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No. 221. Read the following letter from J. R. COCKERELL, Esq., Commissioner of the Nilgiris, to the Hon. W. HUDLESTON, Chief Secretary to Government, Fort St. George, dated Ootacamund, 19th April 1873, No. 15 :—

I HAVE the honour to submit a report from Mr. Broughton on the comparative merits of the mossing-system, which Mr. Broughton has, in compliance with paragraph 7 of Proceedings of Government, Revenue Department, requiring the opinion of the Commissioner, forwarded through me.

2. Mr. Broughton pronounces an opinion adverse to the mossing-process in the red barks, but states that no final conclusion can be arrived at for the next three years. In the meanwhile, he complains that the coppicing-system has never had as yet a fair trial, notwithstanding experiments were ordered to be carried out.

3. With regard to Mr. Broughton's condemnation of mossing red barks, it is necessary that, in order to a complete consideration of Mr. Broughton's conclusions, I should indicate what his statements are. They are briefly these :—

1*st*,—That mossed bark on young Succirubra is enormously superior to natural bark in the proportion of contained alkaloids.

2*ndly*,—That the superiority diminishes with the age of the tree up to eight years, and at ten years (the oldest trees the Government possess) there is an equilibrium and no difference between the natural and renewed bark as respects alkaloids. Mr. Broughton concludes that the evidence available points to even a falling off of the qualities of the mossed as compared with the unmossed natural bark as a tree ages, and appears to imply that coppicing will be found the best mode in the long run of taking the bark from the *C. Succirubra*.

4. I was lately at Neddiwuttum with Mr. McIvor and Mr. Broughton, when an inspection of the Neddiwuttum plantation was made. Wounding a tree was thus expounded. It was said that any incision was a blow aimed at the life of a tree, which the tree took time to recover in proportion to the extent of the wound. Thus it was said peeling the bark was wounding a tree: but coppicing a tree was

inflicting a more radical wound; and the question arose whether minor wounds like peeling made at comparative frequent intervals would be most detrimental to the life of the tree, or performing radical operations at longer intervals; that is to say, coppicing a tree every seven or eight years. I understood from Mr. Broughton that his fear was that, if mossing was carried on, the mossed trees would, in course of years, die and require replanting. He inferred, on the other hand, that trees might be coppiced for hundreds of years like Oaks in England, and thus the plantations would never require replenishing.

5. In order that the Government may have all the evidence which is available to enable them to test these views, I make the following remarks:— Fairly coppicing, that is to say, taking off the head of a tree completely as corn would be cut, is never, I am led to believe, carried out in Oak coppices in England, except in the cases where there are no shoots near the bottom of the stem, and where, therefore, there is nothing to leave; and the reason is that depriving a stem of every shoot is so radical an operation that the life of the tree receives a shock from the operation very difficult for it to recover. Accordingly coppicing, as ordinarily carried out, is the felling of the tree, say, six inches from the ground, but leaving the shoots sprouting from the stool.

6. In my letter, in Government Order No. 126, dated 30th January 1873, I stated that 100 trees were thus fairly coppiced in 1866. I took note at Neddiwuttum of the largest of these coppiced trees. The shoots look weak and sickly. Their diameter is about an inch and-a-quarter at the bottom. I stripped a piece of bark from one of them, and found that when dried it presented a thickness no greater than blotting paper. Mr. Broughton saw this tree, and looked over the other *fairly coppiced trees.* He was of opinion they had not sprung up again well, and attributed their weakness to an insufficiency of light and air.

7. These coppiced trees are intermediate trees, each flanked by untouched trees at a distance of 12 feet from them. It was a matter admitting of various opinions, whether the surrounding trees kept light from the coppiced trees; but one thing was clear: shoots springing from untouched trees were numerous in the vicinity of the coppiced trees; they were obviously kept from light and air much more than the shoots on the latter, and yet their appearance indicated great succulence and vigour.

8. *The healthiness of the shoots on the uncoppiced trees gave rise further to a suggestion. It indicated that the mossing process could never destroy the trees on a plantation if a shoot was left on each tree. The main stems might be stripped of bark until they died, and a strong shoot be left all the time growing to take the* place of the stem on the extinction of the latter. In this manner, not a single tree on a plantation would be lost. The inference was there was no need to run the risk of coppicing; because it was apprehended removing the bark from time to time under the mossing-process might eventually destroy the trees.

9. The next point was the difference in the quantity of bark that would be afforded by mossing and that afforded by coppicing. At Neddiwuttum, I took from an untouched and unmossed *C. Succirubra,* six years old, 2 lbs. of wet bark;

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29th May 1873.

the tree was mossed on decortication. In six months the tree will have grown higher, and will then yield perhaps 3 lbs. of natural wet bark. I should observe the 2 lbs. I took was not all the tree could have afforded. The tree was nineteen feet high, and I stripped it to a height of five feet from the ground. Twenty months from my taking, the first renewed bark will be available, and six months after that the rest of the renewed bark. The renewed bark will aggregate two-thirds of the original bark; thus, in seven years and-a-half, the tree will have given about 8 lbs. of wet bark. In a further twenty-six months, another supply of renewed bark, equal in quantity to the first renewed bark, will be available, and the tree will then have given 10 lbs. of bark.

10. Now, if this tree had been felled, it would have given, at the date I stripped it, 4 lbs. of bark to $4\frac{1}{4}$ lbs., and in eight years, it would perhaps have regrown and have yielded about two thirds of its yield on being coppiced; thus, in fourteen years, the tree would afford only, say, 7 lbs. against, say, 10 lbs. of bark in less than nine years by the mossing-process.

11. Then, as to the commercial value of renewed mossed bark, I understand Mr. Broughton to say that on trees at all ages it is richer in quinine than natural bark, and this is a very important point. I should observe that a difference of one per cent. in quinine makes a difference in price of $1\frac{3}{4}$ pennies in the shilling; and if quinine is selling at 8*s.* an ounce: therefore of eight times $1\frac{3}{4}$ of a penny. Mr. Howard's analyses in all his six reports seem to corroborate the conclusion of the increased richness of renewed mossed bark in quinine.

12. These remarks apply entirely to the *C. Succirubra.* In his report, Mr. Broughton expressly states that in Condamineas mossing affords a fairer prospect, and his appended analyses confirm this view.

13. With regard to *C. Succirubra* the adverse evidence is not, I submit, sufficient as yet to over-balance the evidence favourable to mossing; and I would not, therefore, advocate coppicing experimentally on any large scale. Mr. Broughton, I believe, would not himself risk an extensive experiment. When we were at Neddiwuttum he pointed out four rows of *C. Succirubra* of ten years old and upwards, which he proposes to coppice in May, leaving the shoots on the stool, and to compare these trees with four adjoining rows of trees which are to be mossed. *He thinks this experiment will afford a fair test, and it will not, in any way, disfigure the plantation. I readily consented to this arrangement, subject to the approval of Government, which I now solicit.*

14. In conclusion, I venture to remark on the complaint of Mr. Broughton that the coppicing, sanctioned in Government Order No. 1,646, dated 6th December 1872, was not carried out, that Mr. Broughton was the proper person to call attention to the neglect of the orders.

15. Mr. Broughton requests that six printed copies of his report may be furnished to him, and that he may have the privilege of revising the printer's proof of the report.

16. The delay in forwarding the report has been owing to my wish to inspect the Neddiwuttum plantation before submitting a personal opinion.

From J. BROUGHTON, Esq., Govt. Quinologist, to J. R. COCKERELL, Esq., Commissioner of the Nilgiris, dated Ootacamund, 11th February 1873.

I HAVE the honour to report on the results obtained by the application of Mr. McIvor's plan of mossing to the Cinchona trees of the Government plantations. The report is addressed to you as Commissioner of the Nilgiris, in consequence of the order conveyed in G. O. No. 249 of 7th February 1871. Though the intention with which the proposition adverted to in the G. O. cannot now be entirely carried out in consequence of the death of the late Commissioner, I fulfil in this report the letter of the G. O.

Subject of Report.

2. The origin of the considerable experiments made in order to determine the practical value of the mossing-process arose from a suggestion made in a report of mine dated 17th August 1868, in which the physiological effect of mossing was discussed. In the G. O. on this report, No. 2,453 of 22nd September 1868, and in G. Os. Nos. 3,068 and 426 of 9th December 1868 and 19th February 1869, respectively, a certain number of trees, amounting in all to 7,000, were directed to be treated by the mossing-process, in order to experimentally determine its practical value.

Origin of the Experiments.

3. The first determinations of the value of the process had been made by Mr. J. E. Howard previous to, and shortly after, my arrival in this country. They were necessarily made on a very small scale and on very young trees, whose age in no case exceeded five years. The results were very successful, and were corroborated to a certain extent by my own more early analyses.

Mr. Howard's Analyses.

4. The reasons which induced me to suggest the further trial of the process after these reports are the following:—The experiments were made on but a few trees; an extended trial might possibly, in some respects, modify the results; that the trees of the experiments were so young that it would not be possible to deal with such small plants on a commercial scale, and plants of actual crop-bearing age might possibly give different results. When the average yield of the natural bark of *C. Succirubra* is 7·2 per cent., the yield of the bark renewed under moss may not be so great in comparison as when the yield is but 5 per cent.

Reasons for further Trials.

5. A further ground for my suggestion of an extended experiment arose from a careful trial of my own. Ten trees were barked on the 17th October 1867, being then five and-a-quarter years of age. The bark weighed 5,692 grammes, of which an analysis was made. On May 4, 1869, the renewed bark from

Experiment on 20 trees.

same trees was taken, which weighed 3,800 grammes, and an analysis was also made. I quote the results now for the first time:—

	Natural Bark, 5¼ years old.	Renewed Bark under Moss, 18 months old.
Total alkaloids	5·66	9·27
Quinine	2·15	3·43
Cinchonidine and Cinchonine	3 51	5·84
Sulphate quinine obtained crystallized	undetermined.	2·58
,, Cinchonidine obtained crystallized	,,	4·88

As the renewed bark contained almost exactly the same amount of moisture as the natural bark, the trees had renewed under moss not quite two-thirds of their original weight of bark that had been taken in rather more than eighteen months, though not then quite seven years old.

6. Though the foregoing is a successful result, the amount of quinine in the renewed bark appears less than that apparently ascribed by Mr. Howard in certain instances on younger trees.

Deficiency of Quinine in above result.

7. As many of my reports have shown, the bark of *C. Succirubra* has yielded yearly a larger amount of alkaloid, though the increment appears to be annually diminishing.

The amount of Alkaloid in red bark has hitherto increased.

8. The question naturally occurred whether on older trees than the experiments dealt with, when the percentage of alkaloids is either increasing at a small annual rate, is stationary, or possibly diminishing, the mossed or renewed bark will have the remarkable richness found by Mr. Howard on bark renewed under moss on younger trees. It thus appeared very desirable for several reasons to attempt a larger experiment with the mossing process.

Will cessation of above increase affect the results of mossing?

9. It is now nearly four years since these experiments were commenced. The programme of their fulfilment has been carried out with irregularity, nor is it now complete to the end. The condition of the trees, the difficulty of applying labour at certain times, the state of the weather, etc., etc., have been the main practical reasons of the lack of precision in the carrying out of the plan determined on at the beginning. But it appears to me desirable, now that the trials have so far advanced, to communicate the results obtained, though three years more must elapse before the logical conclusion of the experiments.

Experiments have been conducted with irregularity; reasons of this.

10. The original scheme was as follows:—Trees of two ages of both red and crown barks were to have their trunks covered with moss for eighteen months. A part of the original bark, assumed to be much improved by this treatment, was to be taken, analysed, and sent home for sale, and the trunks thus wounded

Originally proposed plan of procedure.

to be quickly recovered with moss, in order that the bark may renew in darkness. At the end of another eighteen months, the bark thus renewed, which would be of fine quality, was to be again taken, analysed, and sent home for sale, the trunk being again mossed. After successive 18-month renewals, the bark of the second and third renewals was to be treated similarly.

Departures from above plan.

11. In performance, however, the Superintendent of the Plantations has considerably varied from this scheme. After six months had elapsed from the first taking the mossed original bark, a further quantity was taken, and, in some instances, the moss was extended higher up the trunks than was the case at first. The renewed bark under this treatment of the trees at the end of eighteen months was too thin, or adhered too strongly to the cambium to allow of its removal; so that a longer time had to elapse before it could be taken. These changes exceedingly complicate the experiments and render the examination of the results by analysis a work of much labour. Furthermore, this treatment scarcely allows the cost to be strictly debited to the results, as would have been the case had the theoretical scheme been carried out. Unforeseen circumstances necessarily modify an experiment in India which has extended to so considerable a length of time.

Present state of the experiment.

12. At the present date the experiment has advanced so far that considerable amounts of mossed bark have been sent home for sale. At the time of present writing 600 or 700 lbs. of the renewed bark from the oldest trees is prepared for export. The renewed bark from the other trees cannot yet be removed from its slight thickness, though Mr. McIvor* and myself coincide in the opinion that its excellence is more marked at an age of eighteen months; hence, the results at that age have been ascertained by analysis, although the bark cannot yet be removed for export.

Time of the beginning of the Experiment.

13. The trees were first mossed between the months of May and August 1869. 1,000 trees of seven years of age, and 3,000 of 5½ years of *C. Succirubra* at Neddiwuttum, 1,000 trees of *C. officinalis* of 5 years, and 2,000 of four years of age, were thus treated, the age being at the time of mossing.

Mossed bark of eldest trees, results; 18 months under moss.

14. In order to secure a true estimate of the mean alteration in the quality of the bark, a sample of mossed bark was taken from several trees, and its analysis compared with a sample of the natural unmossed bark from several trees growing under similar circumstances; both being taken from same height of trunk. This was done in order to avoid the

* Mr. McIvor states (Return, East India Cinchona, 1870, page 50): "As abovementioned, by the application of moss to the exterior of the bark, the process of oxidation or waste is arrested and the alkaloids increased from 2½ per cent. to 15 or 20 per cent. Moreover, mossing more than doubles the bulk of the bark; thus making the direct yield of alkaloid per acre fully thirty times the quantity that can be procured under any other treatment. But this is a small advantage compared with the great one mossing affords, by enabling us to secure a yearly harvest of bark, without damage to the plants or arrest of the quinine-producing properties. By mossing every twelve or eighteen months, the entire cellular bark of the stem can be removed with facility and without injury."

error that might occur from employing the bark of single trees, which might possibly possess an exceptional yield. In many cases, the analyses were repeated, and samples were taken at different times. I quote the results obtained from trees of *C. Succirubra* of 8½ years of age at the time of analysis:—

	Oldest Trees of C. Succirubra.			
	Analysed, December 19, 1870.		Analysed, January 17, 1871.	
	Mossed Bark, 18 months under Moss.	Natural Bark.	Mossed Bark, 19 months under Moss.	Natural Bark.
Total alkaloids	6·92	7·61	7·22	7·61
Quinine	1·09	1·74	1.25	1·34
Cinchonidine and Cinchonine	5·83	5·87	5·97	6·27
Quinine obtained in crystals	0·70	0·91	0 71	0·99
Other sulphates excluding Cinchonine	4·56	3·18	4·76	3·29

These analyses show that in trees of this age the total yield of alkaloids is not increased by mossing their bark, nor is the yield of quinine augmented. In both analyses a slight decrease in the amount of alkaloid is apparent, but this is compensated for by an increase of Cinchonidine sulphate of more than one per cent. This increases the value of the bark for sale on the Continent of Europe, but scarcely for sale in England. Though the cost of the first mossing is, I believe, but 7½ Pies a-tree, I am quite of opinion that, for the improvement of the bark in trees of this age, the application of moss is unremunerative. Though I attach but small importance to the fact, I may mention that the mossed bark on sale in England fetched a lower price than the natural bark. The alteration in the appearance of the bark produced by mossing, the state of the market, and the fancies of the purchaser, are the reasons of the want of precision that a single sale affords of the real value of the bark.

Mossed bark of younger trees, results; 18 months under moss.

15. The 3,000 trees, aged 4½ years, were also mossed and the bark taken for analysis in a similar manner to the foregoing after being mossed about eighteen months. The analyses are as follow:—

	Bark of C. Succirubra, 6 years old.			
	May 4, 1871.		May 22, 1871.	
	Mossed.	Unmossed.	Mossed.	Unmossed.
Total alkaloids	6·82	6·05	6·31	5·85
Quinine	1·88	1·53	1·61	1·60
Cinchonidine and Cinchonine	4·94	4·52	4·70	4·25
Quinine sulphate obtained crystallized	1·32	1 23	1·19	1·15
Cinchonidine	3·11	2·16	2·15	2 05

16. Hence, in these younger trees an increase in total alkaloids is perceptible, and also the amount of crystalline sulphates obtainable is augmented. The gain is less than was expected, and in the second set of analyses is scarcely perceptible. As the number of trees mossed was large, the two analyses express the yield of trees growing under somewhat different circumstances. As the cost of mossing these trees is nearly the same as that of the older trees, and the trees at this age are too young for their bark to be commercially cropped, I am of opinion that mossing trees of *C. Succirubra* for the improvement of their bark is unremunerative. In a foot-note I quote analyses of Mr. Howard made with mossed bark supplied from younger trees.*

Conclusions.

17. On January 23, 1872, an analysis was made of a carefully selected mean specimen of the bark of the oldest mossed trees, which had been under moss about two years and six months. I compare it with a carefully obtained mean of two analyses of the natural bark, each derived from a specimen taken from several trees.

Mossed bark of oldest trees, results ; 30 months under moss.

	C. Succirubra, about 9½ years old.	
	Under Moss, 2½ Years.	Natural Bark.
Total alkaloids	7·80	7·67
Quinine	1·64	1·49
Cinchonidine and Cinchonine	6·16	6·18
Quinine sulphate obtained crystallized	0·92	1·01
Cinchonidine ,, ,,	3·65	3·50

* Return, East India Cinchona cultivation, 1866, page 134, Report dated 1st August 1865.

No. I.—Bark of three years and five months growth, thickened by the application of moss.

		6·00
Crystallized sulphates per 100 parts		0·94
Of alkaloid soluble in extra light ether		1 06
Of alkaloid insoluble in the above : therefore Cinchonine		

Memorandum.

The sulphate refined into white sulphate of quinine in appearance ; but this did not stand the test used for commercial sulphate of quinine.

Return, East India Cinchona cultivation, 1870, Report dated 4th February 1867.

No. II.—Original bark, six months under moss.

		4·57
Crystallized sulphates		3·78
Alkaloids soluble in ether (Cinchonidine and quinine)	0·80	
Insoluble in ether, Cinchonine	0·11	
Cinchonicine		0·91
		9·26

No. III.—*C. Succirubra*, original bark unmossed.

		4·50
Crystallized sulphates		1·71
Alkaloids soluble in ether	0·40	
Insoluble in ether, Cinchonine crest	0·34	
Cinchonicine		0·74
		6·95

Memorandum.

The sulphates as No. II.

18. On October 2, 1872, a similar analysis was made of bark from the younger trees, which had been three years under moss ; the trees being somewhat over eight years of age. I compare it with natural bark from trees growing under similar circumstances :—

Mossed bark of younger trees, results ; 36 months under moss.

Conclusions.

	C. Succirubra somewhat [illegible] years old.	
	Bark under Moss, 3 Years	Natural Bark.
Total alkaloids	7·72	6·36
Quinine	2·02	1·36
Cinchonidine	5·70	5·00
Quinine sulphate obtained crystallized	0·82	0·80
Cinchonidine ,, ,,	3·57	4·02

Here it is apparent that in the younger trees the amount of alkaloids is increased in the mossed bark that has been three years under moss. The increase exceeds that apparent in the mean of the analyses of the bark of trees of this age mossed for eighteen months, by 0·75 per cent. But this total gain of 1·36 per cent. by three years' mossing consists of Cinchonine and uncrystallizable quinine or quinicine, and does not add perceptibly to the market-value of the bark. I submit, therefore, that the two analyses last quoted corroborate the conclusion I arrived at in the early part of the experiment and stated in paragraphs 14 and 16. This conclusion is that the gain in quality produced by the application of moss to the bark of *C. Succirubra* does not compensate for the labour and expense of mossing the trees and keeping the bark under moss. To this it may be added that the conclusion is practically true, even if the bark be kept a considerable period under moss.

19. From the oldest trees that had been experimentally treated with moss as above, about 700 lbs. of renewed bark have been taken in December and January of 1872-73. The mean age of this bark is twenty months, and has been taken from trees whose age is a few months over ten years. The reason of this renewed bark not being cropped at the end of eighteen months is that at this time it could only be separated with difficulty from the cambium, and its cropping would be consequently attended with injury to the trees. I estimate its mean thickness at slightly less than half of the natural bark. As the thickness varies considerably, it is scarcely possible to obtain a completely accurate estimate. I should state that Mr. McIvor inclines to a somewhat larger estimate of its thickness than I do, but I give the above as more coincident with my own examinations. Of course, the most accurate method of comparing the yield would be to weigh the total products, but unfortunately the state of the trees will not permit of the whole of the renewed bark being taken ; a strip only being taken from the centre of the long patch of renewed bark. It is believed that in May next, when the renewed bark

Thickness of renewed bark.

will be two years old, the remaining portion can be taken and an accurate estimate of the respective yields will be then possible.

Renewed bark oldest trees, results.

20. Two careful analyses have been made of the renewed bark, and the bark of several unmossed trees growing close by and under similar circumstances was analysed for comparison :—

	C. Succirubra.			
	Renewed under Moss.	Natural Bark.	Renewed under Moss.	Natural Bark.
Total alkaloids	5·82	5·72	6·25	6·12
Quinine	3·78	1·37	3·80	1·50
Cinchonidine and Cinchonine	2·04	4·35	2·45	4·62
Quinine sulphate obtained crystallized	2·81	0·50	2·87	0·85
Cinchonidine ,, ,, ...	0·80	3 38	1·00	3·41

The above analyses show that the renewed bark is of superior quality to the natural bark. The amount of quinine is considerably increased, although much of it is uncrystallizable. The amount that crystallizes as sulphate does so with a readiness somewhat resembling that of the quinine from crown barks. The renewed red bark is, however, inferior to the natural crown barks as a source of quinine. I am aware that this result differs somewhat from that of the analyses of Mr. Howard made some years since of the renewed bark from younger trees, but having no doubt of its accuracy, I communicate the fact as I find it.

Mean quality of renewed bark now exported.

21. An analysis of a carefully selected mean sample of this renewed bark now about to be sent home may be conveniently quoted here as corroborating the above results :—

	Mean Sample renewed Bark.
Total alkaloids	5·38
Quinine and quinicine	2·17
Cinchonine and Cinchonidine	3·21
Quinine sulphate obtained crystallized	1·72
Cinchonidine ,, ,, ...	0·85

The bark renewed on the 3,000 trees of *C. Succirubra* of 8½ years of age had arrived at the age of eighteen months in October last. Though then at the greatest excellence of yield, it was too thin to be removed from the trees, adhering firmly

to the wood below. A sample was, however, taken for analysis from three trees of average appearance, and compared with the natural bark of same age grown under similar circumstances. The renewed bark varied greatly in thickness which generally ranged from a fifth to a third of the thickness of the natural bark. The results of the analyses were as follow :—

	C. Succirubra from Trees 8½ Years of Age.	
	Renewed Bark, 18 Months old.	Natural Bark.
Total alkaloids	6·39	6·36
Quinine	3·21	1·36
Cinchonidine and Cinchonine	3·18	5·00
Quinine sulphate obtained crystallized	2·30	0·90
Cinchonidine ,, ,, ...	3·03	4·02

Renewed bark of younger trees, results.

22. Hence it appears that the renewed bark, though thin, had improved in quality over the natural bark. It contained almost precisely the same amount of alkaloid as the natural bark, but yielded more quinine, though much of this was uncrystallizable as sulphate. Though yielding somewhat less quinine than the renewed bark of the oldest trees, it had a certain advantage over the latter in containing more Cinchonidine, giving a crystalline sulphate. From certain results I have during the last year obtained, I have come to the conclusion that as the red barks increase in age, the Cinchonidine becomes partially replaced by Cinchonine, and it also appears that the renewed barks considerably partake of the quality of the natural bark, as altered by increasing age.*

Results with bark 3 years under moss.

23. Though the above results are definite as far as they go, it appeared to me desirable that investigation should decide whether red bark renewed under moss would ever on trees from which it could be profitably cropped possess the high qualities that has been attributed to it. For that purpose I obtained a fresh specimen of some renewed bark that had been three years under moss. Its

* Though a high quality has been ascribed to the bark of first renewal, the single analysis made by Mr. Howard scarcely confirms this opinion.

Return, East India (Cinchona plant) 1866, page 134.

"No. 2 gave of crystallized sulphate ... ... 5·00
of alkaloid soluble in extra light ether ... ... 0·90
of alkaloid insoluble in xtra light ether (Cinchonine) ... ... 1·80

Memorandum.

The sulphate refined into white sulphate of quinine in appearance ; but this did not stand the test used for commercial sulphate of quinine."

analysis gave the following results, which are compared with the natural bark of trees growing near :—

—	C. Succirubra Trees 10 Years old.	
	Renewed 3 Years under Moss.	Natural.
Total alkaloids	6·12	6·12
Quinine	3·37	1·50
Cinchonidine and Cinchonine	2·75	4·62
Quinine sulphate obtained crystallized	2·27	0·85
Cinchonidine ,, ,, ...	2·91	3·41

It, therefore, appears that three years' mossing does not improve the renewed bark.

24. Before discussing the general question of mossing the trees of red bark, I will first detail the results of the experiment of the application of moss to trees of *C. officinalis* so far as it has hitherto advanced.

C. officinalis.

25. The crown barks of two ages, numbering about 2,000, were mossed at the same time as the red barks. At the end of about eighteen months, samples of bark were collected for analysis with much care from trees growing under the same conditions and having the same general habit. Bark for comparison was taken from unmossed trees, growing under as like circumstances as could be found. The reason of the special care necessary in the selection of samples is that the bark of *C. officinalis*, as I have frequently pointed out in previous reports, is especially sensitive to the external circumstances under which the tree grows. This is shown by the considerable alteration produced in the amount of alkaloid in the bark by change of aspect, climate, or soil,—circumstances which produce little alteration in the bark of *C. Succirubra*. The trees at the time of mossing were respectively about five and four years of age, so that at the time of taking the mossed bark their ages were $6\frac{1}{2}$ and $5\frac{1}{2}$ years. In most cases, the analyses have been repeated to secure as complete an accuracy as possible. The results were as follow, quoting the results of both ages in one table with a column expressing the difference produced by mossing :—

Results with mossed *C. officinalis.*

—	C. officinalis.					
	Trees, 6½ Years old.			Trees, 5½ Years old.		
	Mossed.	Unmossed.	Difference.	Mossed.	Unmossed.	Difference.
Total alkaloids	7·41	5·26	2·15	4·73	3·10	1·63
Quinine	4·57	3·48	1·09	2·96	1·62	1·34
Cinchonidine and Cinchonine	2·84	1·78	1·06	1·77	1·48	0·29
Quinine sulphate obtained crystallized	4·46	3·25	1·21	2·55	1·64	0·91
Cinchonidine ,, ,, ...	1·74	2·04	—0·70	0·94	1·14	—0·20

Proceedings of the Madras Government, Revenue Department,
29th May 1873.

26. The above results appear to me to be of great importance, and show a considerable divergence in the effects of mossing between *C. officinalis* and *C. Succirubra*. In the elder lot of trees treated, which alone are of age for cropping, the amount of total alkaloids has been increased 2·15 per cent., of which 1·09 is quinine yielding nearly its due amount of sulphate. In the younger lot the gain of total alkaloids is also marked, being 1·63 per cent., of which 1·34 is quinine, of which a certain portion (though far less than is the case in red bark) is uncrystallizable, the gain in sulphates being 0·91. In the case of both trees a certain amount of the Cinchonidine has been replaced by Cinchonine as is shown by the negative difference of crystallized Cinchonidine sulphate, but as regards the commercial value of the bark this circumstance has no appreciable effect. It may be roughly estimated that at the present price of Cinchona barks the actual value has been increased in the elder trees by at least 9*d.* per pound, and in the younger by about 8*d.* In foot-note I quote the results obtained by Mr. Howard with mossed crown barks.*

Satisfactory character of results.

27. The circumstance that the elder trees show in comparison with the younger trees even a greater increase appears to me a hopeful sign. This is entirely different to the red bark, and seems to show that up to the present time the effect of mossing does not diminish with the increased age of the tree. Whether it will eventually do so experience alone can show. The mossing has, indeed, the ill effect of altering the appearance of the bark by destroying its characteristic lichens, and may even at first prevent its fetching its true value; but such a consequence must eventually cease under the influence of its substantially better quality for the quinine manufacturer.

Increase in elder barks by mossing, a hopeful sign.

28. At the time of analysis as abovementioned, the thickness of the mossed bark was carefully determined by weighing equal areas of both the red and crown barks, as well as by direct measurement. From these experiments I conclude that in neither case has the bark been thickened by the application of

* Return, East India (Cinchona cultivation), 1870, page 35.

No. 5, *C. officinalis* var B. Condaminea (Bonplandiana), original bark, nine months under moss.

Crystallized sulphates	6·66
Alkaloids soluble in ether, quinine and Cinchonidine	0·56
Insoluble in ether, Cinchonicine	0·15
	8·02

Same Return, page 134.

No. 2, Strong growing variety of *C. officinalis*, $3\frac{1}{2}$ years old.

Crystallized sulphates	2·92
Soluble in ether (Cinchonidine and quinine)	0·41
Insoluble in ether (Cinchonicine and Cinchonine)	1·20
	4·53

moss. In both cases, the amount of water present in the bark has been somewhat larger than in the natural bark, but the effect of this, I think, will, in practice, be found of slight consequence.

Bark not increased in thickness by mossing.

29. In October last, the bark had renewed under moss on the crown bark trees with much evenness, and was then two years of age, or six months older than the time ascribed as that of its best yield. But it was still found too thin for removal from the trees, and could not be cropped as intended. Notwithstanding this, it appeared to me desirable to examine it by analysis. Two specimens each from several trees were taken in different localities, and specimens for comparison were taken from unmossed trees growing under similar circumstances. The results obtained were as follow :—

Renewed bark from elder trees, results.

	C. officinalis Trees, 9 Years old.					
	Renewed two Years old.	Natural.	Difference.	Renewed two Years. old.	Natural.	Difference.
Total alkaloids	7·03	6·04	·99	6·93	6·04	·89
Quinine	5·21	4·77	·44	5·17	4·77	·40
Cinchonidine and Cinchonine. ...	1·82	1·27	·55	1·76	1·27	·49
Quinine sulphate obtained crystallized.	4·57	4·80	— ·23	4·40	4·80	— ·40
Cinchonidine ,, ,, ...	0·58	0·92	— ·34	0·60	0·92	— ·32

30. Before discussing these results, I will quote analyses of similarly collected specimens obtained from the trees of eight years old, in which, for entirely similar reasons, the renewed bark had been allowed to attain the age of two years :—

Renewed bark from younger trees, results.

	C. officinalis Trees, 8 Years old.		
	Renewed two Years old.	Natural.	Difference.
Total alkaloids	5·83	3·61	2·22
Quinine	3·34	2·34	1·00
Cinchonidine and Cinchonine	2·49	1·27	1·22
Quinine sulphate obtained crystallized	3·13	2·10	1·03
Cinchonidine ,, ,, ...	2·60	1·44	1·16

Here, as on the trees of red bark, the yield of the renewed bark exceeds that of the natural bark, to the greatest extent on the younger trees. I cannot but consider this a discouraging indication, as it may signify that renewed crown bark will not surpass the natural bark so greatly in after years as when produced by young trees. But the yield of the renewed bark is absolutely greater even on the elder trees, and in this respect *C. officinalis* considerably differs from *C. Succirubra*. In the elder trees the renewed bark is nearly equal in value to the natural bark.

In the younger it exceeds the natural bark in money-value by about 10*d.* per pound. This, of course, assumes that the renewed bark could now be removed from the trees for sale, which, as before stated, is not yet the case.

31. As in the case of the red barks, it appeared to me to be very desirable to ascertain whether a long continuance under moss in any respect improved the quality of the renewed crown bark. I therefore, by the kindness of Mr. McIvor, obtained specimens of bark renewed under moss from the oldest *officinalis* trees. It had been under moss two years and four months. Natural unmossed bark grown upon trees under similar circumstances was analysed for comparison. The results were as follow :—

Renewed bark, 28 months under moss, results.

	C. officinalis, 9 Years of Age.		
	Renewed under Moss two Years and four Months.	Natural.	Difference.
Total alkaloids	5·58	5·10	0·48
Quinine	4·23	3·42	0·81
Cinchonidine and Cinchonine	1·35	1·68	0·33
Quinine sulphate obtained crystallized	4·18	3·38	0·80
Cinchonidine ,, ,, ...	1·41	1·72	0·31

Here it is evident that in this case four months' increase of age under moss has somewhat improved the quality of the bark. But in so variable a bark as *C. officinalis* I am not inclined to place much stress on this fact, inasmuch the alteration in quality between the natural and the renewed bark differs but slightly from the case in which the latter was two years old.

32. Before discussing the results of mossing the trees, certain general consequences of the application must first be stated, which appear to me considerably to influence the results.

Certain consequences of mossing must be first discussed.

33. The crown barks, as I have in former reports had the honour of stating, possess in the highest degree the property of forming the crystalline sulphates with facility. Hence, their peculiar fitness for employment by the European quinine manufacturer. Mossing the crown bark trees, or renewing their bark under moss, does not increase this admirable property, from the fact that it is already at a maximum. The red barks, on the contrary, have the bad quality of affording crystalline sulphates with difficulty. A covering of the bark with moss for eighteen months, however, diminishes this peculiarity, though, at the same time, it appears to increase the difficulty with which the alkaloids are obtained free from red colouring matter. The renewed red barks, however, form crystalline sulphates with far greater ease than the natural bark, though even in this respect they do not rival the crown barks. The alkaloids of the renewed red barks, however, are contaminated with a red colouring

Certain improvements perceptible in renewed bark of *C. Succirubra*.

matter in a greater degree than the natural bark, and from which there occasionally is some trouble in freeing them. This affects the value of the barks, though, I believe, in a less degree than the comparative ease of the crystallization of sulphates. In the renewed barks, it appears to me that the barks are exhausted of their alkaloids with greater ease than the natural barks.

34. The facility with which the bark after being cropped renews under moss appears to me to be the most important element in the application of the process. Mr. McIvor at first stated that the taking of the bark has no effect on the growth of the tree. No doubt small experiments on a few healthy trees led to this conclusion, but notwithstanding I have no hesitation in stating it to be erroneous. That so important a seat of the life of the tree as the bark can be taken from it without affecting its growth appears almost an absurdity. That it is not the case experience has conclusively shown, and I do not think even the Superintendent of the Plantations now holds the contrary. For some months after taking of the bark the growth of the tree ceases; it appears unhealthy; the colour of the leaves changes to yellow or red; and it has generally a more or less sickly aspect. But after a time it recovers its health; the bark that has been taken renews with variable homogeneity, and after a year it reassumes its healthy appearance and growth.

Renewal affects growth of tree.

35. As a matter of fact the renewal of the red bark has not been entirely complete under the circumstances of the experiment. Nearly all the elder trees that I have examined had bare patches of wood, where the bark had not grown again after it had been taken. Among the younger trees there are also many trees on which the bark had not completely renewed. These trees are, of course, considerably injured by the treatment they have received, though I have not observed in any instance one that has actually died. Notwithstanding the many cases in which the bark has failed to renew, the younger red bark trees are a mass of verdure at the present writing; the elder trees alone looking sickly. Mr. McIvor properly states that the application of the process of mossing is still an experiment, and that we have not at present the requisite experience to enable it to be performed without risk. I may mention that in consequence of G. O. No. 1,213 of 13th July 1871, a very fine plot of 2,000 trees of. *C. Succirubra* had its bark taken and the trunks mossed, the work being commenced on October 15, 1871,—a time supposed to be favourable to the renewal of bark. I find by observation that 17 out of 20 trees, or 85 per cent., taken in various parts of the plot have not renewed their bark. This plot, of course, forms no part of the experiment, though the result appears to me to be significant.

Difficulty with *C. Succirubra*.

36. On the other hand, the trees of *C. officinalis* appear to me to renew their bark with far greater certainty, although the growth in thickness is slower than in the case with red bark. The quality of the renewed bark is also far finer, and is well suited for export. I am of opinion that even the renewed red bark will never be employed in English quinine manufacture as long as the market supplies sufficient crown bark, and when the good quality of the latter is

Renewal with *C. officinalis* more certain.

thoroughly known. Notwithstanding that the cost of mossing the crown bark trees at first has been 2 Annas 11½ Pies per tree, while that of the red bark mossing has been but 7½ Pies, it appears to me even now sufficiently evident that the process is more successful on the former from the greater certainty of renewal and the superiority of the product. It is greatly to be regretted that comparative experiments have not been carried out on coppicing the Cinchona trees, in order that the most profitable means of collecting the crop might be experimentally determined.

37. In the report of the Superintendent of the Cinchona Plantations for 1870-71, attached to G. O. No. 1,237 of 20th August 1872, paragraph 14, it is stated that the applied moss grows and increases as well as the trees. I am unable to see the advantage of this ascribed tenacity of life, since the moss must be stripped off the tree half yearly, in order to remove the bark underneath, the wound being again recovered. Another increase of labour produced by the process is that a ladder is necessary for the removal of bark at heights exceeding seven feet, from which it is found that a coolie instead of cropping 50 lbs. of green bark per diem only crops 20 lbs. I mention these circumstances mainly to show that the consequences of the application of the process are more complex than at first appear.

Growth of moss little advantage.

38. The amount of total alkaloids which red bark renewed under moss contained was, by Mr. Howard's analysis in 1865, about 6·37 per cent. In May 1869 I obtained from the same 9·27 per cent. In 1872 from a similar specimen I obtained but 6·03 per cent. The year 1869 was the age in which the most considerable yearly increase in the amount of alkaloids that I have observed took place, as well as that in which the largest yield of alkaloid in the first renewed bark is recorded. At the present time I have some reason to fear that the bark of the eldest trees has arrived at, if not passed, the age of its maximum yield. It appears to me that the foregoing fact furnishes some indications that the quality of the first renewed bark is intimately connected with the changes taking place in the tree, and is highest when the natural annual increase of alkaloids is the greatest. The thickness of the renewed bark may also somewhat depend on the same causes.

Quality of renewed bark depends on age of tree.

39. From the foregoing considerations I am not inclined to look sanguinely on the effects of mossing the trees of *C. Succirubra*. Had the plan of coppicing been tried, a comparative and more definite opinion could have been arrived at. I am quite of opinion that no more trees should be mossed, until the results obtained from the bark of second and third renewal show the actual results they promise from Mr. Howard's reports. The grounds on which I base my opinion are, firstly, the comparative thinness of the renewed bark; secondly, its moderate quality; thirdly, the somewhat uncertainty of its renewal; fourthly, the injury to the trees produced by taking the bark,

Mossing applied to *C. Succirubra* less successful.

40. On the trees of *C. officinalis* these objections are less patent. The renewed bark, though thin, is of fine quality, and the renewal appears to be certain.

Mossing applied to *C. officinalis* promises Success.

I consider the plan of mossing, as devised by Mr. McIvor, applied to this species promises success. But nearly the whole of the Cinchona plantations have now been mossed, so that, unless the application be stopped, there will soon be no trees left of an age on which so necessary a plan as coppicing can be fairly tried.

41. In G. O. No. 701, 19th April 1871, the Government assent to certain proposals of the Nilgiri Commissioner for the comparative trial of coppicing. In paragraph 3 of a letter of the same officer, attached to G. O. No. 1,213 of 13th July 1871, he states, "the same are being carried out," apparently believing it to be the case. But, with the exception of 200 trees of *C. Succirubra* which were felled in June 1871, the matter has hitherto been in abeyance.

Coppicing for comparison still a speculation.

42. The opinion which I hold that the success in export of the Indian Cinchona plantations will, at least for the next twenty years, depend on the amount of the bark of *C. officinalis*, *Calisaya*, and var *Bonplandiana Angustifolia*, sent to Europe, far more than on red bark, receives hitherto, I submit, a further partial corroboration in the results detailed in the foregoing report, and the conclusions I found thereupon.

Results appear to corroborate estimates held of the Cinchona species.

No. 222. Miscellaneous. ORDER THEREON, 29th May 1873, No. 549.

THE Government are obliged to Mr. Broughton for his interesting report. They are not, however, of opinion that his experiments have been sufficiently extensive to justify a general condemnation of the mossing-process, as applied even to the old *C. Succirubra* trees, and they consider that the Commissioner's remarks in paragraphs 9 and 10 of his letter show almost conclusively (if his figures are correct) that this system is likely to be more profitable than the coppicing system which Mr. Broughton advocates.

2. *Sufficient information is not, however, as yet available as to the certainty of a reproduction of bark after a tree has been stripped, and the statements made in paragraph 33 of Mr. Broughton's report, that* 85 *per cent. of a patch of* 2,000 *trees had failed in this respect, is a matter which should receive the Commissioner's and Mr. McIvor's gravest consideration.*

3. *The experiment advocated in paragraph* 13 *of the Commissioner's letter should at once be undertaken, and the number of trees which it is proposed to include in it should be reported.*

4. *No further mossing of the trees should be undertaken until the results of this experiment, which should be reported specially from time to time, are fully*

Proceedings of the Madras Government, Revenue Department,
29th May 1873.

established, and the Government desire to know whether any experiments have yet been made as to the reproduction of bark without this artificial assistance.

(True Extract.)

(Signed) R. A. DALYELL,
Acting Secretary to Government.

To the Commissioner of the Nilgiris.
,, J. Broughton, Esq.
,, the Board of Revenue.
,, the Inspector-General, Indian Medical Department.
,, the President of the Cinchona Commission.

Commissioner's Office
Ootacamund
19th April 1873

No 15

From.

J. R. Cockerell Esquire
Commissioner
Nilgiris

To

The Chief Secretary
to Government
Fort Saint George

Sir.

I have the honor to submit a report from Dr Broughton on the comparative merits of the mossing system, which Dr Broughton has in compliance with para 4 of Proceedings of Government, Revenue Department, requiring the opinion of the Commissioner, forwarded through me.

2. Dr Broughton pronounces an opinion adverse to the mossing process in the Red barks but states that no final conclusions can be arrived at for the next three years. In the meanwhile he complains that the coppicing system has never had as yet a fair trial notwithstanding experiments were ordered to be carried out.

3. With regard to Dr Broughton's condemnation of mossing Red barks it is necessary that in order to a complete consideration of Dr Broughton's conclusions, I should indicate

Govt. of 1873 Revenue.

To

THE COMMISSIONER OF THE NILGIRIS,
&c., &c., &c.

Dated May 29th.

Read.

Rept.

G. O., 29th May 1873, No. 549.

MAY.
Nos. 221-222.

Mossing Cinchona Trees.—Letter from the Commissioner of the Nilgiris submitting Mr. Broughton's report on the comparative merits of the process, with orders thereon.

Y

Y Sept 2, 59/73

indicate what his statements are. They are briefly these: 1st That mossed bark on young Succirubra is enormously superior to natural bark in the proportion of contained Alkaloids.
2nd ly That the superiority diminished with the age of the tree up to 8 years and at 10 years (the oldest trees the Government possess) there is an equilibrium and no difference between the natural and renewed bark as respects alkaloids.
Mr Broughton concludes that the evidence available points to even a falling off of the qualities of the mossed as compared with the unmossed natural bark as a tree ages and appears simply that coppicing will be found the best mode in the long run of taking the bark from the C. Succirubra.

4. I was lately at Neddiwuttum with Mr Ince and Mr Broughton when an inspection of the Neddiwuttum plantation was made. Wounding a tree was then expounded. It was said that any incision was a blow aimed at the life of a tree, which the tree took time to recover in proportion to the extent of the wound. Thus it was said peeling the bark was wounding a tree, but coppicing a tree was inflicting a more radical wound and the question arose whether minor wounds like peeling made at comparative frequent interrals would be most detrimental to the life of the tree or performing radical operations at longer intervals, that is by coppicing

coppicing a tree every seven or eight years. I understood from Mr Broughton that his fear was that if mossing was carried on, the mossed trees would in course of years die and require replanting. He inferred on the other hand that trees might be coppiced for hundreds of years like oaks in England and thus the plantations would never require replenishing

5. In order that the Government may have all the evidence which is available to enable them to test these views, I make the following remarks. Fairly coppicing that is by fairly taking off the head of a tree completely as can would be cut is never, I am led to believe carried out in oak coppices in England except in the cases where there are no shoots near the bottom of the stem and where therefore, there is nothing to leave and the reason is that depriving a stem of every shoot is so radical an operation that the life of the tree receives a shock from the operation very difficult for it to recover. Accordingly coppicing as ordinarily carried out is the felling of the tree say 6 inches from the ground but leaving the shoots sprouting from the stool.

6. In my letter in Government order No 126 dated 30th January 1873 I stated that 100 trees were then fairly coppiced in 1866. I took note at Neddiwuttum of the largest of these coppiced trees.

trees. The shoots look weak and sickly. Their diameter is about an inch and a quarter at the bottom. I stripped a piece of bark from one of them and found that when dried it presented a thickness no greater than blotting paper. Mr Broughton saw this tree and looked over the other fairly coppiced trees. He was of opinion they had not sprung up again well and attributed their weakness to an insufficiency of light and air.

7. These coppiced trees are intermediate trees each flanked by untouched trees at a distance of 12 feet from them. It was a matter admitting of various opinions whether the surrounding trees kept light from the coppiced trees, but one thing was clear. Shoots springing from untouched trees were numerous in the vicinity of the coppiced trees. They were obviously kept from light and air much more than the shoots on the latter and yet their appearance indicated great succulence and vigour.

8. The healthiness of the shoots on the uncoppiced trees gave rise further to a suggestion. It indicated that the mossing process could never destroy the trees on a plantation if a shoot was left on each tree. The main stems might be stripped of Bark until they died and a strong shoot be left all the time growing to take the place of the stem on the extinction of the latter - In this manner

manner not a single tree on a plantation would be lost. The inference was there was no need to run the risk of coppicing because, it was apprehended, removing the bark from time to time under the mossing process might eventually destroy the trees.

9. The next point was the difference in the quantity of bark that would be afforded by mossing and that afforded by coppicing. At Keddington I took from an untouched and unmossed C. Succirubra, 6 years old 2 lbs of wet bark. The tree was mossed on decortication. In 6 months the tree will have grown higher and will then yield perhaps 3 lbs of natural wet bark. I should observe the 2 lbs. I took was not all the tree could have afforded. The tree was 19 feet high and I stripped it to a height of 6 feet from the ground. Twenty months from my taking, the first renewed bark will be available. and 6 months after that the rest of the renewed bark. The renewed bark will aggregate 2/3rds of the original bark. Thus in 4 years and a half the tree will have given about 8 lbs of wet bark. In a further 26 months another supply of renewed equal in quantity to the first renewed bark will be available and the tree will then have given 10 lbs of bark.

10. Now if this tree had been felled it would have given at the date I stripped it 4 lbs of bark & 4 1/4 lbs and in 8 years it would perhaps have regrown and have yielded about 2/3rds

2/3rds of its yield are being coppiced. Shews in 14 years the tree would afford only say 4 lbs against say 10 lbs of bark in less than nine years by the mossing process.

11. Then as to the commercial value of renewed mossed bark. I understand Mr Broughton to say that on trees at all ages it is richer in quinine than natural bark and this is a very important point. I should observe that a difference of one per cent in quinine makes a difference in price of 1 3/5 pennies in the Shilling and if quinine is selling at 8s an ounce, therefore of 8 times 1 3/5 of a penny. Mr Howard's Analyses in all his six reports seem to corroborate the conclusion of the increased richness of renewed mossed bark in quinine.

12. These remarks apply entirely to the C. Succirubra. In his report Mr Broughton expressly states that in Condamineas mossing affords a fairer prospect and his appended analyses confirm this view.

13. With regard to Succirubra the adverse evidence is not, I submit, sufficient as yet to overbalance the evidence favorable to mossing and I would not therefore advocate coppicing experimentally on any large scale. Mr Broughton I believe would not himself risk an extensive experiment. When we were at Neddiwatte he pointed out four rows of C. Succirubra of 10 years old and upwards which he proposes to coppice in May leaving the shoots on the stool and to compare these trees with four adjoining rows of trees which are to be mossed. He thinks this experiment will afford a fair test and it will not in any way disfigure the plantations. I readily consented to this arrangement subject to the approval of Government, which I now solicit.

14. In conclusion I venture to remark on the Complaint of Mr Broughton that the coppicing sanctioned in Government order No 1646 dated 6th December 1872 was not carried out, that Mr Broughton was the fit proper person to call attention to the neglect of the orders.

15. Mr Broughton requests that six printed copies of his report may be furnished to him and that he may have the privilege of revising the printers proof of the report.

16. The delay in forwarding the report has been owing to my wish to inspect the Neddiwatte plantation before submitting a personal opinion.

I have the honor to be
Sir
Your most obedt Servt

H. Cockerell
Commissioner

No 1126 19

No 549 - 29 May 73

The first one referred to Dr Brighton for his interesting report. They are not, however, of opinion that his experiments have been sufficiently extensive to justify a general condemnation of the crossing process, as applied even to the old C. Sinensis trees, and they consider

and they [illegible]

C.O. 22 Sept 1873 pp 334-35
8 Nov 117 - 118
19 Dec 69 - 330 - 37
19 Jan 71 - 82 - 91
19 March 270 - 2701
13 Feb 151 - 153
20 April 72 - 184 - 85
8 Sept 32 - 33
30 Jan 73 250 - 57
31 July 166 of 1873 Sept
15 Jan 73 376 - 77
15 March 236 - 37
13 Dec 306 - 307

Received 18 73 Sept 15:

No 1126.

From

The Commissioner

Nilgiris

To The Chief Secretary

to Government

Fort St George

Dated Ootacamund 18 Sept 1873

Rec'd 21 " "

No 1015

Enclosure - 1.

Submitting Dr Brughelli's Report on the experiments made in the Nilgiris for the destruction of the Parasitical Plants called Loranthus and Viscum.

No 221-222

C.O. No 549 - 29 May 73

C 20 May R 23 Aug R C 23 Aug Ent 27 Aug

that the Comr remarks
in paras 9 and 10 of his
letter, shew, almost conclusively,
(if his figures are correct)
that this system is likely to
be more profitable than
than the Coppicing system
which Mr. Brayshaw
advocates.

Sufficient information
is not, however, as yet
available as to the
certainty of a reproduction
of bark, after a tree
has been stripped, (whether

I do not think it
necessary to print this
enclosure
draft

rationally, or under the
Morris's process,) and
the statements made in
para 35 of Mr Brayshaw's
report that 85 per cent of a
batch of 2000 trees barked
failed in this respect is
a matter which should
receive the Comr's graver
consideration.

The experiment advocated
in para 18 of the Comr's letter
should be at once under
taken, and it would
be advisable to include
in it a trial of the non
morsing against the morsing
system, by stripping another

four rows of trees, in the same locality, of their bark, and allowing it to reproduce itself without any artificial assistance.

The number of trees which it is proposed to include in this experiment should be at once reported, and its results thereof be placed before Govt, from time to time, in Special communications.

WD.

If Mr Strong has extended as far as Sago, almost all new the plantations, it should be visited - until experience can be gained

33 [illegible]

and the statements made in para 35 of Mr Broughton report that 85 per cent of a patch of 2000 trees had failed in this respect is a matter which should receive the Govt's and Mr Gibbons gravest consideration.

The experiment advocated in para 13 of the Govt letter should at once be undertaken, and the number of trees which it is proposed to include in it should be reported

No further morning of the trees thereof be undertaken until the results of this experiment, which should be reported, specially, from time to time, are fully established, and the Govt desire to know whether any experiment has yet been made as to the reproduction of bark without this artificial assistance, ~~and if so what results~~.

WD

3 To the Commissioner of the Kilifi Dist 26th Sept 13
1 Govt Broughton Esqr
14 " Conservator of Forests
6 " Assistant "
6 " Resident Commissioner
" Chief Clerk

C 20 May R. 23 May R.C. 23 May. Rets 27 May