unless the plantation is fenced in as Sambar are exceedingly trouble some in this plot and destroying most of the young plants put out.

The above trees have all been barked 4 times.

Some grass land planted with officinalis very far apart; growth short; pits have been dug for filling in more trees the soil is good and it would have shown far better results, if it had been planted 4' x 4' instead of 8' x 8'.

All the trees have been barked 4 times.

67. No. III Plot 1867 A. 14.21 acres.

$\frac{2}{3}$ grass land formerly very stunted succirubra only a few feet high which has last season all been uprooted and

the

171. 16 34
the ground is now fitted for officinalis which is to be planted out this season.

$\frac{1}{3}$ Shola land succirubra. fine growth and barked 3 times.

68. No. XI Plot 1869 B 9.35 acres.

All shola land planted originally with succirubra. growth good. has all been barked 4 times there are supplies of officinalis - some grey barks were dying out and have been all uprooted.

5 acres coppiced in June 1879 - the stools bled excessively, there are 1379 failures out of 2226 stools, but the 847 which ~~however~~ succeeded have grown well and are 3 to 6 feet high with 1 to 3 stems to each stool.

69. No. VIII Plot 1868 B. 23.74 acres.

Chiefly shola land planted with succirubra. the plot is very patchy as very many trees were injured by the hail in 1879 and died out subsequently, growth of remainder

remainder good now fitted
for supplies of officinalis -

all barked 4 times,

about 2 acres of grass land
covered with very fair officinalis.

- all barked 4 times.

70. Nº XII Plot 1869 C. 6.52 acres
about $\frac{3}{4}$ Shola land and $\frac{1}{4}$
grass land planted almost entire.

by with succirubra which nearly
all died out after the hail
storm in 1879 and has been
uprooted and the plot replanted
in 1880 with officinalis doing
well, there is a sprinkling of
good old officinalis (scattered
about the plot) which were put
down at the same time with
the red barks.

71. Nº I Plot 1867 C. 2.71 acres
Chiefly Shola land, originally
planted with succirubra
which all died out after the
hail storm in 1879, it was

173
afterwards uprooted and replant-
ed with officinalis in 1880 which
is doing well

72. Nº VI Plot 1867 D. 16.07 acres

All grass land. about $\frac{2}{3}$ ²⁸⁵
formerly very stunted succirubra
which died out after the hail
storm in 1879 was uprooted and
the plot replanted with offici-
nalis in 1880 which is doing well.
about $\frac{1}{3}$ ²³ covered with very good
officinalis which has been barked
4 times.

73. Nº IX Plot 1868 C. 16.04 acres.

all grass land. about $\frac{2}{3}$ ²⁸⁵ covered
with fine officinalis, all barked
4 times. about $\frac{1}{3}$ ²³ originally co-
vered with stunted succirubra
which mostly died out after ^{the} hail
storm in 1879 replanted in 1880
with officinalis. doing well
1020 old succirubra still survive
and there are 1100 old officinalis.

Nº

74 No. IV Plot 1867 B. 7.02 acres.

about $\frac{3}{4}$ grass land planted with officinalis fair growth (12 feet high) but very patchy from wide planting, has been fitted for supplies which are to be put down this year. all barbed 4 times.

About $\frac{1}{4}$ shola land planted with succirubra and officinalis growth good but patchy the plot being much wind blown. fitted for supplies to be put down this year. all barbed 4 times.

State of the Hooker Plantation.

The growth here is far inferior to that at Neddiumtum. Considerable tracts of ^{grass} land being planted originally with "succirubra" which was a perfect failure, only attaining a stunted growth of a few feet; this has lately been nearly all uprooted and has been

or

or is being replaced ¹⁷⁵ with "officinalis" which grows very fairly on the grass land soil, there are still some tracts where the succirubra must give place to officinalis or to pubescens.

6. Fencing

Plot No. XIII 1873 must be fenced. And a portion of the shola which has been abandoned and allowed to revert to rank coarse growth should be re-cleared and planted. Fencing is also required in Plot VII 1868 A.

7. Coppicing

2226 Succirubra trees in No. XI Plot of 1869 4 times previously barbed and of good growth were coppiced in June 1879. 1379 stools have died, 847 are growing fairly height 3 to 6 feet.

No.

78. No of trees in Hooker plantation.
Appendix B is a statement of the
number of Casualties amongst the
trees in the Hooker plantation
during the last 3 years; and the
number of trees now existing based
on Major Walker's enumeration.

Pykara

Pykara

17757

The Wood Cinchona Plantation

72. 18 acres.

79. No V Plot 1865 C. 8.80 acres.

All Shola land planted with
"Succirubra" and a very few "offi-
cinalis". Trees a good height
often over 20 feet but not healthy
in appearance, and numbers of
failures. Sub-soil very inferior.
Sized trees barked 6 times.

80. No II Plot 1864. 10.87 acres.

All Shola land "Succirubra"
and "officinalis" growth all poor
and spindly. many failures
and many blank spaces and trees
still dying out. Suffers much
from the N.E. wind and the
sub soil bad. All barked
5 times.

81. No VIII Plot 1867 C. 10.87 acres

All Shola land. all "Succirubra".
growth good, over 20 feet
high. All barked 5 times.

5 acres 2500 trees coppiced in June 1879. 885 stools failed to grow 1155 have succeeded. growth good height 4 to 7 feet and very healthy.

82. No. IX Plot 1868 6.12 acres All Shola land. all planted with "succirubra". nearly all gone out except about 100 trees. replanting has been attempted more than once without success. Soil rocky and bad.

83. No. VII Plot 1867 B. 9.62 acres All "succirubra". except a few "officinalis". Shola land mostly a flat, drainage inefficient and sub soil sour, nearly all the trees gone out. all barked 5 times.

84. No. VI Plot 1867 A. 8.59 acres All Shola land. nearly all "succirubra" a portion planted on a slope good, the greater portion very poor growth and thin

179 38
from many failures and the remaining trees apparently dying out. sized, barked 5 times.
85. No. I Plot 1863. 2.55 acres. All Shola land, "succirubra" and "officinalis" mixed in equal proportions. very poor growth and thin, more than $\frac{1}{2}$ died out, and many still dying. Soil rocky and poor. sized trees barked 6 times.

86. No. IV Plot 1865 B. 4.88 acres. Lower avenue. all Shola land. Chiefly "succirubra" with a few "officinalis" growth good in some places but patchy as there are many blanks. Casualties chiefly caused by insufficient drainage on flat portions. where there is percolation from the channel. sized ^{trees} barked 6 times.

87. No. III Plot 1865 A. 10.08 acres upper avenue. "succirubra" and "officinalis" about $\frac{1}{2}$ and $\frac{1}{2}$
Growth

growth in some places fair
but not always healthy in
other parts very poor and has
been much injured by hail,
many trees dead and many
showing signs of dying out,
upper portions very much
exposed to the S.W. monsoon.
Sized ^{then} barked 6 times.

88. State of the Wood Plantation.

The lower portion of this plan-
tation exhibits very poor growth:
(all except plot N: VIII 1867 C. about
10 acres may be pronounced
a failure) it should I think
be uprooted and abandoned
as the money required for its
up-keep might be far better
spent in keeping up the other
plantations.

I would keep up Plots
N: III + IV on the avenue down
the ravine in which the Pykara
falls are situated and if Go-
vernment should decide to
sell

181 39
sell the remainder I do not
think these 2 Plots or any of
the land in this ravine should
be alienated as it is much
resorted to by the public on
account of its beautiful scenery
and for its water falls, the
other portion of the Wood estate
is over a saddle and in another
ravine.

89 Coppicing. 2500 succumbra
trees previously 4 times barked in plot
VIII 1867 C (the only good growth
in this lower portion of the
Wood estate) were coppiced
in June 1879. 885 stools have
died 1655 are growing and
very healthy, height 4 to 7 feet.

90 No: of trees in ^{the} Wood plantation.
Appendix C is a statement of the
Casualties among the trees in the
Wood plantation, during the last
3 years; & the number of trees now
existing based on Major Walker's
enumeration.

Dodabetta Plantation

Acres 320.47. Elevation over 7000 feet.

91 Ascending to the plantations from the Government Gardens the first 13 Plots as follows are on the slope looking down on to Ootacamund or with a South west exposure.

92 No. ~~XXI~~ 1868A. 1.61 acres chiefly grassland with a little shola at the bottom of ravine, all planted with *Officinalis* 7' x 7', ground very steep, and soil being gradually washed away, growth in fair condition, and not many failures since the renewals were put down 4 years ago, which are doing well, no late renewals, too steep for terracing, average height of the trees 15 feet, 7/4 trees barked once, 11 trees barked twice.

93 No. ~~XXVI~~ 1869B, 3.22 acres, nearly all grassland, very steep, soil gravelly, and being rapidly washed away but too steep for terracing, all planted with *Officinalis* trees healthy but very far apart owing to the original

original wide planting and many failures, many renewals were put down 3 years ago, which are doing well, but none since, average height 15 feet, 1138 trees once barked, remaining trees small.

94 No. XXV 1869A. 4.68 acres, grass land, very steep; remarks the same as for XXVI. A portion was terraced in 1880, remainder too steep for terracing; 2295 trees barked once, 70 trees barked twice.

95 No. I. 1863A 2.32 acres; all Shola land; steep, and the soil has been subject to much wash, but the whole plot was terraced in 1880, all planted with *Officinalis* 8'x8', trees average height 20', not in very good condition, trees very far apart owing to wide planting, and subsequent failures, renewals about 10 per cent put down 3 years ago, no later renewals. 967 trees barked 4 times, 161 trees barked once, remainder small and not barked.

No.

185 41
96 No. II 1860B. 1.67 acres, all Shola land, planted with *Officinalis* 7'x7', trees healthy, average height 22', but there have been many failures, renewals 1 to 4 years of age, 1221 trees barked 5 times, 47 trees once.

97 No. III 1863C. 3.57 acres, all Shola land, planted with *Officinalis*, condition fair, but trees very far apart from very wide planting, average height of original trees 22', many renewals 1 to 4 years of age, 1959 trees barked 5 times, 65 trees once. There are a few *Bahudiana* not growing well; also one *Angustifolia* growing well.

98 No. V 1864B. 7.28 acres, originally patches of Shola, dovetailing with grass land, very steep and soil much washed away, but the whole was terraced in 1880, planted with *Officinalis*, except some 50 *Euccimura* condition bad, 6000 seedlings planted out in alternate lines in 1880. 4969 trees barked 4 times, 2146 barked twice, 311 once.

99 No. V 1864A. 4.06 acres, all Shola land, steep, terraced in 1880, all

all planted with *Officinalis* 8'x8' and 7'x7', Condition fair, lately thicker planting has been attempted, 2500 seedlings being put out in alternate lines, doing fairly well, pits have also been dug for further planting, 1900 trees barked 3 times, 167 barked once, 100 trees have lately been scraped on the Java principle, some are mossed, and some left bare, all are renewing their bark, but those mossed more rapidly.

100 No. IV 1863.D 0.98 acres, all *phala* land planted with *officinalis* trees fair growth but very far apart, 900 late renewals, and now pitted for further planting. 556 trees barked 5 times, 58 trees once.

101 No. XVII 1867A. 5.62 acres, grass land planted with *Officinalis*, Condition good but trees much branched from wide planting, intermediate planting like the old trees last year to an extent of

187 42

of 1800 seedlings doing well, a small *varia* where the ground is level, nearly all gone out from frost, 2853 trees barked twice, 830 trees once.

102 No. XX 1867D. 4.92 acres, grass land, *Officinalis*, Condition fair, average height 14 feet, very few failures, original planting 6'x6', 2572 barked twice, 614 trees once, 5 trees Copied in June '80 as dying, no regrowth.

103 No. XVIII 1867B. 6.24 acres, grass land, Condition fair, but growth rather stunted 8' to 10' in height only, originally planted 7'x7', no late renewals, 2241 trees barked twice, 1537 trees once.

104 No. XIX 1867C. 5.90 acres, grassland, growth stunted 6' to 8' feet in height, trees gone out on a flat portion of about 1 acre said to be caused by frost 1692 trees barked twice, 1314 trees once, 28 trees cut down dead from frost.

105 The next plot No. X is chiefly on the ridge or saddle, all the remainder 25 in number are over

over the saddle, and have a
North Eastern exposure, except a small
portion of No. IX and XXII which is a grass hill & face S.W.
106 No. X 1866A. 7.44 acres, grass

land, but a little shola in hollows,
chiefly hill top, much blown,
growth stunted, and many failures,
growth better in hollows,
1007 trees barked twice, 351 trees
once.

107 No. XI 1866B. 12.18 acres, about
 $\frac{2}{3}$ shola, $\frac{1}{3}$ grassland, Offici-
nalis, growth good, 4627 trees
barked three times, 2615 trees twice,
1859 trees once. 5 acres, twice, barked
trees, upper portion (shola land),
Coppiced in 1879. 3350 trees cut,
157 have failed to sprout, growth
good of remainder.

108 No. XVIII 1869D. 15.33 acres
grassland, Officinalis, planted
7' x 7', Condition fair, but growth
stunted, height 8 to 10 feet, not
barked, no late renewals, but
now fitted for intermediate
planting to an extent of about
35

161 45.
35 per cent. 5 acres Coppiced in
1879, 2493 unbarked trees cut,
failures 400, Coppice growth of
the rest good, 400 seedlings planted
to replace the casualties, 400 unbark-
ed trees scraped in October 1880, some
mossed and some left bare, all
are renewing their bark, but those
mossed renew more rapidly.

109 No. XXIX 1869E. 8.05 acres, grass
land, Officinalis, growth good in
the lower portion only a small area,
rest very patchy from many failures,
trees healthy but stunted, no re-
newals the last 3 years, 2467 trees
barked once. 8 large dead trees fel-
led.

110 No. XXIV 1868D. 13.37 acres,
grassland and fernland, Offici-
nalis, a rather flat portion of
about 3 acres suffers from frost,
and has gone out, almost entirely
in the remainder growth stunted,
but fairly healthy, many failures,
no late renewals, 3579 trees barked
once. 5 old dead trees cut down. 21
angustifolia trees not growing very
well.

well.

111. No. XIV 1866E. 4.33 acres, shola land, *Officinalis*, growth average, but a good many failures from frost, several spots quite bare, no renewals since 4 years. 715 trees barked 3 times, 672 trees barked once.

112. No. XVII 1868B. 6.04 acres grass land, *Officinalis*, originally planted 7' x 7', many failures, and trees far apart, growth generally stunted but fairly healthy, no renewals since 4 years, 706 trees barked twice, 1709 trees once.

113. No. XVIII 1868C. 11.76 acres, fern land, *Officinalis*, (very poor growth with numerous gaps, the rank growth of the common *bractean* (*Pteris aquilina*) is robbing the soil of much of its virtue, it should be thoroughly eradicated as far as possible, and this plot should be fitted and planted up; 1895 trees barked twice, and 1302 once, two old dead trees cut down.

114. No. XV 1866F. 3.24 acres, about 1 acre shola, the rest grass land, *Officinalis*, growth poor and stunted, and many failures, 1412 trees barked 3 times and 697 trees once.

115. No. XII 1866C. 11.16 acres, shola land, *Officinalis*, growth good but patchy in places from many failures, 3573 trees barked three times, 1771 trees once, no renewals since 4 years.

116. No. XXXIX 1873. 1.81 acres, shola land, 44 large *Pitayensis* trees growth good, 15 feet high not barked, except 4 for analysis, 557 large *officinalis* doing very well, not barked, 1000 *officinalis* put down in 1880.

117. No. XIII 1866D. 12.68 acres, shola land, and good soil, very steep in parts, and subject to much wash but was terraced in 1880, trees have been pruned, and the growth is good and promising, but does not cover the ground, which is steep and rocky in places, originally planted 8' x 8' which has prevented straight growth of both, height of trees 8 to 15 feet, there was a good

good deal of intermediate planting.
4 years ago, 2971 trees barked 4
times, 1524 trees once.

118 No. VII 1865 A. 10.20 acres, Shola
land, soil very good, ground terraced
in 1880, chiefly *Officinalis*, growth
very good, originally planted 7'x7'
but not very regularly, fairly covers
the ground, trees 16 to 18 feet high
6601 trees barked 4 times, 816 trees
once, there is a gap in one portion
of about $\frac{1}{2}$ an acre, which has
been replanted twice, but has
failed owing to frost.

About 100 *Calisaya* trees,
growth thin and lanky.

Far pubescens trees grow-
ing luxuriantly, 26 *Micrantha*
and *puccinubra*, growth very poor.

One of the best plots on the
N. East side of the hill.

119 No. XVI 1866 A. 9.57 acres,
Shola land, *Officinalis*, planted
7'x7', growth good but suffers
somewhat from frost, does not
cover the ground and requires
intermediate planting, renewals
15 percent 4 years ago, of which
many

193 45
many have failed, 1000 seedlings
put out in 1880. 3622 trees barked
3 times. 1484 trees once.

120 No. XXXV 1869 K. 6.40 acres,
Shola soil, a very steep ravine, and
very irregularly planted with *Offici-
nalis*, all lately terraced, growth
good on slopes but trees generally
very far apart, about lower por-
tions of the ravines large gaps
owing to failures from frost, 531
trees barked twice, 1663 trees once,
there is 1 *Micrantha* tree not show-
ing good growth, and a few *pubes-
cens* with very fine growth.

121 No. XXXVIII 1872. 8.36 acres, chiefly
grassland, steep hill side, soil
poor and gravelly, *Officinalis*, growth
poor and many failures, suffers from
frost and much blown, many re-
newals, amongst which there are
failures, replanted in portions for
intermediate planting, the extreme
upper portion suffers much from
frost and wind, and has almost
entirely gone out, and it would be
useless to replant this, the upper
portion of the slope has been lately
terraced.

terraced, and should be planted
up; the bracken should be eradi-
-cated, as it is robbing the soil;
about 1 acre shaly land in the
lower portion of the plot exhibi-
-bits good growth, trees not barked.

122 No. XXXIV 1869 J 7.28 acres,
grassland, planted with *Officina-*
-lis, steep, rocky, and gravelly,
very poor growth, many failures;
567 trees barked twice, 1746 trees
once, 6 old trees cut down.

123 No. XXXIII 1869 I. 12.33 acres,
grass and fern land, *Officinalis*,
except a few *pubescens*, very steep,
several small land slips, trees
far apart and very irregular, at
least 25 per cent failures, a very
poor plot, 271 trees barked twice,
3487 trees once.

124 No. XXXII 1869 H. 12.82 acres,
grass and fern land, steep with
rocky gravelly poor soil, planted
with *Officinalis*, growth very poor
and numerous failures, 627 trees
barked twice, 2150 trees once, 300
seedlings planted out in 1880.

No. 2

125 No. XXXI 1869 G. ^{145 46} 14.08 acres, grass
and fern land, steep and gravelly,
Officinalis, growth very poor and
numerous failures, 707 trees barked
twice, 2242 trees once, 4 old dead trees
cut down.

126 No. XXX 1869 F. 17.62 acres, grass
land and fern, steep and gravelly,
Officinalis, very poor growth, and
thin from many failures, 2643 trees
barked twice, 2113 trees once, 11 old
dead trees cut down.

127. These last 5 plots of 1869
planting viz. - F, G, H, I and J form the
lower portion of the North East
side of the Dodabetta plantation,
and are by far the least successful,
and the trees will never cover the
ground, as there are considerable
portions on which growth will
always fail, there is however here
and there much fern land, on
which there is now a rank growth
of bracken robbing the soil, and
if money was expended in uproot-
-ing this the growth of the *Cinchona*
might be much improved in these
portions.

No.

128 No. XXXVII 1870. 8.92 acres,
grassland planted with *Officinalis*,
much of the plot is hill
top with poor rocky soil, the
trees were originally put down at
7' x 7', but they are now very far
apart from many failures, and
the growth is poor and stunted,
generally from 5' to 10' in height,
intermediate planting up should
be undertaken, but there are
several perfectly bare spots on
which perhaps planting would
not succeed, 168 trees barked
twice, 1295 trees once.

129 No. XXXVI 1869 L. 2.19 acres,
grassland, planted with *Officinalis*
poor rocky soil trees far apart
and of stunted growth, height
5 to 10 feet; 176 trees barked
twice, 100 trees once.

130 No. VIII 1865 B. 17.54 acres
grassland, good loam, planted
with *Officinalis* 7' x 7' growth good
trees average 15 feet high, not
many failures, renewals 10 percent
some

199 47
some 4 years ago, none since,
7567 trees barked 4 times, 2347
trees once.

131 No. IX 1865 C. 13.65 acres,
grassland, good subsoil, planted
with *Officinalis*, growth good, but
somewhat stunted, trees 10 to 13 feet
high, rather too much exposed
to the North East monsoon, re-
newals 15 percent some 4 years
ago, none since, not many fail-
ures, the trees covering the ground
well. 7602 trees barked 4 times;
3605 trees once.

132 No. XXVII 1869 C. 14.50 acres,
grassland, little Shola land in
ravine, soil generally good but si-
tuation high and exposed, planted
with *Officinalis*, growth fair but
stunted, some of the highest part
gone out, growth good towards
bottom of plot. 207 trees barked
twice, 1618 trees once.

133 Nurseries. The nurseries are in good
order, in the Dodabetta nursery
there are 2 lakhs of *Officinalis*
seedlings.

In

In the nursery near the Jail
about 10,000 *Officinalis* seedlings;
also 10,000 rooted cuttings of
angustifolia transferred from
the propagating houses.

In the lower nursery (near
the sea) there are 20,000 *Offici-*
-nalis seedlings.

134 In the glass propagating ^{glass houses}
houses 12,000 *Calisaya* *Ledgeria-*
-na seedlings (from Java); 100
Pitayensis seedlings from
plantation trees, 100 *pubescens*
seedlings from plantation
trees, 40 *Calisaya* seedlings
from plantation trees, 100 stock
plants of *angustifolia*; also
the "Santa Fe" and "Carthagena"
plants brought lately by Mr.
Cross.

199 48
185 State of Rodabetta Plantation
This I consider on the
whole promising, and there can
be no doubt, as to their paying well,
the great mistake has been wide
planting, at the commencement and
every endeavour must now be made
to plant up closer, but this is
receiving every attention, the planta-
-tions have been much improved of
late, in places by terracing, but in
some parts the land is too steep
for this, and should never have
been opened, there are besides large
blocks where the soil is very poor,
and where planting must be al-
-ways more or less a failure, though
it will pay at the present high
prices of bark, the effects of frost
and wind are also very evident
in many places. The eradication
of the bracken fern in some of the
plots requires immediate attention,
and would greatly improve the
growth of the *Cinchona*.

136 Coppicing.

In plot N^o XI 1866.
3350 "*Officinalis*" trees (5 acres) which
had been twice barked previously
were

were Coppiced, during the first
10 days in June 1879, the trees
bled very much and 15% died, the
Coppice growth of the rest is good,
Yield in green bark - 1576 lbs.
Yield in dry bark - 5400 lbs.

In plot ~~XXVIII~~ ^{unbarked} 1869, 2492 ^{lb}
cinna trees (5 acres) were Coppiced
from 13th to 19th June 1879, they
bled very much, and 400 died, the
Coppice growth of the
rest being good.

Yield in green bark - 12550 lbs.

Yield in dry bark - 17000 lbs.

Notwithstanding the failures to this
Coppice having been raised and the
loss in the season, it is not
worthy that here, as at the additional
tann there, are many more deaths
amongst the stools of the un-
barked trees than from those
which had been barked, which
is proof that the root system
of the tree does not suffer in
any way from the barking process.

137 Scraping. In plot ~~XXVIII~~
1869, 100 official trees were
scraped on the new sawing bed
on 3rd October '80, yield of bark
246 lbs green and 100 lbs dry;
and

201 11
and in plot V 1864, 100 trees
were scraped during October 1880,
yield of bark 856 lbs green, and 600
lbs dry. Some of the trees have
been mossed over, and others left
unprotected, but all are renewing
their bark satisfactorily though
more rapidly where mossed, and
there are no failures whatever, as far
as I can see.

138 No. of trees in Dodabetta plantation.
Appendix D, is a statement of the
number of Casualties amongst the
trees in the Dodabetta plantation
during the last 3 years; and the num-
ber of trees now existing based on
Major Walker's enumeration.

139. Receipts and Expenditure.
I will not add to the bulk of
this Report by any statements
of Receipts and expenditure,
as these have been given in full
in the last annual report just
perused by Government.

Dried

140. Dried Specimens.

The following dried and mounted specimens accompany this Report.

- Red barks.**
- Cinchona Succirubra* (Red bark). - Specimens from Kaddurattam and Dodabetta.
 - " Sp. called *Magnifolia* at Kaddurattam, and *Peta de Gallinas* by Mr. Cross supposed to be a new species, was collected by Mr. Cross at high altitudes in the Red bark region, called also Mr. Mac Iver's hybrid. - General specimens from Kaddurattam and Dodabetta from forest soil, and grass land.
 - " Called *pubescens*, at Kaddurattam and also on Dodabetta, where it is not distinguished from the last, of which it is supposed to be only a slight variety. - General specimens from Kaddurattam and Dodabetta from forest soil, and grass land.
 - Cinchona officinalis*, typical (Crown bark). - Specimens from Kaddurattam and Dodabetta.
 - " *Var. Viridissima* (Called broad leaved, or strong growing conv. - *damieria*). - Specimens from Dodabetta.
 - " *Var. angustifolia* - Do.
 - " *Var. Crispa* of Blyen. - Do.
 - " *Var. with very narrow leaves probably Crispa of Blyen* - Do.
 - " *Pithecellobium* - Do.
 - " *Calisaya* - Do. - from Kaddurattam.
 - " *Var. anglica*. - Specimens from Kaddurattam.
 - " *Var. javanica* so called at Kaddurattam probably *Josephina* or a bushy shrub. - Do.
 - " *Lagerflora* - Do.
- Crown barks.**
- Yellow barks.**

- Grey barks.**
- Cinchona Micrantha* - Specimens from Kaddurattam and Dodabetta.
 - " *Nitida* - Specimens from Kaddurattam.
 - " *Peruviana* - Specimens from Kaddurattam.
 - " *Pahudiana* - Specimens from Dodabetta.
 - " Unknown species with cork like bark, leaves hairy on both surfaces and hairy capsules. - Specimens from Dodabetta.
 - Supposed by Mr. Cross to be the genuine *Crispa* of L. & A.

141 It appears to me important that I should proceed to Darjeeling to see the large *Cinchona* plantations there, and the different species in cultivation, and take notes on the system of cultivation pursued and other matters, which might be of use to the Officers in charge of these plantations; so if Government wish it I shall be prepared to proceed there shortly.

I have the honor to be
Sir
Your most obed^t. Servt.
Rudolf C. Coland
Conservator of Forests

Print
5

60

REVENUE (1881) DEPARTMENT.

No.

From

Conservator of Forests
P. N. S. S.

Dated
Recd.

4
6

June

No.

SUBJECT.

Submitting his report on the
Chinchona Mantatun and
Addinathun, Yhara and
Colacaminid, with reference
to G. O. dated 8th Dec 1880.

27 June 1881

C. No. 2940.

4 June

My Dear Master.

I send herewith
my enclosure report - the
Diels specimens accompanying it
will follow in a few days.
They are not quite ready -

You will see at the
end of this report I have
suggested that I should
go to Darjeeling to see
the plantations there
& take notes, I think
it very necessary &
I will spare a month
about August after I
get in the annual report.

Yrs sincerely
R. H. S. S.

✓16418 From Colonel R. H. BEDDOME, Conservator of Forests, Madras, to the Secretary to Government, Revenue Department, Madras, dated Ootacamund, 4th June 1881.

ADVERTING to the G.O., No. 1,670, dated 8th December 1880, I have the honor to inform you that I have lately thoroughly inspected all the Government Chinchona Plantations at Naduvatam, Pykara, and Ootacamund, and I herewith submit my report on the same. I have given my field notes on each plot in the different plantations as taken when going over them with the officers in charge: to these I have added general remarks on the condition of the three different plantations; notes on the coppicing, scraping and stripping systems of harvesting the bark; remarks on the different species grown, condition of buildings, nurseries, &c., together with other remarks and suggestions.

NADUVATAM CHINCHONA PLANTATION.

2. No. I Plot, 1862, A.—14.12 acres, east exposure, shola soil, steeper, stonier and not so rich as in the next plot of the same year's planting; growth good though not equal to plot B; planted originally with three-fifths Succirubra and two-fifths Officinalis, all of which have now been barked seven times; one block of about 5 acres of Officinalis is of poor growth, chiefly owing to wide planting.

In one spot 57 trees, Succirubra, were coppiced rather roughly in October 1873; no suckers were left when the trees were cut, and 22 out of the 57 stools have since died.

The following are measurements of ten of the living coppice:—

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Height ...	24'	22'	23½'	23'	24½'	17½'	18½'	19½'	16'	18½'
Girth ...	17"	15"	15"	12"	13"	12"	13"	19"	11"	12"
Number of Shoots ...	2	2	3	3	2	2	2	1	2	2

in the same place and standing in eight rows with the above, 58 trees were also coppiced in May 1873, the suckers being left when the trees were cut, only one stool is dead.

The following are measurements of ten:—

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Height ...	30½'	24½'	26½'	24½'	23'	26'	23'	24½'	24½'	23½'
Girth ...	20"	20"	16"	15"	15"	17"	16"	16"	20"	19"
Number of Shoots ...	2	2	3	2	2	1	1	2	2	1

In another spot 200 Succirubra were coppiced in May 1871 when nine years old; suckers were left and only one stool died, the yield of the bark being 1,350 lb. green, drying to 453 lb.

These 199 were again coppiced in March 1881 when ten years old (all cut flush with the ground, no suckers left), the yield of the bark being 3,365 lb. green, drying to 1,312 lb.; none of these had commenced again to grow when I saw them on 1st of May, but there had not of course been time for this.

3. No. II Plot, 1862, B.—17.06 acres, shola soil, west exposure, but sheltered by a hill; nearly all Succirubra, but some Officinalis and Pubescens.

The following are measurements of six selected Succirubra:—

Height ...	35'	38½'	32'	33'	36½'	37'
Girth ...	31"	34"	29"	26"	33"	32"

All the Succirubra and Officinalis have been barked eight times.

In this plot 115 trees of poor growth, unbarked, were coppiced in May 1875, yielding only 248 lb. of green bark. Thirty-three stools died, the surviving 82 average 9 feet in height and $5\frac{1}{2}$ inches in girth, and the stools have from three to six shoots now growing (not barked).

5. No. IV Plot, 1864, A.—8.86 acres, above the road chiefly *Succirubra*, with a few *Officinalis*, fair growth where the soil was shola, poor in places where it was originally grass; below the road *Succirubra* and *Officinalis* mixed, very poor growth from wide planting and exposure to the wind, the soil is also rather poor, all sized trees. barked seven times.

7. *No. VI Plot, 1864, C.*—7·87 acres, shola soil, planted with *Succirubra* and *Officialis* in nearly equal proportions quite intermixed, growth good but thin in portions owing to the original wide planting, all barked five times. In this plot $\frac{1}{4}$ acre (adjoining coppice in next block) coppiced in May and June 1879, 56 four times barked/trees cut, 43 stools have grown well and 13 died.

In this plot a block of $4\frac{3}{4}$ acres of trees four times previously barked was coppiced in 1879 (from 31st of May to end of June), 2,263 trees were cut and 2,091 are now growing; the trees were sawn through about 3 inches above the ground and adzed over with a convex surface to nearly flush with the ground; they bled excessively owing to the lateness of the season; hence I think the failures. The present growth of the remainder is most healthy and all that could be desired; each stool has from 1 to 3 stems, 4 to 6 feet high; there is also a late growth of smaller stems which, I think, should be pruned off, but Mr. Rowson states that the Duke of Buckingham requested that these should be left.

10. *No. IX Plot, 1864, F.*—8·58 acres, shola soil, planted with *Succirubra* and *Officinalis* in nearly equal proportions; growth of both very good, trees barked three times.

Second portion shola soil (except a small corner of grass land with about 150 trees very poor growth) planted with *Succirubra*, wind-blown and growth poor except in a low protected portion where the growth is fair.

13. *No. XII Plot, 1865, C.*—12·43 acres, shola soil, *Succirubra* chiefly, *Officialis* about 3 acres, all splendid growth, all barked six times; the plantation is too crowded in parts; the trees not being three feet apart; the thin girthed trees not reaching the light should be uprooted.

2,1

14. No. XIII Plot, 1866, A.—4.10 acres, shola soil, nearly all Officinalis, growth good but planted originally too far apart, barked three times.

15. No. XIV Plot, 1866, B.—14.34 acres, shola soil, all Succirubra of very fine growth, barked six times; there was a good deal of Calisaya in this plot, but it all died out some years ago.

16. No. XV Plot, 1866, C.—12.45 acres, shola soil, Succirubra except a small quantity of very fine old Officinalis and some young Calisaya and Pubescens, growth of Succirubra very fine, barked six times, about one acre formerly planted with Calisaya, all dying or dead, was uprooted, yield of bark 730 lb, sale proceeds unknown; this block has been replanted with 2,000 young Calisaya and 600 young Pubescens.

17. No. XVI Plot, 1868, A.—3.71 acres, all shola, planted chiefly with Succirubra, has been burnt over more than once, now poor and very thin, only about 300 trees remaining, soil poor and scarcely worth replanting.

18. No. XVII Plot, 1868, B.—8.13 acres, all shola, about one-third facing west very much blown, planted with Succirubra, condition bad; about two-thirds facing east, Succirubra and Officinalis, about alternate trees very fair growth, all barked twice.

19. No. XVIII Plot, 1869, A.—9.96 acres, grass land, nearly all Succirubra, growth fair, particularly in lower portion, trees not barked; 400 Officinalis barked twice.

20. No. XIX Plot, 1869, B.—11.83 acres, grass land, all Succirubra, upper portion exposed and growth very poor and thin and should be uprooted and replaced by Officinalis, lower portion fair growth of Red barks for grass land, trees not barked.

21. No. XX Plot, 1869, C.—13.69 acres, grass land, 2 acres Officinalis, good growth, all barked, balance Succirubra not barked, fair growth for the soil, but should all be uprooted and replaced by Officinalis which may be said of all grass land planted with Succirubra in these plantations.

22. *No. XXI Plot, 1869, D.—13.26 acres, grass land except a small patch of shola land, all Succirubra except a few supplies of Officinalis, not barked, except the small bit of shola soil all poor growth and very thin in the upper portions, should be uprooted and planted with Officinalis.

*Major Walker's remarks on these two plots are evidently reversed.

23. *No. XXII Plot, 1869, E.—12.18 acres, all shola land except a small corner of grass land (about 50 trees), all Succirubra except supplies of Officinalis, growth very good, not barked.

24. No. XXIII Plot, 1869, E.—11.54 acres, two-thirds shola, one-third grass land, all Succirubra except supplies of Officinalis, growth very good on the shola soil, fair on the grass land, trees not barked, 5 acres coppiced in 1879, balance scraped in 1880, 5 acres Succirubra coppiced in July 1879 (in the same manner as in Plot No. VII), 2,628 unbarked trees cut, all stools bled terribly, 973 dead and uprooted, 1,655 growth healthy, shoots 1 to 3 to each stool, 3 to 4 feet high, blanks from the uprootals to be planted with Pubescens.

Six acres 4,723 Succirubra trees scraped in September 1880 on the new Java principle, ~~Of the trees~~ none were mossed or covered in any way as it was not supposed to be necessary, 1,978 trees have failed to renew their bark, and the bark and cambium being apparently all dead it is supposed the trees must die, and some have already died; the remainder are renewing their bark satisfactorily, and might probably be scraped again in 1882, but not before.

25. No. XXIV Plot, 1869, G.—20.19 acres, all shola land, all Succirubra and Pubescens except supplies of Officinalis, not barked, splendid growth, Pubescens about 20 per cent.

26. No. XXV Plot, 1869, H.—9.20 acres, all shola except a small bit of grass land; shola soil planted with Succirubra, not barked, growth very good; grass land planted with Officinalis, all barked.

27. No. XXVI Plot, 1869, I.—2.55 acres, shola land, all Succirubra of very good growth, barked four times.

28. No. XXVII Plot, 1870, A.—11.52 acres, grass land, now two-thirds Officinalis and one-third Succirubra, originally planted entirely with Succirubra which mostly died out and was replanted in 1872-73, the remainder of the Succirubra should be uprooted and replaced by Officinalis or Pubescens, the Officinalis growth is not good owing to exposure and poverty of soil, but it will pay, not barked.

29. No. XXVIII Plot, 1870, B.—16.37 acres, grass land, an entire failure, uprooted and abandoned, and now pitted for planting Australian acacias for fuel.

30. No. XXIX Plot, 1870, C.—4.30 acres in three separate blocks—

First block.—Grass land, Officinalis, growth good, but too widely planted, barked twice.

Second block.—All shola land, mixture of Succirubra, Officinalis, Calisaya, Javanica and Anglica, not barked, growth good, except the Calisaya. The Anglica and shrubby Javanica of no value.

Third block.—All shola, chiefly Succirubra with a few Officinalis, growth good, not barked.

31. Naduvatam Buildings.—A drying house and new store have been sanctioned at Naduvatam; the work is progressing very slowly, less than one lakh of bricks having been made; owing to the want of this building only a small crop can be collected this coming season.

The general condition of the buildings, other than the stores, is good; the lines for the coolies are also in good order; the house now occupied by the Overseer and the one occupied by the Clerk should have an iron roof substituted for the grass one.

32. State of Naduvatam Plantations.—The Naduvatam plantations certainly show very fine growth, and though I inspected them at the beginning of May after an unusually dry April and at the end of a long season of drought when all the grass hills were as brown as the roads, they were in splendid condition and healthy foliage; taking into consideration the mistake of too wide planting, I think they are all that could possibly be expected and in every way satisfactory. In planting up a large area like this site, it is of course impossible always to avoid too great exposure to wind, bad soil, bad drainage, &c., and there are here and there failures from these causes; but this could not be otherwise, and even in many places where the growth is poor it pays well at the prices bark is now realizing.

33. Fencing.—A considerable expenditure is necessary in fencing in several of the plots, if they are to be properly kept up; as the Sambur are most troublesome, it will well pay.

34. Wide planting.—The great mistake here as elsewhere has been the wide-planting. It was probably supposed that the trees would grow to a far larger size than they now promise; but even supposing that this had occurred, there was the established fact that such large trees as Teak and Eucalyptus had to be planted 6'x6' and afterwards gradually thinned out, otherwise good growth could not be secured: wide planting causes crooked growth and often no fair boll and gives the wind an unfair advantage. The planting was originally 12'x12', but reduced gradually afterwards down to 8'x8' and 7'x7'. I am of opinion that the planting of "Succirubra" should always be 5'x5' or certainly not more than 6'x6' and that the first thinning (alternate lines ~~having~~ the trees 10'x5' or 12'x6') need not take place till there would be some yield from the bark, and that at the final thinning the trees may stand 10'x10' or 12'x12'. "Officinalis" should be planted 4'x4' or perhaps even closer; intermediate planting is always very precarious owing to the shade and drip of existing trees, and 25 or even 50 per cent. very often appear to fail. Throughout the plantations one sees evidence of the great mistake wide planting has been.

35. Is barking injurious or not to the trees?—There is certainly no proof that barking in any way affects the health of the trees. I was formerly of opinion that

leaving

it did, and fancied I detected it in the appearance of the trees, so I was prejudiced in a way, but I made most careful inspection of both barked and unbarked trees both from a distance and close, and could detect no difference in foliage or any way else, and it is a fact that the trees barked seven to eight times are some of the healthiest and finest in growth, foliage and every way, in the plantation, and that they are now flowering and seeding less prolifically, and that the barked trees have grown quite as well, if not better, from coppice, which shows that their root system must be quite as healthy; this is also Mr. Rowson's opinion.

Mr. Rowson thinks that the trees appear to suffer somewhat for a month or six weeks after being stripped, getting somewhat yellowish in leaf, but that they rapidly recover, so that if inspected just after the barking a prejudice might easily be entertained against the system.

Trees that have been barked several times often bear fewer branches, but this is owing to the pruning and to branches having been broken off; the foliage is just as thick as in unbarked trees.

Some trees do fail to renew their bark after being stripped, but it is very uncommon, and it is very rare to find a really healthy tree die out from its effects.

The bark renews just as rapidly in the subsequent strippings as it does in the first, and there is no perceptible difference in its thickness, the renewal is always more rapid on rich soil than on poor. Carelessness in barking prevents immediate renewal and may cause the death of a tree.

36. *Elevation for "Succirubra."*—The "Succirubra" does not attain the same size at Naduvatom as it does in Wynaad and elsewhere at lower elevations; it grows to about 50 feet in Ecuador, and on the Tinnevelly ghâts at 3,000 feet; it has been measured 52 feet in height; at Naduvatom no trees are quite 40 feet: 5,000 to 6,000 feet is probably too high an elevation for large growth, but it is said (I do not know how far correctly) that the bark at these higher elevations is more valuable; in any case "Succirubra" pays well on shola soil at Naduvatom.

37. *Longevity of "Succirubra."*—"Succirubra" is probably not a long-lived tree, but we cannot state the age it will attain when left unbarked, or when barked until we have actual data, and a good quantity of unbarked trees must be left for this purpose.

38. *Method of harvesting.*—With the established facts that the eight times barked trees are still perfectly healthy and that the renewed bark is far more valuable than the natural bark, it would not be advisable to adopt any other system than the present one, the credit of which entirely belongs to Mr. MacIvor; and it should, I certainly think, be pursued as long as the trees appear healthy, but trees showing signs of decay should be either coppiced or uprooted.

39. *Coppicing.*—The marginal paragraphs, if referred to, show the results of the coppicing at Naduvatom in 1879; the coppicing process was very well carried out, the stools being sawn through about 3 inches above the ground and adzed over with a convex surface to nearly flush with the ground; the growth is very healthy and promising wherever the coppice has succeeded.

In the 1864 planting, 2,319 "Succirubra" trees, all previously barked four times, were carefully coppiced early in June 1879; 185 stools have died, 2,134 are growing luxuriantly.

In the 1869 planting, 2,628 unbarked "Succirubra" trees coppiced in the same manner in July 1879; 973 stools died, 1,655 growing luxuriantly.

Here we have a great anomaly: trees fifteen years old have succeeded from coppice with a far better percentage than trees only ten years old; this is quite opposed to my experience in the coppice of any other trees, the growth being generally far more successful in the younger trees; old or even mature trees often failing altogether to make coppice growth beyond a few twigs which die off, when saplings or young trees of the same species grow most readily; this is always the

case with "Teak" and "Babul." Again, it is noteworthy that the four-times barked trees have succeeded from coppice with a better percentage than the unbarked trees.

Both these data however are more or less valueless, as the 1869 planting was coppiced nearly a month later than that of 1864 the sap was therefore more up and the trees bled much more which may account for the extra failures.

The coppicing of both years was carried out too late, and I am inclined to attribute the failures to this cause as the stools bled terribly: if the coppice had been in April or early in May, it is probable there would have been no failures at least of healthy trees.

Of the old coppicing experiments carried out more roughly, where fifty-seven unbarked "Succirubra" trees of 1862 planting were clean coppiced in October 1873, all suckers removed, twenty-two have died, thirty-five have grown well and are about twenty feet high, and of fifty-eight trees of the same year coppiced in May 1873, but the suckers left standing, only one stool is dead; and of 200 "Succirubra" of the same year in another block coppiced in May 1871 (when nine years old) suckers left standing, only one stool died; the 199 again coppiced in March 1881 (when 10 years old) no regrowth yet, but sufficient time has not elapsed. The yield of green bark in 1871 was 1,350 lb., but in 1881 it was 3,365 lb., which is noteworthy; and of 115 "Succirubra" of the same year, but of poor growth and unbarked, coppiced in May 1875, thirty-three stools died, the surviving eighty-two about 9 feet high and 5½ inches in girth.

I do not think we should carry out any further coppicing in blocks, but only coppice trees showing signs of decay. I observed here and there dead trees in the different plantations. A tree should never be allowed to die; as its bark then yields no alkaloids; they should be coppiced or uprooted when the signs of decay are evident. It is an established fact that if a sucker or shoot is left when the tree is coppiced it never dies, and when trees have no shoots one can easily be produced by slightly injuring the bark close to the ground. It is also an established fact that if trees are coppiced in June or July, when the sap is well up, there must be many failures owing probably to the excessive bleeding that takes place. We have not sufficient data to say whether trees coppiced in April or early in May will all grow again without any failures.

40. *Uprooting*.—I do not think that this is to be thought of as a harvesting system, but I would uproot all "Succirubra" on grass land at Naduvatam and elsewhere, where it is advisable to replace it with "Officinalis" or "Pubescens." It is doubtful how far seedlings will succeed on land immediately after it is uprooted; it will probably be found necessary that it should remain fallow for a certain period.

41. *Scraping*.—As to the new Java method of scraping, we want, I think, more experience. This first attempt (*vide* paragraph 24) has, it will be seen, proved a failure with "Succirubra," and caused the loss of a great number of trees; it would probably not fail if the trees were mossed or grassed over after the scraping, but one of its advantages was the supposition that the expense of this would be unnecessary. I am inclined to think that the trees are much more likely to suffer from the complete scraping than from the partial barking in alternate strips; we have yet to learn if the scraped bark is more valuable in the market than the stripped bark.

42. *Grass, a substitute for Moss*.—For the last two years Mr. Rowson has employed the coarse Lemon grass of the hills (*Andropogon Martini* and *Schwananthus*) as a substitute for moss for covering the trees after stripping off the bark; it appears to answer in every way as well as moss, the bark never failing to renew; the grass of course lacks the hydrometric properties of moss, and it is possible that bark renewed under it may not be so replete with alkaloids. But I see no reason to fear this; the grass costs only about one-third what moss does, and moss might in time be exterminated; the moss must act like a sponge round the tree in wet weather when the bark is growing most rapidly, and considering how replete the bark itself is with moisture, this is, I think, more likely to be injurious than beneficial; all that is probably required being protection from solar influences and from

wind. The first report on bark renewed under grass however will be of great interest.

43. *Red Barks (Succirubra)*.—Although this tree is not adapted to grass land on the Nilgiris, it grows very well in shola soil at Naduvatam, and at lower elevations; Ootacamund is of course too high for it. The bark is not nearly so rich in quinine as the "Officinalis", "Calisaya", and some others; but it is perhaps the richest of all the species in the total yield of alkaloids, and on account of its easy culture, robust growth, and great yield of bark will probably always be the one most cultivated in the Wynaad, Coorg, &c., at elevations of 2,500 feet and upwards. It will grow almost everywhere on our western mountains between 2,000 or 2,500 up to about 6,000 feet, if forest soil be selected and a sloping situation; it is however apt to die out on flats as it did in Travancore, unless the subsoil drainage is carefully attended to; and it has been proved that it is useless to attempt its cultivation in the drier climates in the eastern or central parts of this Presidency.

"Succirubra" should never again be planted on grass land at Naduvatam, and what there now is on this soil should be gradually uprooted and replaced by "Officinalis" or by "Pubescens."

44. "*Pubescens*."—No one can visit the Naduvatam plantation or the "Hooker" at Pykara without being struck by the splendid growth on grass land of the species known as "Pubescens."; whilst "Succirubra" is always very stunted and with the leaves very much crimped and unhealthy looking in this soil. This species or variety is of sturdy fine growth ~~for~~ out-topping the Red barks and with very healthy darker green leaves; the difference in growth, however, is not so marked in the shola soil as the "Succirubra" grows there equally or nearly equally robust. This "Pubescens" has generally been supposed to be an accidental hybrid of Nilgiri origin and is often known as Mr. Melvor's hybrid; it is, however, no hybrid* whatever, nor has it any of the characteristics of one, and it has evidently been in the Nilgiri plantations since their commencement, though not recognized as distinct from "Succirubra" in its young growth and before flowering. It differs from "Succirubra" (besides in its more robust growth at a higher elevation and in poorer soil) in its leaves being more pointed, more coriaceous, of a much darker green, and more shining, and in the primary veins being less at right angles with the midrib. Mr. Rowson pointed me out what he called "Pubescens" by Mr. Melvor and the other called "Magnifolia."† On careful examination however the only difference appeared to be a certain amount of pubescens on the young shoots and under surface of the leaves in the former, whereas typical specimens of the latter are quite glabrous on the under

* Note.—Hybrids between distinct species could scarcely occur without isolation, or without removing the anthers (of the flowers to be impregnated) at a very early stage, as I find the anthers burst before the valvate lobes of the corolla are fairly open. I find the flowers of Officinalis (and all the other species as far as I have observed) dimorphic; some trees have all the flowers with short included anthers and long exserted style, others with long anthers and short included style (this dimorphism occurs also commonly in species of Hedyotis—Anotis† and other genera of this tribe (Rubiaceae) indigenous on the Nilgiris). Seeds of hybrids would be sterile except under certain conditions.

two distinct varieties; one he said called

Chin: mag† Nothing to do with the "Magnifolia" Rz and Pavon, which is now placed in another genus "Cascarilla" differing from Chinchona in having a papillose instead of a hairy corolla and in the deliscense of the capsules.

surface of the leaves, and the young shoots are very slightly pubescent; and I found that Mr. Rowson could not tell one from the other except by very close inspection, and that the difference in Pubescens, though sometimes much marked, was in other cases not apparent. The pubescent variety has also been called "Lanosa" and growing in shola soil with "Succirubra" might be passed by as that species by the uninitiated; the leaf however is never so rounded at the apex and it has a flatter surface, and never the crimped look that "Succirubra" always assumes more or

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less. I found a good many of "Magnifolia" and a few "Pubescens" in the Dodabetta plantations, and there are some fine old trees of "Magnifolia" in the 1865 plantation which are certainly not supplies (which alone would prove that they could not be hybrids), but here I found them both known to the Superintendent (Narainsawmy) as "Pubescens," the name "Magnifolia" not being known.

Mr. Rowson informed me that he considered them hybrids, as they had not appeared before the 1869 planting (it will be seen elsewhere that Mr. Cross detected them in the oldest planting); that they both generally came up true from seed, but that he had known many sown as these hybrids come up true "Succirubra" which he however attributed to careless gathering. He also stated that he had largely propagated "Pubescens" and not "Magnifolia" on the supposition that the bark of the former was much more valuable; the bark he also said both of "Pubescens" and "Magnifolia" had not been sent to market except from a few trees taken carelessly by coolies and mixed with other barks, but samples had been collected from one or two trees and sent home for analysis, and this analysis is given in G.O., No. 1,336, of 23rd June 1879, under "hybrid Pubescens," and is most favorable, though I am not inclined, as I have said elsewhere, to give too much reliance on the analysis from single individuals perhaps grown under very favorable circumstances. These specimens were taken from the glabrous "Magnifolia" and not from "Pubescens."

Narainsawmy, the Dodabetta Superintendent, informed me that he did not consider "Pubescens" a hybrid, as there were large trees in the 1865 plantation which he had always been familiar with since he took charge in 1868; he also stated that if sown they sometimes come up true, but they often come up "Officinalis" (this must of course be due to careless gathering). I subsequently got Mr. Cross to make a careful examination of this species or variety both at Naduvattam and on Dodabetta. He informs me that "Magnifolia" and "Pubescens" are one and same species, and scarcely distinguishable, that he is quite familiar with the tree which he found himself in the Red bark region on the slopes of Chimborazo, but always at a higher elevation than "Succirubra", and that the Cascarilleros or bark collectors always distinguished it as the "Pata de Gallinazo" (or turkey buzzard's foot), whilst they called the "Succirubra" "teja" (or tile bark), but that the bark was not put up separately by their collectors. He also states that he believes this tree has never been figured or described although Weddell (Notes sur les Quinquinas) refers to no less than four species as the source of Pata de Gallinazo, whilst Mr. Spruce in his report includes the Pata de Gallinazo as bark collector's lore, evidently regarding it as an *alias* of "Succirubra," though he could never have seen the trees. Mr. Cross also states that he examined the very tree at Naduvattam, that the bark was taken from for analysis, and that it is typical "Pata de Gallinazo" (or the glabrous "Magnifolia" of Mr. Rowson), and that there can be no mistaking the strong growing varieties of both sorts on the grass land; but that in some cases true "Succirubra" has been pointed out to him as "Pubescens" in the Naduvattam plantations and the same mistake he says seems to have occurred at Darjeeling. There is evidently some confusion about the pubescent variety, and I fear that the officials do not always distinguish between some forms of "Succirubra" and "Pubescens," when growing in shola soil, and that awkward mistakes are liable to occur both in the supply of seed and collection of bark. Mr. Cross also informs me that he found trees of this "Pata de Gallinazo" in the oldest plantations at Naduvattam and that he has no doubt it was introduced here from the commencement, but that it was not distinguished from "Succirubra" till it grew up and flowered or till its robust growth became apparent.

I forward with this report carefully dried and mounted specimens of both "Magnifolia" and "Pubescens," so, I trust that they may be compared with typical specimens of the various species in the Kew Herbarium. I also forward specimens of all other species referred to in this report for comparison, &c.

specimens
I examined the two trees in Dodabetta from which Narainsawmy tells me the analysis of "hybrid Pubescens" is given in G.O., No. 1,336, dated 23rd June 1879 (Nos. 10, 11 and 12); they are both the glabrous variety that Mr. Rowson

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calls "Magnifolia" and Mr. Cross styles "Pàt de Gallinazo." The results from the three specimens sent vary much in the percentage of the different alkaloids, and also the variations with the samples sent from Naduvatam are considerable; this is not satisfactory, though there is proof that we have in this plant a very valuable species.

The Dodabetta Superintendent informs me that this tree suffers less from frost than the "Officinalis."

Mr. Howard calls this tree "Officinalis" var. "Pubescens." It is in my opinion nearer "Succirubra" than "Pubescens," and it will be seen from some specimens that I forward that the ~~young~~ leaves from shoots and suckers are nearly as large as those of "Succirubra" though more ~~lanceolate~~ lanceolate in shape and more pointed. No varieties of "Officinalis" not even its ~~longest~~ largest leaved form "Uritusinga" ever produce leaves nearly as large as this. *largest* *lanceolate*

I much fear that in some cases seed of true "Succirubra" may have been forwarded from Naduvatam to Ceylon, Darjeeling or elsewhere instead of true "Pubescens," and that unfortunate mistakes may thereby arise.

I have had long talks with Mr. Cross about this tree, and we have examined many together, and he now writes me: "the circumstance that this prolific and hardy sort has so long escaped notice, and the uncertainty that still exists as to which of the two sorts ('Succirubra' or the so-called 'Pubescens') ~~are~~ the richest

in alkaloids is much to be wondered at." It is I now think all important that the doubts about it should be cleared up, and that we should have a careful analysis from a considerable number of both the glabrous and pubescent varieties.* Narrainsawmy of Dodabetta informs me that he sent it home to market for the first time in December 1880, and that two bales were forwarded, viz., 111 lb. of mossed "Pubescens" (not renewed) and 138 lb. of natural "Pubescens;" the report on this is not yet to hand, and will be of the greatest interest. There is not a tree of "Succirubra" in Dodabetta fit to be barked, so it is doubtlessly all from the true "Pubescens" or "Pàt de Gallinazo" of Mr. Cross; it is besides nearly all from the glabrous variety as very few trees of the pubescent form exist in this plantation. No bark of these sorts has as yet gone to market from Naduvatam, so I think that some, both of the pubescent and glabrous varieties (from grass land and from forest soil separately), should be forwarded without further delay. If this species is really far more valuable in its yield than "Succirubra" Government have been losing enormously by the extensive propagation of the latter to the exclusion of the former. Mr. Cross states that it grows at a much higher elevation in its native country, and this is borne out by the fact that it is growing vigorously on Dodabetta above 7,000 feet elevation (where "Succirubra" is a complete failure) and by its more vigorous growth at Naduvatam in exposed situations.

This species is very strong growing, and will certainly yield far more bark in a given time than any other; it will also, I think, prove to be longer lived.

The questions, however, first, whether it is to oust "Succirubra" from the forest soil at Naduvatam, and second, to what extent it is to be planted on grass land to the exclusion of "Officinalis" must entirely depend on the report on the analysis of a sufficient quantity of its bark.

Mr. Rowson informs me that he has 5,000 "Magnifolia" on the Hooker plantation and 2,000 at Naduvatam, 5,000 "Pubescens" on the Hooker and 4,000 at Naduvatam, and there are about 1,000 at Dodabetta chiefly "Magnifolia."

In the 1869 planting at Naduvatam 20 per cent. of the trees are of this species.

45. *Unknown Species*. *—I found five trees of a curious species in the 1865

* Since this report has been copied I got Mr. Cross to examine these trees. He writes: "great discovery! incredible fact!! the celebrated 'Chinchona Crispa' of the Loxa mountains, a packet of the seed of which we collected when collecting the *Officinalis*." He also tells me that it is a very valuable bark, that the plant is probably almost unknown and was only collected by himself, and that the seeds which were sent to the Nilgiris were said never to have germinated.

I can find no description of *C. "Crispa"*, and the nomenclature and synonym of the genus seems in a most confused state at present; it can, however, scarcely be the "*Crispa*" of *Afella* mentioned in Triana's work without description, as that is said scarcely to differ from "*Officinalis*" and is made a variety of it by most authors which this very distinct species could never be. If Mr. Cross is correct the plants lately supposed to be "*Crispa*" are spurious, but I do not know where "*Crispa*" is originally described or by whom. Whatever this may be its bark should be analyzed at once; it has been in these plantations since 15 or 16 years without ever having been noticed; it is in flower and seed now and has probably been seeding for many years and might be propagated largely if advisable; in its bark, leaves and fruit it is utterly unlike anything else in any of the plantations.

Mr. Cross says he found it at 10,000 feet elevation, and that it grows at a higher elevation than any other known species of the genus.

"broad-leaved *Condaminea*" is evidently only a variety of "*Officinalis*." It is of much stronger growth with broader leaves and promises to be a much larger tree; but twigs can often be gathered from ordinary "*Officinalis*," particularly from suckers or young growth, in which the leaves are quite indistinguishable from this "*Uritusinga*." Mr. Cross believes our tree to be the same as the "*Uritusinga*" of Pavon, which takes its name from a hill near Loxa, where he himself collected it, and which is now quoted in botanical works as a synonym of "*Officinalis*;" but it should certainly be considered as a variety, and its bark should be kept distinct from that of "*Officinalis*." Our plant is exceedingly strong growing and healthy and I think it should be largely grown and receive more attention; at present there are about 1,000 of it in Dodabetta, but only about a dozen at Naduvatam. "*Uritusinga*" is a lofty tree in its native habitat.

Angustifolia.—Evidently only a variety of "*Officinalis*;" it sometimes looks very distinct, the leaves being narrower and deeper colored, but it is not always true to its characteristics, and broader leaves in no way distinguishable from "*Officinalis*" can often be gathered on it. There is none of this in the Naduvatam side; some 700 rooted plants sent out from Ooty to Pykara as this variety have turned out to be ordinary "*Officinalis*." There are a few planted out in the Dodabetta plantations, but they do not show good growth, or promise to be a success; it is supposed to yield a very large percentage of quinine and there are now 10,000 rooted cuttings in the Dodabetta nurseries propagated in the glass

plantation on Dodabetta. It has most curious rough bark like that of the Cork tree (*Millingtonia*) quite unlike any other *Chinchona*, and its leaves are exceedingly hairy on both sides, and it has hairy capsules; nothing is known of its origin except that it was received with the original seeds or plants. Mr. Cross thinks from the character of its bark that it may be of great value. Dried specimens of this species and fragments of the bark (to show its character) accompany this report with other specimens. "*Asperifolia*" Weddell is the only species I can find described at all like it in botanical works, but I have only DeCandolle and Walpers for reference, not all the later works, such as Weddell's. There are very few species known with the leaves hairy on the upper surface. The bark of this has never been analyzed.

46. *Crown Barks*.—*Officinalis* (Linn.) (of which *Condaminea* (Lamb) is only a synonym), flourishes exceedingly well on grass land at Naduvatam, Pykara and Ootacamund as well as on shola land. Is a small tree of no great girth, but this is, I believe, also its characteristic in the Crown bark region in Loxa.

Uritusinga.—The tree known by this name in the Dodabetta and Naduvatam plantations and also called "strong-growing *Condaminea*" and

houses from the few stock plants. Considering its poor growth I cannot recommend its extended planting until its treatment is better understood or a more favorable habitat is found for it.

Mr. Jamieson informs me that Mr. McIvor considered it hopeless to grow this variety/its growth being so slow and poor/ it would be far less profitable than the ordinary variety of "Officinalis" notwithstanding the superiority in its yield in alkaloids. I can always distinguish this plant at the first glance, but Mr. Cross considers it not even a variety but only a condition of growth of "Officinalis," conduced by poverty of soil or some other condition. I cannot say that I quite agree with this, but there is the fact that some 700 plants, supposed to be this species, in the nurseries at the Ootacamund Gardens, and planted out in rich soil at Naduvatam, turned out to be ordinary "Officinalis." There is not sufficient evidence, however, as to what the original plants really were.

Var. Crispa? Mr. Cross informs me that he recognizes many plants of the "Crispa" var. of "Officinalis" (at least the one known in Ceylon as such) supposed to be very rich in quinine, scattered about with "Officinalis" in our Dodabetta plantations. I forward dried specimens of this form which Mr. Cross distinguishes by its rather smaller leaves, but I must say that I cannot distinguish it satisfactorily from ordinary "Officinalis," and it appears at any rate to run into it.

Var. with very narrow leaf.—There are a few plants of a very narrow-leaved form of "Officinalis" in the Dodabetta plantations, of which I also forward specimens. This variety is easily distinguished, and I believe it is the one Mr. McIvor considered as "Crispa;" it is only of shrubby growth and cannot, I think, be of much value. I am very disinclined to attach too much value to the fact of a very favorable analysis (as we find in reports) of single individuals of varieties like "Angustifolia" or "Crispa" grown perhaps under very favorable conditions, or to attempt their extended cultivation on such grounds. It is of course evident that they are valuable yielders under certain conditions, but it would require stronger evidence, I think, to establish the fact that they are far superior to the ordinary type of "Officinalis," as a very high percentage of alkaloids has sometimes been obtained from single specimens of that also. If a cultivator takes a fancy to any particular variety he can probably get a very flourishing report on its yield by the high cultivation of a few individuals, but this does not hold good in a large plantation, and I should be sorry to place faith in it with varieties like "Angustifolia" and "Crispa." Uritusinga is, I think, valuable on account of its very strong growth and much greater yield in bark; the analysis of this from Dodabetta is given in G.O., No. 1,336, of the 23rd June 1879, under the head of "Condaminea" as distinct from Crown barks.

47. *Cultivation of Crown Barks by Government should be kept up.*—Crown barks will only grow at a high elevation and there are few or no sites for them except on the Nilgiris, where only grass land and not shola is now available to the public. "Succirubra" and "Calisaya" on the other hand are spreading all over the Wynnaad, Coorg, &c.; it is desirable therefore that Government should keep this in view and, if possible, extend the cultivation of Crown barks, or at any rate work up their present estates without any stint as to expenditure.

48. *Yellow Barks.*—It is to be regretted that these are such a failure at Naduvatam; they all die out and the climate is evidently too cold and probably too dry for them; they grow at low elevations and in a very moist climate in their native habitat in Bolivia and Southern Peru, and it is useless to make further attempts at the cultivation of "Calisaya" or its variety "Ledgeriana" at Naduvatam. But I would strongly recommend that a small garden should be opened out for experimenting on their growth at 1,000 or 2,000 feet below our present plantations; they are, I believe, growing well in parts of Wynnaad and in the Ouchterlony Valley at about 3,000 feet elevation.

It is not easy to distinguish the variety "Ledgeriana" from ordinary "Calisaya" when in leaf only, but Mr. Rowson tells me he can always do so when they are in flower as the "Ledger" has white flowers, whilst those of the ordinary "Calisaya" are pinkish.

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Anglica, supposed to be a sport or variety of "Calisaya," is represented by a few trees at Naduvatam; its bark is said to be of little or no value.

Javanica, said also to be a variety of "Calisaya," is also represented by a few plants at Naduvatam; it appears to be of no value and not to be worth growing, at least in the form it assumes at Naduvatam, which is a small very bushy shrub. I do not know whether this is the variety usually called "Josephiana."

49. *Grey Barks*.—"Micrantha," "Peruviana" and "Nitida" from the Grey bark region around Huanico in North Peru are all represented at Naduvatam and Pykara, but they do not succeed and are in fact all fast dying out; they yield no quinine but are valuable for their yield of Cinchonine and Cinchonidine; it is useless to grow them at Naduvatam, but it would be a pity that they should be lost to India, and I propose that another site at a lower elevation should be opened out for them. "Micrantha" and "Peruviana" grow at about 4,000 feet elevation and in a much moister climate than that of Naduvatam, and could hardly be expected to answer in their present situation; but "Nitida" grows at high elevations and might have been expected to thrive at Naduvatam.

50. *Columbian Barks*—*Pitayensis* (Pitayo bark).—There are some few very healthy trees of this in the Dodabetta plantation, but the tree has not been propagated here as yet. Mr. Cross anticipates valuable results from its introduction, and informs me it grew to 70 and 80 feet high and 3 to 4 feet in diameter where he met with it at 9, to 10,000 feet in New Grenada. Samples of the bark of our Dodabetta trees have been sent by Mr. Cross to Mr. Howard for analysis and on this report the question of its extended cultivation must depend; it is supposed to yield much quinine.

Santa Fé.—Soft Columbian (*C. Lancifolia*).—The plants brought by Mr. Cross from New Grenada (7 to 10,000 feet elevation) are healthy and are being propagated, so it is hoped this valuable species may ere long be established on the Nilgiris. It is known to yield a very high percentage of quinine, and Mr. Cross anticipates great results from its introduction. It grows, he tells me, 70 feet high with a diameter of 3 feet in its native habitat; it may be expected to answer well at Naduvatam and perhaps also in sheltered places in Dodabetta.

Carthagena Bark.—(*Chinchona Cordifolia*).—The two plants brought lately by Mr. Cross from the Central Cordillera near Bogota (elevation 4 to 6,000 feet) are healthy and strong growing and are being propagated, and the prospects of establishing it on the Nilgiris are promising. It is supposed to be a strong growing large tree which its present appearance does not belie; its yield in quinine is much the same as that of *Succirubra* and it will probably succeed in the same localities as that species. Mr. Cross tells me that he believes the "China Cuprea," the seed of which is promised to this Government (*vide* G.O., No. 630, of the 8th April 1881) from Bogota is the same species.

51. *Pahudiana*.—There are a few of this very distinct species in the Dodabetta plantations; it is said to be quite valueless, and its extensive propagation in Java, owing to its robust and rapid growth, caused much loss and annoyance.

52. *Hybrids*.—I am inclined to disbelieve in any hybrids of Nilgiri origin; it has been stated that there are many hybrids amongst the "Officinalis" and "Calisaya" trees, but after most careful examination I can see no indication of such, nor have any of our trees the characteristics of hybrids, which I am sure would not seed so prolifically; individual twigs may be gathered from many "Officinalis" trees and also from "Calisaya," showing great difference in the shape and size of the leaves, but the same difference may be found on one and the same tree, and often on the same bough. We have varieties or sports of species, such as "Uritusinga" and "Angustifolia," varieties or sports of "Officinalis," sometimes looking very distinct but at other times running into the type and not to be distinguished; but of hybrids between distinct species I do not think we have any.

53. *Hybridizing experiments*.—Though I do not believe in accidental hybrids between different species on the Nilgiris, I have no doubt that the different species

could be crossed. I am not inclined, however, to recommend any experiments of this nature, as it would be useless to attempt it without the services of a scientific gardener, thoroughly trained in the art of hybridising, such as Mr. Dominicy or Mr. Seden on the establishments of Messrs. Bull and Vitch, and such a man could only be procured on a very high salary, and other expenses connected with any experiments of this nature would be very costly. The experiments would be exceedingly interesting and of great scientific value, but practically perhaps of no value. We have now in cultivation all the finest-known species of the genus, and it is not likely that hybridising would improve the bark, or give us anything better than, or as good as, we now possess; so that we might be spending large sums to get some variations in leaf and flower, or perhaps in some cases sturdier growth.

54. *Analysis of the various Barks.*—I fear that too much reliance may hitherto have been placed on the analysis of the barks of single individuals of one species or variety, grown under unusually favorable conditions; soil, solar influences, shade, moisture, long droughts, exposure to wind, frost, &c., must probably exercise great influences on the bark and yield of alkaloids, and analysis should not be too much relied on, unless taken from a considerable number of trees subject to the varied conditions which they must experience in a plantation.

55. *Sites for Species requiring a Lower Elevation.*—A fine-sheltered shola in the "Silent Valley," elevation about 3,000 feet, has been reserved by the Collector of Malabar at the request of the Conservator, in case it should be required by this department for the growth of "Rubber trees," or any other products. I now recommend that this should be taken up by the Forest Department at Nilambúr, and that a small clearing should be at once made for experiments on the growth of "grey barks" and "yellow barks" at that elevation; if they grow well, there is ample room for opening out a considerable area; it may also be necessary to try "Carthagena" and "Santa Fé" at this lower elevation. A small pukka building should be erected, and the Chinchona budget should furnish the necessary funds; it is also desirable to try some of the rubber trees and the "Ipecacuanha" (*Cephaelis*) in the same locality.

56. *Renovating Pits.*—Mr. Rowson has much improved the health of the trees in the plantations under his charge (at Neddivattam and Pykara) by the renovating pits (2 feet cube). In many parts of the plantations the trees have a far more vigorous look than they had two years ago; it has been surmised that the lateral roots might be injured by this system, but this is not the case; where the lateral fibrils have been touched, they shoot out again with great vigor through the humus in these pits; in some cases cattle-manure has been put in the pits, but much of this not being available, they have generally been filled up with dead leaves, and decaying vegetation, such as the weeds, cleared off the plantations; they have, I consider, improved the condition of the plantations in a most marked manner.

57. *Perfect Drainage most necessary.*—All the varieties of Chinchona appear to grow much better on slopes than on flats, the tree being most impatient of anything like insufficient sub-soil drainage.

58. *Lichen.*—In wind blown situations the trunks and branches are often much covered with white lichen. Mr. Rowson assures me this in no way affects the health of the trees or bark; it is easily rubbed off.

59. *Diseases and Enemies.*—There is very little sign of canker at Neddivattam, and the Chinchona seems to have few or no insect enemies; sambur and wild animals are, of course, destructive, and fencing is most necessary in some parts if the plantations are to be worked up to their highest possible yield.

60. *Number of Trees in Neddivattam.*—Appendix A is a statement of the number of casualties amongst the trees in Neddivattam Plantation during the last three years (or since Major Walker's report), and the number of trees now existing based on Major Walker's enumeration.

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61. Statement showing number of plants in the nurseries at Neddivattam, 28th May 1881:—

Botanical Names.	Plants in Nurseries and Hot House on 31st March 1880.	Plants raised during 1880-81.	Total.	Plants issued during 1880-81.	Plants planted out permanently during 1880-81.	Balance in Nurseries and Hot House on 31st March 1881.	Remarks.
<i>C. Succirubra</i>	216,000	585,950	801,950	489,950	12,000	300,000	
<i>C. officinalis</i>	155,000	378,000	533,000	228,000	105,000	200,000	* Received from Do-
<i>C. Calisaya</i> var. <i>Ledgeriana</i> .	4,400	1,560	5,960	50		72,027	dabatta.
<i>C. other varieties</i>	4,000	1,305	5,305		2,305	3,000	† 3,383 seedlings have
<i>C. pubescens</i>		20,010	20,010	1,000	8,010	11,000	died.
Total	379,400	986,825	1,366,225	719,000	127,315	516,027	

PYKARA.

The Hooker Chinchona Plantation, Acreage 134.19.

62. *No. I Plot, 1866, A.*—Acreage 10.91, about half grass land and half shola land. The grass land chiefly *Officinalis*, only a few *Succirubra*; the crown barks have been planted too far apart, but the gaps are to be filled in this season.

The shola land all *Succirubra*, growth good (about 20 feet high) except a small bit on the upper portion, which is much wind blown and thin from failures, and in which supplies are to be put down this season.

All the plantation has been barked five times.

63. *No. II Plot, 1866, B.*—15.09 acres; about one-third grass land planted with *Officinalis*, about two-thirds shola land planted with *Succirubra*; growth good or fairly good; in portions there is a yellowish appearance in the foliage which is not noticeable at Neddivattam; it is probably due to the long drought and east wind, and will disappear with the monsoon.

All the plantation has been barked five times.

64. *No. XIII Plot, 1873.*—10.59 acres, all shola land, planted with *Officinalis*; a few *Succirubra* put in as supplies; there are about 20 *Pitayensis*; but 726 plants sent out from Ootacamund as *Angustifolia* have turned out ordinary *Officinalis*; growth of trees good, but the plantation is very patchy and the trees far apart caused by the inroads of sambur.

In addition to the 10½ planted acres, there are some 15 or 20 more of abandoned shola cleared in 1873, but now over-grown; it would be a good plan to fence in the plantation and to re-clear and re-plant this portion, and to plant up the vacancies in the 10½-acre plot, but it would be useless without fencing on account of wild animals.

This plantation has not been barked.

65. *No. X Plot, 1869, A.*—3.58 acres, grass land, *Succirubra* and *Officinalis* in nearly equal proportion; growth not good; soil poor, rocky, and gravelly. Has been barked four times.

66. *No. VII Plot, 1868, A.*—18.36 acres, chiefly shola land, good soil, planted with *Succirubra*; the growth of the trees is good, but the plantation is very patchy from many trees having died out; cause not known; the gaps are to be filled in with *Officinalis*, but I fear this will not answer unless the plantation is fenced in, as sambur are exceedingly troublesome in this plot, and destroying most of the young plants put out.

The above trees have all been barked four times.

Some grass land planted with *Officinalis* very far apart; growth short; pits have been dug for filling in more trees; the soil is good, and it would have shown far better results if it had been planted 4' x 4' instead of 8' x 8'.

All the trees have been barked four times.

15
854
67. *No. III Plot, 1867, A.*—14.21 Acres. Two-thirds grass land formerly very stunted ~~with~~ Succirubra, only a few feet high, which has last season all been up-rooted, and the ground is now pitted for Officinalis which is to be planted out this season. One-third shola land Succirubra; fine growth and barked three times.

68. *No. XI Plot, 1869, B.*—9.35 acres, all shola land, planted originally with Succirubra, growth good, has all been barked four times; there are supplies of Officinalis; some grey barks were dying out, and have been all up-rooted.

Five acres coppiced in June 1879, the stools bled excessively; there are 1,379 failures out of 2,226 stools, but the 847 which succeeded have grown well, and are three to six feet high with one to three stems to each stool.

69. *No. VIII Plot, 1868, B.*—23.74 acres, chiefly shola land, planted with Succirubra; the plot is very patchy as very many trees were injured by the hail in 1879 and died out subsequently; growth of remainder good, now pitted for supplies of Officinalis. All barked four times. About two acres of grass land covered with very fair Officinalis; all barked four times.

70. *No. XII Plot, 1869, C.*—6.52 acres, about three-fourths shola land and one-fourth grass land, planted almost entirely with Succirubra which nearly all died out after the hail-storm in 1879, and has been up-rooted and the plot re-planted in 1880 with Officinalis, doing well; there is a sprinkling of good old Officinalis (scattered about the plot) which were put down at the same time with the red barks.

71. *No. V Plot, 1867, C.*—2.71 acres, chiefly shola land, originally planted with Succirubra which all died out after the hail-storm in 1879; it was afterwards up-rooted and re-planted with Officinalis in 1880 which is doing well.

72. *No. VI Plot, 1867, D.*—16.07 acres, all grass land, about two-thirds, formerly very stunted Succirubra which died out after the hail-storm in 1879, was up-rooted and the plot re-planted with Officinalis in 1880 which is doing well; about one-third covered with very good Officinalis which has been barked four times.

73. *No. IX Plot, 1868, C.*—16.04 acres, all grass land, about two-thirds covered with fine Officinalis; all barked four times; about one-third, originally covered with stunted Succirubra which mostly died out after the hail-storm in 1879, re-planted in 1880 with Officinalis, doing well; 1,020 old Succirubra still survive, and there are 1,100 old Officinalis.

74. *No. IV Plot, 1867, B.*—7.02 acres, about three-fourths grass land, planted with Officinalis, fair growth (12 feet high), but very patchy from ~~with~~ planting, has been pitted for supplies which are to be put down this year; all barked four times.

one
About quarter shola land planted with Succirubra and Officinalis, growth good but patchy, the plot being much wind blown, pitted for supplies to be put down this year. All barked four times.

75. *State of the Hooker Plantation.*—The growth here is far inferior to that at Neddivattam, considerable tracts of grass land being planted originally with "Succirubra," which was a perfect failure, only attaining a stunted growth of a few feet; this has lately been nearly all up-rooted, and has been, or is being, replaced with "Officinalis" which grows very fairly on the grass land soil; there are still some tracts where the Succirubra must give place to Officinalis or to Pubescens.

76. *Fencing.*—Plot No. XIII, 1873, must be fenced, and a portion of the shola, which has been abandoned and allowed to revert to rank coarse growth, should be recleared and planted. Fencing is also required in Plot VII, 1868, A.

77. *Coppicing.*—2,226 Succirubra trees in No. XI Plot of 1869, four times previously barked and of good growth, were coppiced in June 1879; 1,379 stools have died, 847 are growing fairly, height three to six feet.

78. *Number of Trees in Hooker Plantation.*—Appendix B is a statement of the number of casualties amongst the trees in the Hooker Plantation during the last three years, and the number of trees now existing based on Major Walker's enumeration.

wide

PYKARA.

The Wood Chinchona Plantation, 72.18 acres.

79. *No. V Plot, 1865, C.*—8.80 acres, all shola land, planted with "Succirubra" and a very few "Officinalis;" trees a good height, often over 20 feet, but not healthy in appearance, and numbers of failures; sub-soil very inferior; sized trees barked six times.

80. *No. II Plot, 1864.*—10.87 acres, all shola land. "Succirubra" and "Officinalis;" growth all poor and spindly; many failures and many blank spaces, and trees still dying out; suffers much from the north-east wind; and the sub-soil bad. All barked five times.

81. *No. VIII Plot, 1867, C.*—10.87 acres, all shola land, all "Succirubra;" growth good, over 20 feet high. All barked five times. Five acres 2,500 trees coppiced in June 1879; 885 stools failed to grow, 1,655 have succeeded; growth good, height 4 to 7 feet and very healthy.

82. *No. IX Plot, 1868.*—6.12 acres, all shola land, all planted with "Succirubra," nearly all gone out, except about 100 trees; re-planting has been attempted more than once without success. Soil rocky and bad.

83. *No. VII Plot, 1867, B.*—9.62 acres all "Succirubra," except a few "Officinalis," shola land, chiefly a flat; drainage insufficient and sub-soil sour; nearly all the trees gone out. All barked five times.

84. *No. VI Plot, 1867, A.*—8.39 acres, all shola land, nearly all "Succirubra;" a portion sheltered on a slope, good; the greater portion very poor growth and thin from many failures, and the remaining trees apparently dying out. Sized trees barked five times.

85. *No. I Plot, 1863.*—2.55 acres, all shola land, "Succirubra" and "Officinalis," mixed in equal proportions; very poor growth and thin, more than half died out, and many still dying; soil rocky and poor. Sized trees barked six times.

86. *No. IV Plot, 1865, B.*—4.88 acres, lower avenue, all shola land, chiefly "Succirubra" with a few "Officinalis;" growth good in some places but patchy, as there are many blanks; casualties chiefly caused by insufficient drainage on flat portions. ~~Where~~ ^{There} there is percolation from the channel, sized trees barked six times.

87. *No. III Plot, 1865, A.*—10.08 acres, upper avenue, "Succirubra" and "Officinalis;" about half and half, growth in some places fair, but not always healthy; in other parts very poor, and has been much injured by hail; many trees died and many showing signs of dying out; upper portions very much exposed to the south-west monsoon. Sized trees barked six times.

88. *State of the Wood Plantation.*—The lower portion of this plantation exhibits very poor growth (all except Plot No. VIII, 1867, C, about 10 acres, may be pronounced a failure); it should, I think, be up-rooted and abandoned as the money required for its up-keep might be far better spent in keeping up the other plantations.

I would keep up Plots Nos. III and IV, or the avenue down the ravine in which the Pykara falls are situated; and if Government should decide to sell the remainder, I do not think these two plots or any of the land in this ravine should be alienated, as it is much resorted to by the public on account of its beautiful scenery and for its water-falls; the other portion of the Wood Estate is over a saddle and in another ravine.

89. *Coppicing.*—2,500 Succirubra trees, previously four times barked in Plot No. VIII, 1867, C (the only good growth in this lower portion of the Wood Estate) were coppiced in June 1879; 885 stools have died; 1,655 are growing and very healthy; height 4 to 7 feet.

90. *Number of Trees in the Wood Plantation.*—Appendix C is a statement of the casualties amongst the trees in the Wood Plantation during the last three years; and the number of trees now existing based on Major Walker's enumeration.

common
before grass
died in
after the
work.

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V.

DODABETTA PLANTATION.

Acres 320.47, elevation over 7,000 feet.

91. Ascending to the plantations from the Government Gardens the first thirteen plots, as follows, are on the slope looking down on to Ootacamund or with a south-west exposure.

92. No. XXI, 1868, A.—1.61 acres, chiefly grass land with a little shola at the bottom of ravine, all planted with *Officinalis* 7' x 7'; ground very steep and soil being gradually washed away; growth in fair condition and not many failures since the renewals were put down four years ago which are doing well; no late renewals, too steep for terracing, average height of the trees 15 feet; 714 trees barked once, 11 trees barked twice.

93. No. XXVI, 1869, B.—3.22 acres, nearly all grass land, very steep, soil gravelly, and being rapidly washed away, but too steep for terracing; all planted with *Officinalis*; trees healthy, but very far apart owing to the original wide planting, and many failures; many renewals were put down three years ago, which are doing well, but none since; average height 15 feet; 1,138 trees once barked, remaining trees small.

94. No. XXV, 1869, A.—4.68 acres, grass land, very steep; remarks the same as for No. XXVI. A portion was terraced in 1880; remainder too steep for terracing; 2,295 trees barked once, 70 trees barked twice.

95. No. I, 1863, A.—2.32 acres, all shola land, steep, and the soil has been subject to much wash, but the whole plot was terraced in 1880; all planted with *Officinalis* 8' x 8'; trees average height 20 feet, not in very good condition; trees very far apart owing to wide planting and subsequent failures; renewals about 10 per cent. put down three years ago, no later renewals; 967 trees barked four times, 161 trees barked once, remainder small and not barked.

96. No. II, 1863, B.—1.67 acres, all shola land, planted with *Officinalis* 7' x 7'; trees healthy; average height 22 feet, but there have been many failures; renewals one to four years of age; 1,221 trees barked five times, 47 trees once.

97. No. III, 1863, C.—3.57 acres, all shola land, planted with *Officinalis*; condition fair, but trees very far apart from very wide planting; average height of original trees 22 feet, many renewals one to four years of age; 1,959 trees barked five times, 65 trees once. There are a few "*Pahudiana*" not growing well; also one "*Angustifolia*" growing well.

98. No. VI, 1864, B.—7.28 acres, originally patches of shola dovetailing with grass land, very steep, and soil much washed away, but the whole was terraced in 1880, planted with "*Officinalis*," except some 50 *Succirubra* condition bad; 6,000 seedlings planted out in alternate lines in 1880; 4,969 trees barked four times, 2,146 barked twice, 311 once.

99. No. V, 1864, A.—4.06 acres, all shola land, steep, terraced in 1880, all planted with *Officinalis* 8' x 8' and 7' x 7', condition fair; lately thicker planting has been attempted, 2,500 seedlings being put out in alternate lines doing fairly well; pits have also been dug for further planting; 1,900 trees barked three times, 167 barked once; 400 trees have lately been scraped on the Java principle, some are mossed and some left bare, all are renewing their bark, but those mossed more rapidly.

100. No. IV, 1863, D.—0.98 acre, all shola land, planted with *Officinalis*; trees fair growth, but very far apart; 900 late renewals, and now pitted for further planting. 556 trees barked five times, 58 trees once.

101. No. XVII, 1867, A.—5.62 acres, grass land, planted with *Officinalis*; condition good, but trees much branched from wide planting, intermediate planting between the old trees last year to an extent of 1,800 seedlings doing well; a small area where the ground is level nearly all gone out from frost; 2,853 trees barked twice, 830 trees once.

102. No. XX, 1867, D.—4.92 acres, grass land, *Officinalis*; condition fair, average height 14 feet; very few failures; original planting 6' x 6'; 2,572 barked twice, 644 trees once; 5 trees coppiced in June 1880 as dying; no re-growth.

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103. No. XVIII, 1867, B.—6.24 acres, grass land; condition fair, but growth rather stunted; 8' to 10' in height only; originally planted 7' x 7'; no late renewals; 2,241 trees barked twice, 1,539 trees once.

104. No. XIX, 1867, C.—5.90 acres, grass land, growth stunted; 6' to 8' in height; trees gone out on a flat portion of about 1 acre said to be caused by frost; 1,692 trees barked twice, 1,314 trees once, 28 trees cut down dead from frost.

105. The next plot, No. X. is chiefly on the ridge or saddle; all the remainder, 25 in number, are over the saddle, and have a north-east exposure, except small portions of Nos. IX and XXVII which over-top a grass hill and face south-west.

106. No. X, 1866, A.—7.44 acres, grass land, but a little shola in hollows, chiefly hill-top, much blown; growth stunted and many failures; growth better in hollows; 1,007 trees barked twice, 351 trees once.

107. No. XI, 1866, B.—12.18 acres, about two-thirds shola, one-third grass land, *Officinalis*; growth good; 4,627 trees barked three times, 2,615 trees twice, 1,859 trees once. 5 acres, twice barked trees, upper portion (shola land) coppiced in 1879; 3,350 trees cut, 157 have failed to sprout; growth good of remainder.

108. No. XXVIII, 1869, D.—15.33 acres grass land, *Officinalis*, planted 7' x 7'; condition fair but growth stunted; height 8 to 10 feet, not barked; no late renewals but now pitted for intermediate planting to an extent of about 35 per cent.; 5 acres coppiced in 1879; 2,493 unbarked trees cut, failures 400; coppice growth of the rest good; 400 seedlings planted to re-place the casualties, 100 unbarked trees scraped in October 1880, some mossed and some left bare, all are renewing their bark, but those mossed renew more rapidly.

109. No. XXIX, 1869, E.—8.05 acres, grass land, *Officinalis*; growth good in the lower portion only a small area, rest very patchy from many failures; trees healthy but stunted; no renewals the last three years; 2,467 trees barked once, eight large dead trees felled.

110. No. XXIV, 1868, D.—13.37 acres, grass land and fern land, *Officinalis*; a rather flat portion of about 3 acres suffers from frost, and has gone out almost entirely; in the remainder growth stunted, but fairly healthy; many failures; no late renewals; 3,579 trees barked once. Five old dead trees cut down. Twenty-one *Angustifolia* trees not growing very well.

111. No. XIV, 1866, E.—4.33 acres, shola land, *Officinalis*; growth average, but a good many failures from frost; several spots quite bare; no renewals since four years; 715 trees barked three times, 672 trees barked once.

112. No. XXII, 1868, B.—6.04 acres, grass land, *Officinalis*, originally planted 7' x 7'; many failures, and trees far apart; growth generally stunted, but fairly healthy; no renewals since four years; 706 trees barked twice, 1,709 trees once.

113. No. XXIII, 1868, C.—11.76 acres, fern land, *Officinalis*; very poor growth with numerous gaps, the rank growth of the common Bracken (*Pteris aquilina*) is robbing the soil of much of its virtue; it should be thoroughly eradicated as far as possible, and this plot should be pitted and planted up; 1,895 trees barked twice, and 1,302 once, two old dead trees cut down.

114. No. XV, 1866, F.—3.24 acres, about 1 acre shola, the rest grass land, *Officinalis*; growth poor and stunted, and many failures; 1,412 trees barked three times, and 697 trees once.

115. No. XII, 1866, C.—11.16 acres, shola land, *Officinalis*; growth good but patchy in places from many failures; 3,573 trees barked three times, 1,771 trees once; no renewals since four years.

116. No. XXXIX, 1873, —1.81 acres, shola land, 44 large *Pitayensis* trees; growth good, 15 feet high, not barked, except four for analysis; 557 large *Officinalis* doing very well, not barked; 1,000 *Officinalis* put down in 1880.

117. No. XIII, 1868, D.—12.68 acres, shola land, and good soil, very steep in parts, and subject to much wash, but was terraced in 1880; trees have been pruned.

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and the growth is good and promising, but does not cover the ground which is steep and rocky in places, originally planted 8' x 8' which has prevented straight growth of boll; height of trees 8 to 15 feet; there was a good deal of intermediate planting four years ago; 2,971 trees barked four times, 1,524 trees once.

118. No. VII, 1865, A.—10.20 acres, shola land, soil very good, ground terraced in 1880, chiefly *Officinalis*; growth very good, originally planted 7' x 7', but not very regularly, fairly covers the ground, trees 16 to 18 feet high; 6,601 trees barked four times, 816 trees once; there is a gap in one portion of about half an acre which has been re-planted twice, but has failed owing to frost.

About 100 *Calisaya* trees, growth thin and lanky.

A few *Pubescens* trees growing very luxuriantly; 26 *Micrantha* and *Succirubra*; growth very poor.

One of the best plots on the north-east side of the hill.

119. No. XVI, 1866, G.—9.57 acres, shola land, *Officinalis*, planted 7' x 7'; growth good, but suffers somewhat from frost, does not cover the ground and requires intermediate planting; renewals 15 per cent. four years ago, of which many have failed; 1,000 seedlings put out in 1880; 3,622 trees barked three times, 1,484 trees once.

120. No. XXXV, 1869, K.—6.40 acres, shola soil, a very steep ravine and very irregularly planted with *Officinalis*, all lately terraced; growth good on slopes, but trees generally very far apart; about lower portions of the ravines large gaps owing to failures from frost; 531 trees barked twice, 1,663 trees once; there is one *Micrantha* tree not showing good growth, and a few *Pubescens* with very fine growth.

121. No. XXXVIII, 1872.—8.36 acres, chiefly grass land, steep hill side, soil poor and gravelly, *Officinalis*; growth poor and many failures, suffers from frost and much blown; many renewals, amongst which there are failures, re-pitted in portions for intermediate planting; the extreme upper portion suffers much from frost and wind, and has almost entirely gone out; and it would be useless to re-plant this; the upper portion of the slope has been lately terraced, and should be planted up; the Bracken should be eradicated as it is robbing the soil; about one acre shola land in the lower portion of the plot exhibits good growth; trees not barked.

122. No. XXXIV, 1869, J.—7.28 acres, grass land, planted with *Officinalis*, steep, rocky, and gravelly, very poor growth, many failures; 567 trees barked twice, 1,746 trees once; six old trees cut down.

123. No. XXXIII, 1869, I.—12.33 acres, grass and fern land, *Officinalis*, except a few *Pubescens*; very steep, several small land-slips; trees far apart and very irregular, at least 25 per cent. failures; a very poor plot; 271 trees barked twice, 3,487 trees once.

124. No. XXXII, 1869, H.—12.82 acres, grass and fern land, steep with rocky, gravelly, poor soil, planted with *Officinalis*; growth very poor and numerous failures; 627 trees barked twice, 2,150 trees once; 300 seedlings planted out in 1880.

125. No. XXXI, 1869, G.—14.08 acres, grass and fern land, steep and gravelly, *Officinalis*; growth very poor and numerous failures; 707 trees barked twice, 2,242 trees once; four old dead trees cut down.

126. No. XXX, 1869, F.—17.62 acres, grass land and fern, steep and gravelly, *Officinalis*; very poor growth and thin from many failures; 2,643 trees barked twice, 2,113 trees once; 11 old dead trees cut down.

127. These last five plots of 1869 planting, viz., F, G, H, I, and J form the lower portion of the north-east side of the Dodabetta Plantation, and are by far the least successful, and the trees will never cover the ground, as there are considerable portions on which growth will always fail; there is, however, here and there much fern land, on which there is now a rank growth of Bracken robbing the soil, and if money was expended in up-rooting this, the growth of the *Chinchona* might be much improved in these portions.

128. No. XXXVII, 1870.—8.92 acres, grass land, planted with *Officinalis*; much of the plot is hill top with poor rocky soil; the trees were originally put down at 7' x 7', but they are now very far apart from many failures, and the growth is poor and stunted, generally from 5' to 10' in height; intermediate planting up should be undertaken, but there are several perfectly bare spots on which perhaps planting would not succeed; 168 trees barked twice, 1,295 trees once.

129. No. XXXVI, 1869, L.—2.19 acres, grass land, planted with *Officinalis*; poor rocky soil; trees far apart and of stunted growth; height 5 to 10 feet; 176 trees barked twice, 100 trees once.

130. No. VIII, 1865, B.—17.54 acres, grass land, good loam, planted with *Officinalis* 7' x 7'; growth good; trees average 15 feet high; not many failures; renewals 10 per cent. some four years ago, none since; 7,567 trees barked four times, 2,347 trees once.

131. No. IX, 1865, C.—13.65 acres, grass land, good sub-soil, planted with *Officinalis*; growth good, but somewhat stunted; trees 10 to 13 feet high; rather too much exposed to the north-east monsoon; renewals 15 per cent. some four years ago, none since; not many failures; the trees covering the ground well; 7,602 trees barked four times, 3,605 trees once.

132. No. XXVII, 1869, C.—14.50 acres, grass land; little shola land in ravine; soil generally good, but situation high and exposed; planted with *Officinalis*; growth fair but stunted; some of the highest part gone out; growth good towards bottom of plot; 207 trees barked twice, 1,618 trees once.

133. Nurseries.—The nurseries are in good order; in the Dodabetta nursery there are 2 lakhs of *Officinalis* seedlings.

In the nursery near the jail about 10,000 *Officinalis* seedlings; also 10,000 rooted cuttings of *Angustifolia* transferred from the propagating houses.

In the lower nursery (near the tea) there are 20,000 *Officinalis* seedlings.

134. Glass Houses.—In the glass propagating houses 12,000 *Calisaya Ledgeriana* seedlings (from Java), 100 *Pitayensis* seedlings from plantation trees, 400 *Pubescens* seedlings from plantation trees, 40 *Calisaya* seedlings from plantation trees, 100 stock plants of *Angustifolia*; also the "Santa Fe" and "Carthagena" plants brought lately by Mr. Cross.

135. State of Dodabetta Plantation.—This I consider on the whole promising, and there can be no doubt as to their paying well; the great mistake has been wide planting at the commencement, and every endeavour must now be made to plant up closer, but this is receiving every attention; the plantations have been much improved of late in places by terracing, but in some parts the land is too steep for this, and should never have been opened; there are besides large blocks where the soil is very poor, and where planting must be always more or less a failure, though it will pay at the present high prices of bark; the effects of frost and wind are also very evident in many places. The eradication of the bracken fern in some of the plots requires immediate attention, and would greatly improve the growth of the *Chinchona*.

136. Coppicing.—In Plot No. XI, 1866, 3,350 "*Officinalis*" trees (5 acres) which had been twice barked previously were coppiced during the first ten days in June 1879; the stools bled very much and 157 died; the coppice growth of the rest is good—

Yield in green bark = 13,762 lb.

Yield in dry bark = 5,400 lb.

In Plot XXVIII, 1869, 2,493 unbarked *Officinalis* trees (5 acres) were coppiced from 13th to 19th June 1879; they bled very much and 400 stools died; the coppice growth of the rest being good—

Yield in green bark = 4,853 lb.

Yield in dry bark = 1,700 lb.

I attribute the failures to the coppice having been carried out too late in the season; it is noteworthy that here, as at Naduvatam, there are many more deaths amongst the stools of the unbarked trees than from those which had been barked, which is proof that the root system of the tree does not suffer in any way from the barking process.

137. *Scraping*.—In Plot XXVIII, 1869, 100 *Officinalis* trees were scraped on the new Java method on 3rd October 1880, yield of bark 246 lb. green and 100 lb. dry; and in Plot V, 1864, 400 trees were scraped during October 1880, yield of bark 856 lb. green and 400 lb. dry. Some of the trees have been mossed over and others left unprotected, but all are renewing their bark satisfactorily, though more rapidly where mossed; and there are no failures whatever as far as I can see.

138. *Number of Trees in Dodabetta Plantation*.—Appendix D is a statement of the number of casualties amongst the trees in the Dodabetta plantation during the last three years and the number of trees now existing based on Major Walker's enumeration.

139. *Receipts and Expenditure*.—I will not add to the bulk of this report by any statements of receipts and expenditure, as these have been given in full in the last annual report just reviewed by Government.

140. *Dried Specimens*.—The following dried and mounted specimens accompany this report:—

Red Barks	Chinchona Succirubra (red bark) ...	From Naduvatam.
	Chinchona sp. Called Magnifolia at Naduvatam and Pata de Galluazo by Mr. Cross; supposed to be a new species; was collected by Mr. Cross at high altitudes in the red bark region; called also Mr. McIvor's hybrid ...	Several specimens from Naduvatam and Dodabetta from forest soil and from grass land.
	Chinchona. Called Pubescens at Naduvatam and also on Dodabetta, where it is not distinguished from the last, of which it is supposed to be only a slight variety ...	Do.
	Chinchona Officinalis, typical (crown bark) ...	Specimens from Naduvatam and Dodabetta.
Crown Barks	Chinchona Officinalis, var: Uritusinga (called broad-leaved or strong-growing Condaminea) ...	Specimens from Dodabetta.
	Chinchona Officinalis, var: Angustifolia ...	Do.
	Chinchona Officinalis, var: Crispa of Ceylon ...	Do.
	Chinchona Officinalis, var: with very narrow leaf, probably Crispa of Mr. McIvor ...	Do.
	Chinchona Pitayensis ...	Do.
Yellow Barks	Chinchona Calisaya ...	Specimens from Dodabetta and from Naduvatam.
	Chinchona Calisaya, var: Anglica ...	Specimens from Naduvatam.
	Chinchona Calisaya, var: Javanica; so called at Naduvatam, probably "Josephiana," only a bushy shrub ...	Do.
	Chinchona Calisaya Ledgeriana ...	Do.
Grey Barks	Chinchona Micrantha ...	Specimens from Naduvatam and Dodabetta.
	Chinchona Nitida ...	Specimens from Naduvatam.
	Chinchona Peruviana ...	Specimens from Dodabetta.
	Chinchona Pahudiana ...	Specimens from Dodabetta.
	Chinchona. Unknown species with cork like bark; leaves hairy on both surfaces and hairy capsules; supposed by Mr. Cross to be the genuine "Crispa" of Loxa ...	Do.

141. It appears to me important that I should proceed to Darjeeling to see the large Chinchona plantations there, and the different species in cultivation, and take notes on the system of cultivation pursued and other matters which might be of use to the officers in charge of these plantations; so if Government wish it, I shall be prepared to proceed there shortly.

APPENDIX A.

NADUVATAM.

STATEMENT showing the Number of Chinchona Trees enumerated in 1878, and those that were cut since being dead, and the Balance existing on the Government Plantations, Neddivattam.

Plot.	NUMBER AS PER MAJOR WALKER'S REPORT.			CASUALTIES IN 1878-79.			CASUALTIES IN 1879-80.			CASUALTIES IN 1880-81.			TOTAL NUMBER OF DEAD TREES CUT.			BALANCE.			NUMBER OF PLANTS PLANTED IN 1880-81.			TOTAL NUMBER OF TREES EXISTING.		
	Red.	Crown.	Others.	Red.	Crown.	Others.	Red.	Crown.	Others.	Red.	Crown.	Others.	Red.	Crown.	Others.	Red.	Crown.	Others.	Red.	Crown.	Others.	Red.	Crown.	Others.
1	3,197	2,325	..	113	84	..	..	..	..	199	58	..	312	142	..	2,885	2,183	..	..	..	..	2,885	2,183	..
2	6,272	1,984	4	186	35	2	132	..	..	53	21	6	239	56	8	6,033	1,928	8	..	..	..	6,033	1,928	8
3	3,469	2,24	16	..	..	..	43	..	..	34	6	..	77	2	..	3,219	924	..	..	..	..	3,219	924	..
4	3,484	1,300	..	..	..	..	181	..	..	..	2	..	187	51	..	3,407	1,295	..	..	..	..	3,407	1,295	..
5	1,418	640	..	..	..	..	64	..	..	32	20	..	125	2	..	1,231	638	..	..	..	..	1,231	638	..
6	2,849	3,202	..	28	31	..	197	..	..	29	58	..	294	110	..	2,724	3,151	..	..	..	..	2,724	3,151	..
7	7,719	7,400	..	68	62	..	42	..	..	28	23	..	113	50	..	7,425	7,290	..	..	..	..	7,425	7,290	..
8	4,707	3,693	..	43	27	..	27	..	..	37	60	12	64	85	25	4,594	3,643	..	..	..	..	4,594	3,643	..
9	3,625	3,305	164	..	25	13	196	..	..	223	21	..	419	21	..	3,561	3,220	139	..	..	..	3,561	3,220	139
10	11,201	1,201	..	..	..	..	..	..	..	..	..	..	55	29	..	10,782	1,180	..	..	..	..	10,782	1,180	..
11	9,161	795	..	102	..	..	..	..	..	48	17	..	150	46	..	9,106	766	..	..	..	..	9,106	766	..
12	8,802	2,687	..	..	21	..	..	..	..	3	67	..	185	88	..	8,652	2,641	..	..	..	..	8,652	2,641	..
13	209	50	5	..	..	..	85	..	..	100	..	2	249	11	4	206	2,676	1	..	..	..	206	2,676	1
14	9,563	211	..	..	..	..	92	..	..	157	..	..	18	2	..	9,378	50	..	..	..	..	9,378	50	..
15	9,347	211	..	..	..	..	..	..	..	18	2	..	53	9	..	9,098	200	..	..	..	..	9,098	200	..
16	1,208	386	..	..	..	..	..	..	..	9	..	..	..	..	..	1,190	884	..	..	..	..	1,190	884	..
17	4,461	1,179	..	..	9	..	..	..	..	..	..	..	..	..	..	4,408	1,170	..	..	..	..	4,408	1,170	..
18	6,298	772	..	..	6	..	..	..	..	..	..	..	..	..	..	6,298	767	..	..	..	..	6,298	767	..
19	7,924	350	..	..	..	..	44	..	..	..	..	..	..	..	..	7,924	350	..	..	..	..	7,924	350	..
20	10,186	854	..	..	10	..	..	..	..	..	..	..	..	30	..	10,186	824	..	..	..	..	10,186	824	..
21	6,300	62	..	..	..	..	..	..	..	..	..	..	..	..	..	6,300	52	..	..	..	..	6,300	52	..
22	5,904	1,894	..	..	..	..	1,279	..	..	..	..	..	..	..	..	5,904	1,894	..	..	..	..	5,904	1,894	..
23	8,719	374	..	..	..	..	..	..	..	..	..	..	..	..	..	8,719	374	..	..	..	..	8,719	374	..
24	13,805	915	..	..	..	..	..	..	..	..	..	..	..	..	..	13,805	915	..	..	..	..	13,805	915	..
25	7,559	823	..	..	8	..	..	..	..	..	..	..	..	..	..	7,559	815	..	..	..	..	7,559	815	..
26	1,099	..	25	..	..	..	22	..	..	10	..	..	..	..	..	1,067	3,000	..	..	..	..	1,067	3,000	..
27	3,190	3,600	..	..	..	..	..	..	..	..	..	..	..	..	..	3,190	3,000	..	..	..	..	3,190	3,000	..
28	2,780	1,814	387	..	48	..	..	..	..	..	..	..	..	..	..	2,780	1,266	..	..	..	..	2,780	1,266	..
29	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Total	161,456	43,694	601	541	395	15	2,404	..	4	1,159	403	22	4,104	798	41	160,352	42,896	560	200	..	2,905	160,352	42,896	3,465

(Signed) W. ROWSON,
Assistant Superintendent.

NADUVATAM,
20th May 1881.

APPENDIX B.

HOOKER ESTATE.

STATEMENT showing the Number of Clinchona Trees enumerated in 1878, and those that were cut since being dead, and the Balance existing on the Government Plantations, Hooker Estate.

Plot.	NUMBER OF TREES AS PER MAJOR WALKER'S REPORT.			CASUALTIES IN 1878-79.			CASUALTIES IN 1879-80.			CASUALTIES IN 1880-81.			TOTAL NUMBER OF DEAD TREES CUT.			BALANCE.			NUMBER OF PLANTS PLANTED IN 1880-81.			TOTAL NUMBER OF TREES EXISTING.		
	Red.	Crown.	Others.	Red.	Crown.	Others.	Red.	Crown.	Others.	Red.	Crown.	Others.	Red.	Crown.	Others.	Red.	Crown.	Others.	Red.	Crown.	Others.	Red.	Crown.	Others.
1 ..	4,789	2,876	..	..	42	..	87	..	..	130	36	..	217	78	..	4,572	2,798	..	..	..	..	4,572	2,798	..
2 ..	6,735	2,036	..	198	36	..	289	..	..	416	81	..	903	117	..	5,832	1,919	..	..	..	..	5,832	1,919	..
3 ..	7,539	196	..	..	..	..	..	..	..	6,114	..	..	6,114	..	..	1,425	196	..	..	..	..	1,425	196	..
4 ..	390	3,357	..	..	121	..	84	..	..	..	172	..	84	293	..	306	3,064	..	..	..	..	306	3,064	..
5 ..	1,542	207	..	..	9	..	1,784	..	..	..	11	..	*1,784	20	..	..	187	..	..	..	..	..	5,187	..
6 ..	5,271	5,520	..	..	247	..	5,636	..	..	..	284	..	*5,636	531	..	..	4,989	..	..	..	..	..	38,389	2,000
7 ..	4,951	3,910	1	64	89	..	..	..	..	83	179	..	147	268	..	4,814	3,642	1	..	..	..	4,814	3,642	1
8 ..	10,569	2,223	72	..	43	..	6,453	..	..	144	84	..	6,597	127	..	3,972	2,996	72	..	..	..	3,972	24,096	3,432
9 ..	7,448	1,152	..	..	24	..	6,320	..	..	108	28	..	6,428	52	..	1,020	1,100	..	..	..	..	1,020	29,050	..
10 ..	1,320	1,096	..	17	13	..	..	..	..	23	43	..	40	56	..	1,280	1,040	..	..	..	..	1,280	1,040	..
11 ..	4,225	390	777	..	10	..	1,399	..	..	152	11	..	1,551	21	..	2,674	369	777	150	..	..	2,824	369	777
12 ..	3,429	416	..	..	14	..	3,906	..	..	..	15	..	*3,906	29	..	..	417	..	..	..	..	..	16,467	2,000
13 ..	319	4,500	..	..	..	..	..	..	..	..	..	..	..	..	..	319	4,500	..	..	..	..	319	4,500	..
Total ..	58,537	27,909	850	279	648	..	25,958	..	..	7,170	944	..	33,407	1,592	..	26,214	26,317	850	150	105,000	7,410	26,364	131,317	8,260

* Excess 1,084 trees.

NADUVATAM,
20th May 1881.

(Signed) W. ROWSON,
Assistant Superintendent.

APPENDIX C.

WOOD ESTATE.

STATEMENT showing the Number of Chinchona Trees enumerated in 1878, and those that were cut since being dead, and the Balance existing on the Government Plantations, Wood Estate.

Plot.	NUMBER AS PER MAJOR WALKER'S REPORT.			CASUALTIES IN 1878-79.			CASUALTIES IN 1879-80.			CASUALTIES IN 1880-81.			TOTAL NUMBER OF DEAD TREES CUT.			BALANCE.			NUMBER OF PLANTS PLANTED IN 1880-81.			TOTAL NUMBER OF TREES EXISTING.		
	Red.	Crown.	Others.	Red.	Crown.	Others.	Red.	Crown.	Others.	Red.	Crown.	Others.	Red.	Crown.	Others.	Red.	Crown.	Others.	Red.	Crown.	Others.	Red.	Crown.	Others.
1	612	607	..	..	..	..	37	..	..	..	..	..	37	44	..	575	563	..	..	..	..	575	563	..
2	6,972	1,682	64	..	..	..	234	..	42	219	228	11	453	228	53	6,519	1,454	11	..	..	..	6,519	1,454	11
3	4,571	4,094	65	184	195	..	176	..	38	210	421	18	570	616	56	4,001	3,478	9	8,430	..	..	12,431	3,478	9
4	2,430	509	657	102	24	83	89	..	115	125	20	347	316	44	545	2,114	465	112	3,210	..	..	5,824	465	112
5	4,888	112	..	..	..	..	143	..	..	225	..	..	368	..	..	4,620	112	..	..	..	..	4,620	112	..
6	5,687	41	..	78	..	..	..	..	..	..	..	..	78	..	..	5,009	41	..	..	..	..	5,009	41	..
7	4,744	117	..	..	..	..	298	..	..	443	..	..	741	..	..	4,003	117	..	..	..	..	4,003	117	..
8	7,208	20	..	..	..	..	1,017	..	..	154	..	..	1,171	..	..	6,037	20	..	160	..	..	6,197	20	..
9	667	..	..	..	..	..	35	..	..	..	..	..	35	..	..	632	..	..	..	..	..	632	..	..
Total	37,779	7,182	786	364	219	83	2,029	..	195	1,376	713	376	3,769	932	654	34,010	6,250	132	11,800	..	..	45,810	6,250	132

NADUVATAM,
20th May 1881.

(Signed) W. ROWSON,
Assistant Superintendent.

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APPENDIX D.

STATEMENT showing the Number of Chinchona Trees on Dodabetta Government Chinchona Plantations, Number of Failures in the coppiced or uprooted, and Number of Plants planted.

Number of Plot.	Date of Planting.	NUMBER OF TREES AS IN MAJOR WALKER'S REPORT.		Number of Failures in the coppiced or uprooted since.	Remain- ing.	Planted since.	Now Existing.	Remarks.
		Crown Bark.	Other Species.					
I ..	1863 A.	1,478	3	..	1,481	..	1,481	
II ..	1863 B.	1,032	..	..	..	1,032	1,032	
III ..	1863 C.	1,930	17	..	1,947	1,700	3,647	
IV ..	1863 D.	662	2	..	664	900	1,564	
V ..	1864 A.	2,835	..	..	2,835	2,500	5,335	
VI ..	1864 B.	5,060	46	..	5,106	6,000	11,106	
VII ..	1865 A.	9,112	117	..	9,289	..	9,289	
VIII ..	1865 B.	11,282	..	..	11,282	..	11,282	
IX ..	1865 C.	12,423	..	..	12,423	..	12,423	
X ..	1866 A.	5,176	..	..	5,176	..	5,176	
XI ..	1866 B.	11,063	..	170	10,893	500	11,393	Coppiced and failed to grow.
XII ..	1866 C.	11,722	..	..	11,722	..	11,722	
XIII ..	1866 D.	10,523	..	..	10,523	..	10,523	
XIV ..	1866 E.	3,583	..	..	3,583	..	3,583	
XV ..	1866 F.	2,922	..	..	2,922	..	2,922	
XVI ..	1866 G.	8,072	..	..	8,072	1,000	9,072	
XVII ..	1867 A.	4,038	..	..	4,038	1,800	5,838	
XVIII ..	1867 B.	5,199	..	37	5,162	..	5,162	Dead trees cut down.
XIX ..	1867 C.	4,333	..	28	4,305	..	4,305	
XX ..	1867 D.	4,258	..	5	4,253	..	4,253	
XXI ..	1868 A.	1,193	..	..	1,193	..	1,193	
XXII ..	1868 B.	4,739	..	..	4,739	..	4,739	
XXIII ..	1868 C.	8,595	..	2	8,593	..	8,593	Do.
XXIV ..	1868 D.	8,755	..	5	8,750	..	8,750	
XXV ..	1869 A.	3,880	..	..	3,880	..	3,880	Do.
XXVI ..	1869 B.	2,633	..	..	2,633	..	2,633	
XXVII ..	1869 C.	10,467	..	..	10,467	..	10,467	Coppiced and failed to grow.
XXVIII ..	1869 D.	11,532	..	400	11,132	400	11,532	
XXIX ..	1869 E.	6,309	..	8	6,301	..	6,301	Dead trees cut down.
XXX ..	1869 F.	10,184	..	11	10,173	..	10,173	
XXXI ..	1869 G.	8,485	..	4	8,481	..	8,481	Do.
XXXII ..	1869 H.	6,446	..	..	6,446	300	6,746	
XXXIII ..	1869 I.	6,754	..	4	6,750	..	6,750	Do.
XXXIV ..	1869 J.	4,019	..	6	4,013	800	4,813	
XXXV ..	1869 K.	5,102	..	..	5,102	..	5,102	Do.
XXXVI ..	1869 L.	1,481	..	4	1,477	..	1,477	
XXXVII ..	1870	4,864	..	..	4,864	..	4,864	Do.
XXXVIII ..	1872	3,949	..	..	3,949	..	3,949	
XXXIX ..	1873	557	44	..	601	400	1,001	
Total ..	..	226,647	289	684	226,252	16,300	242,552	

DODABETTA, .
23rd May 1881.

(Signed) T. NARRAINSAWMY NAIDU,
Head Overseer in charge.

c. 1890.

Copy corrected by
C. F. Beddome,
vide letter to H.
15 August 81

These corrections
to be attended to
when the paper
is finally printed
with the C.F.

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Office of Conservator of Forests
No. 207. Ootacamund, 6th June 1881.

To, From,

Colonel R. F. Beddome,
Conservator of Forests

To, The Secretary to Government,
Revenue Department,
Ootacamund.

Sir,
Referring to G.O. No. 781 of the
17th ultimo I have the honor to inform
you that I have just sent in a very
long Report on the Cinchona plantations
after a careful inspection and study
of them for about 2 months, - I did
not receive this Government Order until
after my report had been despatched,
nor had I seen Mr. Croft's report before,
but it will be seen that I had arrived
at much the same conclusions as he
had on the question of hybrids, and
various other matters.

I have treated in my report
fully on the subjects of the cultivation
of Pitayo, Calisaya, and other Spe-
cies; necessity of coppicing or uproot-
ing (as the case may be) trees the
decay of which is evident; the ill
effects

effects of the original wide planting,
and the advisability now of immediate
planting as far as possible;
and hybrids, so I need not add
more here.

2. Coppicing. I have objected
to such a large area being given
Coppiced, and it has been said that some
have been Coppiced, to some extent,
and that 12 to 15 inches of the trunk
or collar should have been left.

There has always been a difference
in opinion as to the height the
collar should be, and I find in

my letters to Mr. Rogers, the
Commissioner at the time (also
also G. O. M. of 27th May, 71) that
I was anxious to restrict the area
to about 5 acres, and that I wanted
that system tried as an experiment
for data; 1st to edge the collar flush
with the ground, 2nd to leave about
6 inches of collar, 3rd not to coppice
without first establishing a shoot.

The Commissioner was in charge of
the plantations at the time, and that
only

only been ordered to select the area
to be Coppiced, and these suggestions
of mine do not seem to have carried
weight, as they were not acted up to,
and all the stools were edged nearly
flush to the ground. I have no reason
to find fault with the result as will be
seen from my report, and I think
if Coppicing were again ordered and
in the absence of actual data, which
I was anxious to obtain I would rather
give ^{the} preference to the flush collar
than to a collar several inches high.

I do not think we shall have
more Coppicing as a system over
given areas, I am much opposed to
it for many reasons, and I think
my report will go to prove that it is
not desirable, but if we did again Cop-
pice I should prefer the plan of first
establishing a shoot; it will be seen
by my report, that when this plan
is followed there is not a single
failure, and that this is fully proved
from several blocks of older experi-
ments, which I was quite ignorant
of at the time that I made the pro-
position. Mr. Croft appears to
think that the young Coppice growth

was

was thinned out, & removed, but
I do not understand how it could
give an opinion at this point without
having seen the tree at the time
it was thinned - it is very easy to
tell the proportion, as in specimens
allowed to grow up till time and
several prominent leaders, the growth
of these would then be obvious & be-
-tasted, and in the growth with which
the first were cut away, and it is
then apparent whether it is advisa-
-ble to leave 2, 3 or 4 others, & being
off with a rounded top, in my
opinion preferable to a sloping
cut or wedge form of top.

3. I do not agree with Mr.
Cross's remarks as to the climate
of the Nilgiris being unsuited to
the "Pubescens" form of Red Bark,
and I think that he was not well
informed, to make these statements
from his independent observation,
as many of his letters to me quite
contradict them. Mr. Cross is
this time "Pala de Gullinaga" and
he informs me that he found it
at a much higher elevation than

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"tile" or red bark, - he now considers
it a new and undescribed species,
and I agree with him, but whether
a new species or only a variety of
the "Succirubra" it has evidently
found its home on the plateau
of the Nilgiris, and would proba-
-bly not grow so well at lower ele-
-vations; it succeeds admirably
on Doddabetta, over 7,000 feet, where
"Succirubra" will make no growth,
and on the higher exposed situa-
-tions at Keddawattam and Pykara
where "Succirubra" never grew more
than 3 or 4 feet high, and is now
being uprooted, and Mr. Cross has
himself lately written to me on
the subject of its hardy character
and robust and splendid growth.
I agree with Mr. Cross that the
Nilgiri is too high and cold for
"Succirubra" but still it is grown to
a good profit in the forest soil of
Keddawattam, and exhibits exceedingly
healthy growth.

4. Mr. Cross is inclined to taboo
"Succirubra", altogether on account
of its inferior yield of quinine; its
growth is so rapid compared to
Crown Bark, and its yield in bark

is far greater than that of the
general of the finer kinds, and
its cultivation is recommended,
that I expect it will soon be
own; its yield exceeds in other
alkaloids many others; it may
have to be put in place of its
Congener "Purpurea" or the "Indu-
-linga" var. of "Officinaria"; but
this is a question for the sci-
entific, and practical.

5. I cannot agree with Mr.
Hoffman's suggestion about
forming a dense sort of underwood
of *Cinchona* in the plantations; it
would be opposed to every system
of arboriculture and would be im-
-ly ruin to the plantations; the
trees that did not get their heads
to the light would come to nothing
and interfere with the root room
of others, and the result would
be little or no bark of any value;
we are not growing *Osiris* or *Serai-
-fir* wood.

6. Regarding the remarks on
"Collection of seed" by Mr. H. H. H.
the Collector I cannot believe that

this

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this has not received attention;
this selection of the fittest is the
first aim of all florists, and ar-
-boricultural artists, as well as breeders
of animals, and was so, long before
Mr. Darwin's voluminous writings
on the subject; a practical man,
with the training Mr. Mac Ivor
had before he came to this Country,
must have been fully alive to the
importance of this. During my
inspection I observed much, bags
tied round the panicles of seed on
some of the finest trees, which is
proof that attention is paid to the
subject. Regarding the cutting off of
the panicles of flowers, which the
young trees produce so profusely
-ly, I would observe that I long
-ly recommended, many years ago,
when the trees first commenced to
flower so profusely that this
should be done as an experiment
over about an acre, as I thought
it would favor the growth of the
trees and perhaps the virtue of the
bark, and at any rate be a very
interesting experiment, but I was
met by the statements that it

would

would be too expensive to attempt
it in large plantations; and that
expensive work would be necessary,
otherwise the branches would be
much broken and injured.

7. The *Calisaya* is a very
anxious addition, but I
have written fully on this question
in my paper, & there are your ex-
ceptions only, "the ordinary *Calisaya*,"
the *Ledger*, the *Anglica*, and the
Javanica, the 2 former are known
to be most superior, they are
scarcely distinguishable, and
I shall be surprised if further
research proves the *Ledger* to be
very superior, the very favorable
reports on this variety are pro-
bably due to the high cultivation
of a few individuals, however I
may be wrong. Mr. Koster told
me, that *Anglica* and *Javanica*
had been analyzed, and gave a
very poor yield, and this has
been found the case in Java, where
their cultivation is given up, the
last named is only a bushy shrub.

8. I quite agree with Mr. Croft
that grafting could be of no value,
when the object is "bark"; and
Mr. Croft agrees with me that the
art of hybridizing would not be
at all likely to increase the value
of the bark.

9. Mr. Croft appears to be of
opinion that the natural bark
may be picked in a *Raloid*, than
renewed bark, this is opposed to
all the experience hitherto gained;
I believe I am right in saying,
that every analysis has hitherto
proved the great superiority of
the latter, and that it always
fetches a much higher price.

Mr. Croft is also wrong in say-
ing that a tree once barked, will
always require to be wrought after
the same manner, as long as it
lives, as it is a fact that trees
which have been many times barked
are now growing splendidly from
Coppice.

10. We must be careful not to
be guided too much by any re-
port on the analysis of Mr. Croft's

30 small selected specimens. I
much fear more harm than good
has been done by the analysis
of only a few individuals, and
that it is likely to be the result
of much annoyance, & do not
myself believe in the general
superiority of such varieties
as "Angustifolia" or "Eriophora"
over ordinary "Effusata", nor
of "Ledgeriana" over ordinary
"Calycina", it is, in fact, due
only to high cultivation or to the
favorable conditions appertaining
to the selected individual; this
only however can fully prove this.

11. The Plantation have
only lately been handed over to
this Department, and it is my
intention to draw up a full memo-
randa of instructions for the Officers
in Charge, but this would be pre-
mature till Government have
reviewed my report and ex-
pressed their wishes, as to

Various

Various points.

I have the honor to be
Sir,
Your most Obedt. Servt.
J. B. Sand. Colonel
Comdr. of Forests

1881-82
Revenue Department
From No. 3005
The Conservator of
Forests

To
The Secretary to
Government

Dated 6th June 1881
Recd. 8th
Received of

By

Conservator of
Forests

Handwritten

Government. (Mentioned)
Plantations. (Mentioned)

Referring to G.O. No.
10 of 17th Dec 1880
in connection with
regarding

8.17-8-81.
8.17-8-81.

25
Office of Conservator of Forests
Cotacamund, 6th June 1881
No. 208.
To 420 From,

Colonel R. H. Beddome
Conservator of Forests
To, The Secretary to Government
Revenue Department,
Cotacamund.

Sir,
Referring to para 2 of
the G.O. No. 398 dated 1st March
last, I have the honor to forward
* dated 23rd May '81 a letter from Mr. Cross.
2. I quite agree with Mr. Cross
as to the elevation required for
"Calisaya" or its variety "Ledgeria-
nia", and that there is no place on
the plateau of the Nilgiris adapted
for it. I have fully treated
on this question in my report
on the plantations just submit-
ted to Government, and I have
recommended that ground should
be taken up on the slopes below
Beddivattam or in the Silent
Valley.

* Sent to Mr. Cross to be
forwarded.

Handwritten note at bottom right

Valley

I have the honor to be
Sir
Your most Obedt. Servt.
Johnstone Colonel
Comdr. of the 1st Regt.

1881-82.
Forest Department
Form No. 3000
The Conservator of
Forests

The Secretary to Govt

Rev. Secy

Dated 6th June 1881

Ref. 8th June 1881
Received of

247-108

Enclosure 6

Subject

Cinchona ledgeriana

Submitted with
Remarks a letter
from Mr. Cross on
the cultivation of
with an add

Melbourne Govt Secy
23 May 1881.

Recd
To - Colonel Reddome
Conservator of Forests

Sir. I beg to acknowledge receipt
of communication of 21st of this month
respecting the *Cinchona ledgeriana*.
I have not the slightest doubt that
both Veddavattam and Do 'abettu
are unsuited for this sort the
elevation of both places being
far too high.

If the Forest Department
possessed conveniently any
good moist wooded ravine
somewhere along the course of the
Western Ghats with an elevation
of from 3,000 to 4,000 feet
the tree might be expected to
thrive well in such a site.
Planting in the ordinary manner
4 ft. apart each way would
suffice.

With a proper elevation

No Merit with reference

8 June 1881 No 398

4 March 1881 No 398

MS

C23-6-81
B27-6-81
C19-8-81
A29-8-81

and the 26th. similar conditions
success of the experiment is
rather insured, if the plants are
strong and healthy when put out
and fairly cared for afterwards.

The Sedgiana is manifestly
a rank free strong growing
species of much the same character
as the Succinibractea Red Bank.

I am Sir,
Your most Obedient Servant,
Robert Cross.

C23-6-87
A27-6-87
C16-8-87
A27-8-87

realized by "Succumbra" in this and other lists there is not a doubt about the fact that we are enormous losers by propagating "Succumbra" so largely at Neddiat-tam to the exclusion of "pubescens", and that "Succumbra" must in the future, be relegated to the Wynad, and similar elevations where probably "pubescens" will not succeed so well, and that the sooner this is done the better.

3. The 35 bales of renewed "Officinalis" sold for $7^{\text{sh.}}$ to $9^{\text{sh. 8}}$ per ton; we have yet to learn what renewed "pubescens" will realize, but judging by the analysis from a small quantity, as given in G.O. 1236 of the 23^d of June 1879, it will probably fetch a very high price.

4. These sale lists give us data of bark in the bulk, which is, I think, far more valuable than the analysis of picked specimens from one or two favoured trees; in "pubescens" and "magnifolia" we evidently have most valuable trees,

Rec'd 3006/4

trees, and it is most important
to learn all we can about them,
and I trust that the copious ex-
-cimens in flower and fruit, which
I have forwarded, may lead to
their identification at Kew; Mr.
Cross assures me that he found
"Magnifolia" on the Chimborazo
at high elevations under the name
of "paka de gallinazo", and that
he believes it to be an undescribed
species, but although "pubescens"
is to me only a slight variety
of it, Mr. Cross's opinions re-
-garding it, at different times,
have been most contradictory,
and I am very anxious to as-
-certain whether there is or is
not any difference in the quali-
-ty of the bark. It would also
be interesting to have experi-
-ments on the growth of these
two trees at lower elevations.

5. In all the Lists penaeo
bark fetches a much higher price
than

ral, but it

D.O. 309

24th June

283

My dear Webster.

My letter to you
no 293 of 22nd inst
sent back Sales.

Will you kindly alter
the fig^{ure} 557 x 115
in the margin of para
one (the number of
trees from which bark
was taken) into
236 + 33. The
mistake arose by
the verser giving
the total no. of trees

alter to 236 + 33

of Forests

of the 2 varieties
(magnifica & pubescens)
in the plots where
stripping had taken
place, instead of
the number of trees
which had been stripped

The 2 bales were
the product of

236 magnifica
33 pubescens

Yrs Sincerely
A. S. Holmes

than natural, but it is to be
noted, that mossed "pubescens"
sells at ² per ^{the} ^{than} less natural
"pubescens", whereas in the different
reports on itilgeri Pinchonas, moss-
ed "Crown" (Officinalis) and moss-
ed "Red bark" (Euccirubra), al-
ways fetch more than natural,
though much less than renewed, this
may be a coincidence of no value,
and likely to be upset at other
sales, but I should be glad
of an explanation, should it
be available.

b. The prices realized in these
lists under notice, and the lists
for March and April ^{by} the South
American "Soft Columbian" and
"Carthagena", the species we are
growing to so much expense in
introducing, are not very en-
couraging.

I have the honor to be
Sir
Your most obedt. servt.
A. S. Holmes Colonel,
Conservator of Forests

28
Office of Commr. of Forests.
No: 293. Ootacamund, 22nd June '81

1431 From,

Colonel R. H. Beddome,
Conservator of Forests.
To, J. Webster Esquire,
Ag: Secretary to Government,
Revenue Department,
Ootacamund.

Sir,
I have the honor to inform
you, that I am this day in receipt
of "Particulars of Bark sales" 5th and
10th May 1881. This document is of
great interest as containing the
prices realized by the 2 bales of
"Pubescens" bark sent to England
from Dodabetta, as noticed in
para 44 of my Report on the Cin-
-chona; the bale of natural "pu-
-bescens" (138 lbs) sold for $\text{Rs. } 7 \frac{1}{2}$ per
lb; and the bale of mossed pubes-

* There are 1042 "Magnifolia" - cons (111 lbs) and 170 "pubescens" in the Doda- For $\text{Rs. } 5$ per lb. In betta plantations, and I carry these 2 bales for this consignment 57 trees of the former and 45 trees of the latter were barked, all from the the trees we call different plots of 1869, most of "pubescens" and which (vide my report), are the "magnifolia" worst soil and exhibit the poorest were mixed growth of all the Dodabetta plantations. in-

136
33
500

indiscriminately, and I think it
very important that Government
should ask for more information
regarding them if forthcoming,
viz:- What was the analysis?
did the quality justify the high
price given? was all the bark in
each bale fairly equal in quality,
or was any great difference de-
tected?

2. In the same sale list it
will be seen that the 128 bales
of Natural "Officinalis" (Erown
bark) only realized ^{sh. 8} 4. 6. to ^{sh. 8} 5. 7.
per lb. or very considerably less
than "pubescens"; if "pubescens"
is to keep up this high price, and
if the purchasers of these two
bales can report that it has
answered their expectations, we
are losing much by propaga-
ting "Officinalis", a spindly
weak growing tree, so largely, to
the exclusion of "pubescens", a
tree of strong and vigorous growth.
Looking also at the ^{small} very prices
realized

Revenue 1881 Dept.

N. 3250.

Rev.

1881-82.

Revenue Forests

From

The Conservator of Forests

To The Secretary
to Government
Rev. Dept.

Dated 22nd June '81
Received 23rd June '81

N. 293

Enclosures Nil

Subject

Particulars of Cinchona

Bark Sales

Submitting certain
remarks on the

C 19-8-81.
A 29-8-81.

No. 498A

From

Colonel R. F. Reddome,
Conservator of Forests

To, C. G. Master Esquire,
Secretary to Government,
Revenue Department,
Ootacamund.

Sir,

In accordance with G.O.
No. 1105 of the 25th July last, I
have the honor to forward Mr.
Cross's remarks on the analysis
of Bark submitted by Mr. J. C.
Howard, and recorded in the same
G.O.

2. I must myself observe
that Mr. Cross's samples go a
very short way towards testing
the relative excellence of all our
different species, 22 out of his
30 specimens (i.e. 1 to 14, 16 & 17, 21,
and 26 to 30) being all from or-
dinary "Officinalis" or "Crown Bark"
of

Of the other 8 samples No. 15 is the Pitayo, No. 18 the so called 'magnifolia', Nos. 19, 20, 22, 23 & 24 'Succirubra' (or red bark), and No. 25 'Calisaya'. So that only 5 out of our 18 species or varieties were sent, and these were I regret not accompanied by botanical specimens.

3. Mr. Cross informs me that he could not now identify all the trees from which the different samples of crown bark were sent, he identified No. 1, which gave the highest yield of Natural bark (6.52 per cent) and this is quite the ordinary 'Officinalis', he could not however identify No. 11, which gave the highest yield in renewed bark (7.69 per cent).

4. From what Mr. Cross tells me the whole of these 22 specimens were from the ordinary 'Officinalis', which forms the bulk of our Dodabatta plantation, it

it will be seen from the analysis how the yield in quinine differs in some of the individuals, the smallest yield of natural bark being 2.01 per cent in quinine, and the highest 6.82 per cent, and the renewed bark (of which only a few samples were sent) varying from 4.01 per cent to 7.69 per cent, which however is easily accounted for by difference in soil, aspect, age &c. it goes however to prove what I have already said in my report on the plantations, that it is a great mistake to attach too much value to the analysis of single individuals, if however the average of the 22 samples were taken it would, I consider, give fair data as to the yield of this species in our plantation.

5. 'Cristusinga' was, as Mr. Cross states, not sent at all; I am not sure that what we know by this name is really this variety

variety; (it is called here "Strong
growing Condaminia", & "Broad
leaved Condaminia" as well as
"uritinga") the specimens
however that I have forwarded
with my report should settle
this question. It is very like
"Officinalis" only with much
larger leaves and of stronger
and quicker growth, promi-
sing to be a large tree; there
are only about 1000 of it
scattered in the Dodabetta
plantation, and about one
dozen only at Medinabatta,
so that there is some mis-
take in the supposition that
Mr. MacDermott planted yuccas
with it in 1875; there are many
applications for the seed
of this from various parts of
the world, probably owing to
reports of Mr. MacDermott.
Money; and considering its
healthy strong growth, and
close affinity with "Officinalis"
I should not be surprised if
it turns out our most valuable
species

39
species. I learn from Mr. Mac-
Dermott that small samples of the
bark were sent to England for
analysis, and that these are the
Nos 18, 19 and 20 under "Condaminia"
from Dodabetta given in the
table of analysis in G.O. 1336
dated 23rd June '79. It is a species
or variety however that we must
learn more about.

b. The analysis of No 15 Pitaya
is a valuable addition to the
Chemical knowledge of our species;
we have 14 good sized trees of
this species near the Dodabetta
Jail, but it has not been further
propagated, this analysis differs
considerably from that given in
G.O. 1336 of 23rd June '79, when it
was much younger, this giving
3.98 per cent of quinine, Mr. Paul's
specimen only 1.50. Mr. Howard
urges its propagation partly be-
cause of its yield in quinine
which in his specimen is 2.01
per cent (though in Mr. Paul's only
0.82). I observe the yield in
-quinidine

quinidine is as high as 2.20
in some of Mr. Cross's samples
of "Crown bark", now analysed
by Mr. Howard, and in part
bark of the same species it
is as high as 3.45. The ex-
tended propagation however of
"Pitayo" seems desirable if
only the yield of quinine is
considered...

7. No. 18 is one of the 2 species
or varieties confounded under
the name of "Macdonald hybrid"
or "pubescens", it is the so-called
"magnifolia" of my report (not
"pubescens"), and the "Pata de
Gallinayo" of Mr. Cross, & Mr.
Howard now says it is the "Cincho-
na coccinea" of Pavon, but he has
only saw bark, no specimens of
leaves or flowers having been
forwarded, - I regret such a
small sample only of this was
forwarded, as it is not a fair
criterion; it is very similar, as
far as the natural bark and
the yield in quinine, to the
analysis

analysis given by Mr. Paul in
G.O. No. 1336 of 23 June '79 under the
head "hybrid pubescens". Heddi-
-vatham and Dodabetta,
which samples were
from the same variety
(the glabrous "magnifolia") not
from "pubescens", as Mr. Cross ex-
-amined the trees from which Mr.
Rowson stripped it at Heddi-
-vatham and I examined them on
Dodabetta, the yield in cincho-
-nine however in the specimens
analysed by Mr. Paul differs
enormously from the specimens
sent by Mr. Cross, but a simi-
-lar difference is observable
between many of the crown bark
samples now analysed by
Mr. Howard. As already reported
2 Bales of the natural bark of
this species went to England from
Dodabetta last December, and
sold at 7.1 per lb under the
name of "Hybrid pubescens".
Mr. Howard and Mr. Cross both
advocate the propagation of
"Eccirubra" being given up in favor
of

of this species, I quite agree with this, considering the healthy and splendid growth of this species, which I have written about very fully in my last report.

8. I much regret that samples of the "pubescens" bark were not forwarded. +

9. Mr. Cross states that in the samples forwarded to Mr. Howard, Nos 21 and 24, have evidently been changed.

10. Of the samples 19 and 20 he compared with 22 and 23 it will be seen what a very poor yield in quinine the original bark of "Succirubra" gives compared with the renewed bark, this alone quite rebuts the coppicing system of harvesting for this species at least; nearly all the red bark pieces at Meddivattam are now yielding renewed bark, and the yield of these samples (viz 3.08 and 2.04 per cent of quinine)

is very high for red bark, but here again we have to be cautious as they are only small samples taken perhaps from exceptionally fine trees grown under favorable conditions; in any case the yield is inferior to that of the "magnifolia".

11. Of the "Crown barks" only 5 samples of renewed bark were sent, against 16 of original bark, but the result is sufficient I think to show the great superiority of the former, and that coppicing is a mistake to be avoided, when I have shown in my report that, after most careful inspection the pieces have not as yet suffered in the slightest degree from ^{the} shipping process.

12. Of No 25 "Calisaya" I must write further later on; we have at Meddivattam of yellow barks "Calisaya", "Calisaya Ledgeriana", "Calisaya var. Anglica" and "Calisaya var. Javanica". Mr. Cross informs me

me that he looked upon all
as the same, and that we does
not know which. No. 25 is a
taken from, but he thinks Mr.
Rowdon knows the exact tree,
so I may be able to identify
it, if from one of the few trees
now alive of "Lageriana." I
have no remarks to make, but
the only shrubby variety at
Keddiattam is the "Javanica".

13. At the present stage of
our Plantations, when most of
the species and varieties are of
a good age, and well developed
and easily recognized, I consider
that the employment of a com-
petent Chemical analyzer, up
at Cotacamund, if only for a
few months, would result in
the greatest possible benefits
in the future both as regards
the Government plantations
and the wide field of private
planting. In Mr. Broughton's
days many of the species were
young

303 42
Young, and not developed suf-
ficiently in their characteristics,
and there is most evident proof,
that the question of species and
varieties was in a great jumble.

14. I attach the greatest
importance to the careful col-
lection of seeds from the heal-
thiest and largest trees of "Offici-
nalis", as well as from our other
finer species or varieties, and
I have already given very full
directions on this point to the
Officers in charge.

15. I do not understand Mr.
Howard's remark that the quanti-
ty of Bark sent to England
from Doddabatta seems dispropor-
tionate, and exhaustive, or on
what data he surmises this to be
the case; we are not uprooting
or even coppicing; the superior
quality of this crown bark, which
he alludes to himself is proof I
think, that it is not harvested
prematurely, and as long as this
is

is guarded against the sooner
the 1st stripping of the natural
bark takes place the better, as
the renewed bark is far more
valuable in the market; the
subsequent stripings can al-
ways be taken off every two

years, and to delay removing it
after maturity is of course a
dead loss; On account of in-
sufficient room for drying and
storing, our estimates this year
at Meddivattam have calculated

for a shorter crop than we ought
to gather. I have however quite
lately received Mr. Morris's
interesting report, for last year,
on the Jamaica Gardens and
plantations, which contains
much valuable information
on Cinchona, and he has proved
that sun-dried Cinchona
bark is more valuable than
that dried by artificial heat.
I hope therefore if we have any

Continuation

Continuation of sunny weather,
this September or October, to try this
system of drying, although it
has hitherto been supposed here
(I do not know from what experi-
-ence), that bark dried in the sun
loses in virtue.

I have the honor to be
Sir,
Your most obed^t. serv^t.
R. W. D. Colver
Conservator of Forests.

Revenue 1881 Depart.

11/14

Print

1881-82

Revenue Stamps

From

The Secretary of Forests
To, The Secretary to Govt.
Revenue Department
Calcutta

Dated 10th }
Sept: 12th } August '81
Recd: 12th }

10/1/81A

(Enclosure - One)

Subject.

Analysis of the sam-
ples of Cinchona bark
submitted by Mr. Howard

Forwarding Mr. Prof's
remarks on the — with
the enclosed observations.

18-8-81
22-8-81

Enclosed

Small Print

309

Colonial Office, India
Circular (numbered 10000)
The following is a copy of the report from the Secretary of State for India on the analysis of 80 samples of bark from the Cinchona plantations collected by me at the Government Plantations of Patala and Veddi-ditham.

The results of the analysis of the samples of Cinchona bark are as follows:—
1. The samples of Cinchona bark are of the same quality as those which were submitted for analysis. The fact is that the bark of the Cinchona plantations is of a very good quality, such as Cinchona and Cinchona would be of sufficient value for medicinal purposes.

2. The samples of Cinchona bark are of the same quality as those which were submitted for analysis. The fact is that the bark of the Cinchona plantations is of a very good quality, such as Cinchona and Cinchona would be of sufficient value for medicinal purposes.

[Faint, mostly illegible handwriting in the top left corner of the left page.]

31st 15th August

My Dear Mother...
 I am much
 obliged to you for all
 this -
 I have gone thro
 it carefully twice, there
 were only a few
 mistakes

Y^r sincerely
 M. B. L.

[Faint, illegible handwriting at the bottom of the left page.]

120 313 45

Draft G.O. No 1280 of 29 August 1887

C. No 2940 { Letter from the Pres^t
 of Forests of 4th June/87
 - Do - do - of 6th
 C. No 3085 { June/87 No 207
 - Do - do - of 6th
 C. No 3086 { June/87 No 208
 - Do - do - of 22nd
 C. No 3250 { June/87 - No 293
 - Do - do - of 10th
 C. No 4164 { Aug/87. C. No 498 & 9.

The papers recor-
 ded above contain va-
 luable information on
 the several points dis-
 cussed relative to Chi-
 cuna cultivation. The
 series commences with
 the inspection report on
 the Govt. Plantations
 which Col. Reddome
 was

was directed to prepare
on assuming charge of
the Plantations - Next in
order, come the Com^{rs}
remarks upon Mr. Cross's
recent, interesting account
of his impressions on
visiting the different
locations on the Hills
where Chinichona is grown
under Governmental Su-
perintendence - This is
followed by Mr. Cross's
remarks on the most
appropriate elevation
for the cultivation of
the Chinichona, Cali-
Saya Var Andegiriana
and his observations
upon Mr. Howard's ana-
lysis of samples of
bark selected and
sent home by him
during the Spring.
Finally

L.O. 8th Dec/80
L. 1670 R.D.

* L.O. 17th May 1881
L. 781 R.D.

* L.O. 25th July 1881
L. 1105 R.D.

315 46
Finally, though not
latest in point of date,
come Col. Beddome's
remarks upon the results
of recent Chinichona sales.
2. The Lpt^{rs} in Council
proceeds to ^{remark} briefly
on some of the more
salient points brought
to notice. He observes
that on the whole the
Conservator's report is
favorable as regards
the progress made
since, Capt. Campbell
Walker's detailed exa-
mination in 1878. The
appendices to Colonel
Beddome's report fur-
nish particulars
of the number and
variety of trees existing
in 1878 and at the
present date.
3. Turning the planter-
ies in the order in
which they are dealt
with

with, it is observed, that while the bulk of plants at Keddiwattam are of the succumbra variety, it is the Comd^{rs} opinion that all of this kind which have been planted on grass land should be uprooted and replaced by affinealis or pubescens. He states that though the elevation of Keddiwattam is too high for succumbra still it grows well to grow it on chola soil there.

Mr. Cross, it is noted, bears testimony to the quality of the soil in the Keddiwattam ravine which appeared equal in fertility to "the lower slopes" of

* Appendix A

* Report printed with
G.O. 17th Nov 1881
a.d. 781 H.E.

he observed
native

para 4, letter off.
6th June 1881 No 207

217 47

"of Shimbarago the ^{we} native habitant of the Red bark," and he remarks upon the growth and development of the plants which excelled even those he had seen growing in South America. With reference however to the inferiority of the Red bark for the purposes of the guanine manufacturer he appears to deprecate any extension of its cultivation. Colonel Beddome points however to other reasons why this variety may be expected to hold its own. On the whole it seems to Govt that it is unnecessary to devote much further attention to

to this species and that the proposals advocated by the Comd. for replacing it in certain localities may be carried out.

4. The information furnished as to the mistake made in attempting to propagate the Calisaya varieties anywhere on the Mt. Gilgiri plateau leads the Govt. to consider favorably the recommendation in which Col. Beddome and Mr. Cross concur, as to the opening up at an elevation of from 3000 to 4000 feet of a small plantation where these

Col. Beddome's report
para 48 No. 207
Mr. Cross's report in reply
Col. Beddome's letter to Govt.
181-19207, para 7.

Col. Beddome's letter
of 5th June 1878 No. 208

para 49 Col. Beddome's report.

319 48

these 'yellow barks' as well as 'grey barks' may be tried with fair prospect of success. The proposal is (para 55 of Col. Beddome's report) that the Forest Dept. at St. Paul's should clear part of a shola in the 'Silent valley' for this purpose, and for experiments with rubber trees and the 'Specuambha'. The Comd. will prepare an estimate of probable cost and will take the necessary preliminary steps to carry out his suggestions. 5. Adverting to the great number of casualties in the Hooker Estate, and the suggestion to

to abandon the lower portion of the Wood plantation, the Com^d will report separately and in detail on the question of retaining these estates after consulting the correspondence which has already taken place on the subject.

b. The state of the Dodabetta plantation is pronounced promising by the Com^d and Mr. Cross, though they do not agree on the question of terracing which Mr. Cross thinks unnecessary.

The eradication of the bracken fern

para 88 of Col. Beddome's report.

Report in G.O. No 787.

+ para 34

para 11 letter of 6th June 81 No 207

321 119
fern which is stated to be robbing the soil of its goodness will doubtless be taken in hand without delay.

7. Mr. Cross noticed the fact that in this locality especially the plants at the beginning were placed far too wide apart. From Col. Beddome's report it appears that the same mistake has been made elsewhere. The subject will doubtless receive attention in the full Memo: of instructions which the Com^d intends to prepare for the use of the officers in charge of the Plantations; a copy of

of this should be
furnished for the
information of Govt.

8. The Govt. are not
prepared at present
to express any decided
opinion on the merits
of barbing as com-
pared with the cop-
ping system. The
latter has had but
small trial as yet,
and the present re-
port shows that the
coppicing carried out
in 1879 resulted in
failure to a large
extent in consequence
of the lateness of
the season. There
is no necessity
at

para 39.

para 2 letter
df. 6 June 81
No. 207

G.O. 27 May 1879
No. 1161 R.D.

323
at present to coppice
any more blocks, but
the Comd. will of course
take care to coppice
isolated trees which
may show signs of
decay. As to the matter
to be observed in cop-
ping it is observed -
that while Col. Bed-
dome does not agree
with Mr. Cross, he
alludes to suggestions
for trying three dif-
ferent systems of cop-
ping one of which ap-
pears identical with
that advocated
by Mr. Cross. How-
ever the plan finally
adopted under the
instructions of Govt.
is now stated to
be on the whole the
best. Some

9 Some information is given as to the results - so far as the trees are concerned - of the plan of harvesting the bark by scraping reported to have been carried out on a small scale in 1879-80. A large proportion of some 5000 *Succumbas* at Keldiwattum failed to renew, and Col. Beadome is inclined to think that the system is likely to be more trying to trees generally than partial barking in alternate strips. No losses occurred at Dodabet where a similar experiment was made. The question requires more study, and experiments.

Para 9 Administration
Report in G.O. 4th March
1881 & 1898 P.D.

Col. Beadome's Report
Para 24

Para 41

Para 157

Note. It is observed from the enclosure to the Secretary of State's Despatch of 16 June last No 18 (G.O. 21 July 1881 No 1102) that 5 bales of 'Scrappings' of Natural Gum Bark (Sale lots 81 & 82) were sold last year and realized 6/4 & 6/8 per lb.

(Report para 44)

3251

Experiments should be carefully prosecuted. The forest will report when the first consignment of scraped bark was despatched to England. The result of the sale should be noted, as already directed in G.O. 4th March 1881 & 1898 para 7.
10. The forest enters at considerable length into the history of the 'Pubescens' variety which has until lately been looked upon as a hybrid. It is clearly shown however to be a distinct plant known in South America as the 'Pata de Gallinazo' and is a narrow-leaved

leaved variety of
 the Red Bark. There
 appears every pro-
 bability of this
 species proving hardy
 and valuable. The
 first specimens sent
 home (in Dec last)
 have lately been
 sold, and the prices
 realized were 7-1
 per lb for natural
 Pubescens and 5-0
 for ^{removed} marked ditto. The
 Comd^r is anxious for
 more information as
 to these particular
 bales, but it seems
 hardly likely that
 they can be followed
 at this date, and
 the only way will
 be

McCrossin Report on
 G.O. 781 of 1881

Letter from Comd^r of
 27th June 81 No 293

3275th
 be to draw special
 attention to the next
 ensignment. The
 Comd^r will, in due
 course, specify the
 information which he
 requires to be ob-
 tained.
 11. In forwarding to
 the Secretary of State
 the dried specimens
 referred to in para-
 140 of the Comd^r's Re-
 port, for the purpose
 of comparison with
 the various species
 in the New Herba-
 rium, attention will
 be solicited to Genl
 Beddome's request
 that the 'Magnifolia'
 and 'Pubescens' may
 be specially exa-
 mined - The

12. The Govt. agree
with the Com^r that
it is unnecessary at
present to attempt
hybridization in the
plantations.

para 53 of Report.

* para 31 G.O. 24 Feb/79
No. 463

13. Colonel Bed-
dome's proposal to
proceed to Darjee-
ling to see the Chin-
chona Plant^{ns} there
commends itself to
the Govt. in Council.
The Govt. of Bengal
will be addressed
on the subject.

⊕ Report para 14.

14. The remarks which
Mr. Cross and the
Com^r of Forests have
recorded upon Mr.
Howard's recent
analysis of samples
of *Chinchona* Bark
Collected

⊕ Com^r G.O. 498 A.
dt. 10 Aug 1881.

* Received with Secy. of State
Despatch dt. 16 June 1881 No. 114
(Rev) communicated with G.O.
25 July 1881 No. 1105.

329 53
Collected by Mr. Cross
will be forwarded to
the ~~Post Office~~ the
Secretary of State with
reference to his recent
Despatch

15. The first point to
be noticed here is the
extraordinary difference
of opinion as to the
extent to which the
Writtingia species of
Chinchona *Condaminea*
has been propagated.
Colonel Beddome re-
iterates the statement
which will be found
at para 46 of his de-
tailed Report that
there are but a thou-
sand of this kind in
the Godabetta plan-
tation and a few only
at Medolivattum. Mr.
Howard must there-
fore have been mis-
informed, and as it is
clear

Clear that all the samples of Crown bark sent home by Mr. Cross were of the ordinary officinalis it is im-

portant that Mr. Howard should be made aware of this fact and that 'Witrusinga' was not sent at all.

Mr. Cross planted 70 acres of it prior to 1875 it could not have been in the Govt. Plantations. The analysis made by Paul of this species in 1879 shows the following results:-

See entries 18, 19 & 20 for labels to Log C. Cordaminea in S. Malacca to Log of Mr. Cross's plantation July 8th Aug 1879 & 13 (Rev.) L. C. O. 25th June 1879 No 1335

Samples	Percentage amount of					Crystallized Quinine Sulphate
	Quinine	Quinidine	Quinone	Chinoline	Amorphous Alkaloid	
Natural	1.20	"	1.50	0.18	0.10	1.62
Mashed	2.13	"	2.00	0.47	0.20	3.00
Renewed	3.40	"	1.48	0.14	0.20	4.58

It

It is desirable that further specimens of this species should be forwarded for analysis and the Conservator will issue the necessary instructions. The difference which he noticed in the analysis of the Pitaya bark in 1879 and 1881 renders it probable that the yield of alkaloid in the Witrusinga will also be greater now the trees are older.

Samples of the P. baccata or Magnolia (Mr. Cross's Pata de Gallinazo) should also be transmitted to England for analysis as well as specimens of bark of different

See entries 18, 19 & 20 for labels to Log C. Cordaminea in S. Malacca to Log of Mr. Cross's plantation July 8th Aug 1879 & 13 (Rev.) L. C. O. 25th June 1879 No 1335

different sorts have
vested by the scraping
process - as suggested
by Mr. Cross

16. The Govt. agree
with Col. Beadome
that the extended
propagation of Pitaya
is desirable. The ne-
cessary steps should
be taken to this end.

17. The Govt. will re-
port further on the
Calisaya specimens
transmitted by Mr.
Cross -

18. With reference to
his suggestion to em-
ploy a competent
Chemical Analyzer
at Cotacambul, the
Govt. will be referred
to para 27 of 24th
for decision - Feb

Trach when the attempt
was made in 1878 to dry
back
G.O. 18 January 1878 No 95
G.O. 9 May 1879 No 1022
G.O. 3 January 1880 No 1
J. C. who carried out
the trial at Cotacambul
suggested that a short
exposure daily to the
sun in the morning sun w^d pro-
bably ensure the per-
fect desiccation of the
bark.

13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25
333
Feb 1879 No 463, It
was then settled that
reference could be
made when neces-
sary to an European
Chemist of repute.
19. The proposal to
dry bark by the heat
of the sun as an ex-
periment is approved
and should be re-
ported upon in due
course - It is observed

20. The Govt. remarks
in paras 14 and 15 of
his letter No 498 it
will be brought to
the notice of the
M^{rs} of State and
the members of the
Govt. in Council
will at the same
time be tendered
to the M^{rs} of State

for their careful
analysis and inter-
esting report -

QML

- 3 To the Commission on Agriculture,
via 4 Key Chiefs, etc. ✓
- 2 The Commissioner of Indian Affairs ✓
- 13 Board of Revenue ✓
- 1 Surgeon General with
the Govt. of Honduras ✓
- 1 R. Cross Esq ✓
- 5 copies to the Dept. of Forests
in the Range ✓

Sept 14/9/81

E. H. H.

111
P. 111
C. 111
J. P. 111

P. 111

J. P. 111

C. 111

C19-8-81.
R29-8-81.

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