

R E T U R N.

East India (Chinchona Cultivation).

*Ordered, by The House of Commons, to be Printed,
9 August 1870.*

[*Price 4s.*]

Under 28 oz

EAST INDIA (CHINCHONA CULTIVATION).

RETURN to an Address of the Honourable The House of Commons,
dated 3 May 1870;—for

“ COPY of all CORRESPONDENCE between the Secretary of State for *India*
and the Governor General, and the Governors of *Madras* and *Bombay*,
relating to the Cultivation of CHINCHONA PLANTS, from April 1866 to
April 1870.”

India Office, }
20 May 1870. }

H. L. ANDERSON,
Secretary, Public Department.

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(*Mr. Frederick Walpole.*)

Ordered, by The House of Commons, to be Printed,
9 August 1870.

C O N T E N T S.

— I. —

CHINCHONA CULTIVATION ON THE MADRAS PRESIDENCY.

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COPY of all CORRESPONDENCE between the Secretary of State for *India* and the Governor General, and the Governors of *Madras* and *Bombay*, relating to the Cultivation of CHINCHONA PLANTS, from April 1866 to April 1870.

— I. —

CHINCHONA CULTIVATION IN THE MADRAS PRESIDENCY.

— No. 1. —

From the Secretary of State for India to the Government of Madras.

India Office, 9 May 1866.

I HAVE received a letter from Captain Maury, Councillor of State to His Majesty the Emperor of Mexico, requesting on behalf of His Majesty that a supply of Chinchona seeds grown in India may be sent to him, in order that the cultivation of that tree may be carried on in His Majesty's dominions.

I have to request, therefore, that you will direct Mr. M'Ivor to send to this office, for transmission to Mexico, parcels of well developed seeds of *C. succirubra* and *C. officinalis* as soon as they are available. I also request that you will direct that several copies of Mr. M'Ivor's most recent manual of Chinchona be sent to me at the same time. No copies of that pamphlet remain in this office.

— No. 2. —

From the Secretary of State for India to the Government of Madras.

My Lord,

India Office, 16 June 1866.

Para. 1. I have considered in council the letters in the Revenue Department, noted in the margin,* forwarding various reports and proceedings relating to the progress of chinchona cultivation in your Presidency, together with the letter dated 13th March 1866, submitting your proceedings consequent on Sir C. Wood's Despatch of the 30th September 1865, and on the report furnished by Mr. Markham after his visit to the chinchona plantations at the commencement of the present year.

* No. 55, dated	24th August 1865.
" 59, "	23rd Sept. "
" 65, "	26th Oct. "
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" 74, "	25th Dec. "
" 75, "	" " "
" 4, "	6th Feb. 1866.
" 5, "	10th March "
" 13, "	11th April "
" 16, "	24th " "

2. It is highly gratifying to me to find that the favourable reports from time to time submitted by Mr. M'Ivor, as to the progress of the plantations, are fully confirmed by Mr. Markham, and I gladly recognise the skill and energy on the part of Mr. M'Ivor which have conduced so materially to this result.

3. With regard to the future management of the Government plantations and the extension of chinchona cultivation throughout the hill districts of your Presidency, I concur in the opinion of your Government as to the manner in which you propose to deal with the plantations of Neddiwuttum, Pykarah, and Dodabet. As regards the Maikondah plantation, as to the maintenance of which you solicit my instructions, I am of opinion that operations should, at least for the present, be continued there on the part of Government. The site is reported by Mr. Markham to be peculiarly well suited for the cultivation of the chinchona. If it should be decided eventually to dispose of it, there can be

little doubt that any expenditure which may be incurred on it will be reimbursed; and, although it may be hoped that private enterprise may hereafter render the continuance of operations by Government on an extended scale unnecessary, it is impossible at present to regard as settled the question as to the extent to which Government may see fit to take part in the undertaking. The amount of land specified in para. 5 of your letter should, therefore, be retained for the present at Mailkondah, the remainder being sold as proposed by you.

4. In order, however, to carry out as fully as possible the great object contemplated by Her Majesty's Government in introducing the chinchona into India, viz., that of making its produce accessible to the greatest possible number of the poorer inhabitants of the country, it is evident that every effort should be made to promote the cultivation of the tree by private persons in all the localities where the cultivation is likely to be successful. It is gratifying to observe the readiness with which planters, both European and Native, are disposed to undertake the growth of the chinchona plant, in many cases in connection with coffee plantations; but I am of opinion that the greatest benefit would result, and that one of the most effectual methods of diffusing among the bulk of the community the benefits which the introduction of the chinchona is calculated to produce, would be secured should it be found practicable to promote the cultivation of the tree by villagers and small holders of land in suitable situations, even if they should not be able to do more than plant a few trees around their houses. The agency of the officers of Government of different ranks, who would make known the uses of the bark, and through whom the young plants might be distributed, would, of course, be indispensable to the carrying out of this plan: and I am of opinion that every encouragement should be given to those officers who, like Mr. Levinge and Mr. Ballard, show an interest in the matter, and a desire to assist in spreading the cultivation.

5. I agree with your Government that it is not expedient that Government should undertake the maintenance of any plantations in addition to those which it has already established, and I further agree in your decision that in all cases where the cultivation of the chinchona is undertaken for the purposes of trade or profit, a charge should be made for the plants set up from the Government plantations; but in all cases, whenever a Government officer sees an opportunity of introducing the cultivation among the lower classes in his district, a supply of plants should be furnished to him for gratuitous distribution, and every other practicable assistance afforded in the prosecution of the work.

6. I concur in the opinion of your Government that it is expedient, at this stage of the undertaking, that an experienced chemist or analyzer, possessed of a thorough knowledge of the chinchona and its products, should be appointed to investigate on the spot various points connected with the cultivation of the tree and the extraction and use of its alkaloids, without a determination of which a satisfactory decision cannot be passed on various questions now awaiting solution. The establishment of a manufactory of quinine and of the inferior products of the chinchona is the most important of these questions, and this cannot evidently be disposed of without further inquiry. I have, accordingly, resolved to sanction the appointment of an analytical chemist for a term of three years, and I shall lose no time in obtaining the services of a thoroughly qualified individual to proceed to your Presidency at as early a period as possible.

7. I approve the measures proposed to be taken by you for obtaining satisfactory reports on the relative efficiency of the various products of the chinchona bark proposed by Mr. Howard, and recently sent out to your Presidency.

8. Three copies of Mr. Howard's work will be transmitted to your Government, in accordance with the request contained in the 7th paragraph of your letter of the 13th March last.

I have, &c.
(signed) *De Grey and Ripon.*

— No. 3. —

From the Secretary of State for India to the Government of Madras.

My Lord,

India Office, 17 October 1866.

Para. 1. WITH reference to the recommendation contained in your Despatch to my predecessor, dated 13th March 1866, that a quinologist should be stationed at Ootacamund for three years to investigate various questions connected with chinchona cultivation, I have now to inform you that I have, at the recommendation of Dr. Frankland, appointed Mr. John Broughton to this post. Mr. Broughton has worked as Dr. Frankland's assistant at the Royal Institution in Albermarle-street, and I am assured by that eminent chemist that he has been occupied with organic chemistry for several years, that he has made original investigations of his own, and that he is already intimately acquainted with the chemistry of the chinchona plant.

2. I herewith transmit, for the information of your Government, a copy* of a letter which I have caused to be addressed to Mr. Broughton, informing him of the nature of the duties that will be expected from him, and directing him to report himself to the Secretary to your Government in the Revenue Department, on his arrival at Madras. His appointment is for three years, and I have fixed his salary at 1,000 £. per annum. I have also allowed him 150 £. for outfit and passage, and a sum not exceeding 200 £. for the provision of the necessary apparatus and chemicals, which will be shipped for transmission round the Cape.

* Dated 22nd September 1866.

3. It will be for your Government to decide, in consultation with Mr. M'Ivor and Mr. Broughton, whether the latter gentleman shall reside at Ootacamund or at the Neddiwuttam plantations; but it will be necessary to furnish, at one or other of those places, a room for a laboratory, with a smaller room opening on it, and a supply of water.

4. Mr. Broughton will leave England by the steamer of the 20th of November.

5. I have also had under my consideration, in Council, your despatch in the Revenue Department, dated 25th May 1866, reporting your proceedings in connection with the appointment of a Commission for testing the value of chinchona alkaloids, other than quinine, as febrifuges; and requesting that further supplies of the sulphates of these alkaloids may be transmitted to Madras.

6. The arrangements of Dr. Shaw, the officiating Medical Inspector General of Madras, appear to be very judicious, with a view to testing the efficacy of chinchonidine, quinidine, and chinchonine as cures for fevers; as well as for trying the bark, twigs, and leaves of the chinchona, as simple decoctions. I am not, however, of opinion that it will be advisable, in the present state of our knowledge, to include quinium amongst the febrifuge alkaloids to be experimented upon by the Commission.

7. One hundred and fifty ounces of the sulphates of each of the chinchona alkaloids have been ordered from Mr. Howard, and will be shipped for Madras as soon as they are delivered to the Stores Department of this office.

8. I also herewith transmit 30 copies of a pamphlet by Dr. Gustave Planchon on Peruvian barks, which has been translated from the French. Copies should be supplied to Mr. M'Ivor, and others who are engaged in chinchona cultivation, as well as to Dr. Shaw and the members of the Commission appointed to report upon the chinchona alkaloids.

30.

I have, &c.
(signed) Cranborne.

Enclosure in No. 3.

From the Under Secretary of State for India to Mr. Broughton.

Sir,

22 September 1866.

I AM directed by the Secretary of State for India to inform you, that it is his intention to employ an analytical chemist to conduct investigations in concert with the superintendent of chinchona plantations on the Neilgherry Hills; and that, at the recommendation of Dr. Frankland, he has resolved to offer you the appointment.

2. You will be under the orders of the Madras Government, from whom you will receive instructions, and to whom you will report the results of your investigations from time to time. It will not be necessary, therefore, to do more, on this occasion, than indicate very generally the nature of the duties that will be expected from you, and of the results that it is desired to secure from your labours.

3. The objects of the Government in introducing the cultivation of chinchona plants into India were the provision of an abundant and cheap supply of the febrifuge derived from them for the use of hospitals and troops in India, and the spread of chinchona cultivation throughout the hill districts, in order to bring the remedy within the reach of all classes of the native population. The oldest trees on the Neilgherries have now been planted out for nearly four years, and the analyses of their barks, which have been made by Mr. Howard, prove that there is a very marked increase of the yield of febrifuge alkaloids under cultivation. The time has now come, therefore, when it is necessary to investigate the causes which regulate the yield of alkaloids from cultivated chinchona barks, and to ascertain the preparation of the febrifuge which will combine cheapness with efficacy in the greatest degree. To attain these very important objects the Secretary of State considers that a scientific chemist should be associated with the able and intelligent cultivator who now superintends the plantations.

4. The analysis of bark from plants growing in different situations, by a competent scientific chemist on the spot, will be a principal means of discovering the conditions, as regards elevation, climate, soil, and exposure, best calculated to produce the largest possible yield of alkaloids, those conditions, of course, varying with the different species. There are several difficult questions connected with the formation of the alkaloids in bark, and particularly with the changes in the alkaloids themselves, caused probably by cultivation, which should be carefully and diligently investigated. It will also be an important duty of the chemist attached to the chinchona plantations to ascertain the difference, as regards yield and efficacy, between green and dried barks; and to make accurate analyses of the leaves, and hereafter possibly of the flowers, of the different species. The best method of drying the bark must be decided by scientific experiments; and, finally, it will be expected from the chemist that he should, through his investigations, enable Her Majesty's Government to arrive at a decision with respect to the best and cheapest method of preparing the febrifuge for use among the labouring classes of the natives of India. He will also be required to consider the questions connected with the manufacture of the chinchona febrifuge for the use of hospitals and troops in India.

5. Dr. Frankland has assured Lord Cranborne that you have been occupied with organic chemistry for several years, that you have made original investigations of your own, and that you are already intimately acquainted with the chemistry of the chinchona plant; and his Lordship, therefore, feels justified in the expectation that you will prove competent to perform the difficult and important duties to which I have briefly alluded, in a way which will give satisfaction to the Government; and that you will advance a branch of science, which, in its bearings on chinchona cultivation, has now become of great economic importance.

6. Your investigations should be carried on after consultation with the cultivator who is in charge of the plantations, and I am to impress upon you the great importance of acting, on every occasion, in concert with the superintendent of chinchona cultivation. It will be useful, also, if you were to put yourself in communication with the medical authorities, with reference to the investigations which are now in operation with respect to the comparative value of the different alkaloids.

7. Your periodical reports are to be made direct to the Madras Government.

8. You are required to undertake to serve the Government for three years, on a salary of 1,000 *l.* a year. You will be allowed a sum of 150 *l.* for outfit and passage, and a sum not exceeding 200 *l.* for the provision of the necessary apparatus and chemicals, which will be payable at this office. The latter sum of 200 *l.* will be exclusive of freight and transit costs.

9. It is desirable, that, in the event of your accepting this appointment, you should proceed to the Neilgherry Hills with as little delay as possible; and that you should arrange for the shipment of the laboratory previous to your departure from England.

10. On your arrival at Madras, you will report yourself to the Secretary to the Madras Government in the Revenue Department.

I am, &c.
(signed) *Herman Merivale.*

From Mr. *Broughton* to the Under Secretary of State for India.

Sir,

Royal Institution, W., 24 September 1866.

I HAVE the honour to acknowledge the receipt of your official letter of the 22nd instant, containing the terms of my appointment as chemist to the chinchona plantations of the Madras Presidency, and also containing general instructions connected with the performance of the duties of that post.

I beg therefore, in reply, to state my acceptance of the appointment according to the terms mentioned in paragraph 8 of your letter. Also I am prepared in obedience to your instructions to proceed to the Neilgherries in order to commence an active examination of the chinchona barks, &c., as early as the due selection and careful packing of the chemicals and apparatus required for the future laboratory will permit.

I beg also to express my trust that by the investigation of the points mentioned in your instructions, and by the eventual resolution of the questions connected with the same, I may be enabled to justify the hopes entertained by Lord Cranborne, and alluded to in paragraph 5 of your letter.

Herman Merivale, Esq., C.B.

I have, &c.
(signed) *John Broughton*.

— No. 4. —

From the Governor of Madras to the Secretary of State for India.

Madras, 25 May 1866.

1. IN continuation of our Despatch, dated 13th March 1866, we have the honour to forward copy of a letter from Mr. Shaw, Officiating Principal Inspector General of the Medical Department, containing his proposals for testing the value as febrifuges of the alkaloids and preparations, other than quinine, referred to in your Despatch dated 30th September 1865, No. 27, and in Mr. Markham's letters to us, dated 16th January and 7th February 1866.

2. We have approved of Mr. Shaw's proposed arrangements.

3. We have received 128 ounces of each of the four alkaloids, but no quinium; and request that you will cause us to be supplied overland, without delay, with 150 ounces more of each of the alkaloids, and 250 ounces of quinium.

4. You will observe from our Proceedings that we have sanctioned the employment of Dr. Keess in the Wynaad Talook, to test the efficacy of the new alkaloids in that feverish locality; and that advantage is to be taken of this opportunity to test also the efficacy of the bark, twigs, and leaves of the Neilgherry chinchonas as a simple decoction.

Enclosure 1, in No. 4.

From the Officiating Principal Inspector General, Medical Department, to the Secretary to Government (Revenue Department), Fort Saint George, 23rd March 1866.

1. I HAVE the honour to acknowledge the receipt of the Order of Government, 10th March 1866, No. 617, in which I am requested to submit a list of medical officers whom (having regard to the qualifications mentioned in the Despatch), I would recommend for appointment to the proposed Commission "to test the efficacy of these alkaloids (viz., Chinchonidine, Quinidine, and Chinchonine), on a scale sufficiently extensive to ensure decisive results."

2. I am also to point out what will be, in my opinion, the best mode of conducting the inquiry, so as to ensure a decisive trial of the relative and positive qualities, as febrifuges, of the chinchona alkaloids, other than quinine, specified in the Despatch, and of the preparations quinium, &c., alluded to by Mr. Markham.

3. As members of the proposed Commission, I beg to name Deputy Inspector General Mackenzie, C.B., Deputy Inspector General Inglis, C.B., F.M.O., British Troops, Surgeon-Major Kennedy, Garrison Surgeon, and the Principal Inspector General, President; another member might be added hereafter.

4. I have recommended Drs. Mackenzie, Inglis, and Kennedy, not because they hold high official rank, but because I know they possess the qualifications demanded in the Despatch from the Secretary of State.

5. These gentlemen have all had long experience in the treatment of fevers, and a report from them will, I am satisfied, carry weight with the medical profession generally. Dr. Mackenzie was stationed for many years in the most feverish districts, in the Hyderabad Division, and is now Deputy Inspector General of the Mysore territory, also a feverish country. Dr. Inglis was with his regiment for about 19 years in the Bengal and Bombay Presidencies, and Dr. Kennedy has been nearly all his service a regimental officer, the latter seven years of which he was in charge of European Artillery at Kamp-tee, where fever is scarcely ever absent.

6. I have been in communication with the gentlemen just named, and they all agree with me that the first step should be to select medical men in whose reports implicit confidence can be placed, and whose medical charges are in feverish localities. These gentlemen should be supplied with sufficient quantities of the alkaloids, to enable them to give the medicines a full trial. I propose that instructions, as much in a tabulated form as the inquiries will admit of, should be supplied to each investigator.

7. These tables or reports should be sent in monthly, afterwards printed, and a copy sent to each member of the Commission. This would keep them informed as to the progress of the investigation, and would afford opportunities of suggesting, if necessary, modifications in the mode in which the inquiry is being carried on; I do not propose, except a necessity should arise, that the members of the Commission meet until, in their opinion, a sufficient amount of evidence has been obtained to enable them to offer an authoritative opinion upon the qualities relative and positive, as febrifuges, of the new alkaloids, but they will have no doubt frequent communications by letter.

8. The members of the Commission will themselves have an opportunity of watching the effects of the alkaloids in some of the hospitals at the Presidency and Bangalore.

9. When the Government has been pleased to nominate the members of the Commission,

Surgeon-Major C. B. Hearn, H.M.'s 1st Royal Regiment of Foot, Kamptee.
Ditto - F. L. Clementson, 11th Regiment N. I., Berhampore.
Surgeon G. W. Walter, 4th Regiment N. I., Secunderabad.
Ditto, H. R. Oswald, M.D., Surgeon, Mysore Commission.
Ditto, C. Cooper, M.D., 21st Regiment N. I., Mysore.
Assistant Surgeon W. N. Chipperfield, Acting Physician, General Hospital,
Ditto - J. Houston, M.D., Assistant Civil Surgeon of Mysore.
Ditto - J. Keess, M.D., M.R.C.P.L., Civil Establishment and
Superintendent of Gaol, Kurnool.
Ditto - W. C. Elliot, M.D., 7th Regiment N. I., Raepora.
Ditto - G. E. Whitton, M.B., Civil Surgeon, Cochin.
Ditto - J. M. Miller, M.D., 30th Regiment N. I., Thyetmyo.
Ditto - J. M. Houston, M.D., Medical charge Engineer's Estab-
lishment, Upper Godavery.
Ditto - W. H. Roberts, M.D., Zillah Surgeon and Superintendent
of Gaol, Salem.

* Jeypore. Nursipatam.
Ruselcondah. Ganjam.
Hill Tracts of Orissa. Sumbalporo.
Juggiapett.

I shall, after communicating with them, issue, if the Government approves, instructions to the medical officers marginally named, as to the mode in which the experiment is to be carried on.

10. These officers I know to be observing and intelligent, and will in the stations they are at present have extended opportunities of testing the new drugs.

11. In the Northern Division, more especially in the hilly districts, fever in every variety prevails at the stations noted in the margin; * at most of these there are medical subordinates, generally good men in their position, but in an inquiry so important as the one now under consideration, it appears to me that an intelligent medical officer should be selected to visit these districts, and who

should be instructed to remain at the different stations a sufficient length of time to enable him to test for himself the effects of the alkaloids both relatively and positively.

12. This duty must necessarily be accompanied by some risk, and very great discomfort. I think a liberal allowance should be granted to the officer undertaking this duty, and I hope the Government will not consider it extravagant to sanction the officer, besides the pay of his appointment, a personal allowance of at least 10 rupees a day, and travelling allowance whilst actually engaged on this duty.

13. Assistant Surgeon Dougall, now civil surgeon at Rajahmundry, is an officer well suited for this duty; he is energetic and zealous, and has informed me that he is willing to undertake it.

14. No quinium has been sent from England. I would suggest that the chemical examiner be directed to prepare a quantity at his earliest convenience, so that it might be tested with the other drugs.

ORDER of the Madras Government, 28th March 1866.

1. THE Government approve and sanction the various arrangements proposed by Mr. Shaw.

2. The Commission will, for the present, be constituted as follows:—

President, Mr. Shaw, Officiating Principal Inspector General, Medical Department.

Members - - - { Dr. W. MacKenzie, C.B.
Dr. J. G. Inglis, C.B.
Dr. J. Kennedy.

3. Mr.

3. Mr. Shaw will, as he proposes, issue such instructions as may be necessary to the officers whose names are mentioned in the margin of paragraph 9 of his letter.

4. Mr. J. Dougall will be employed in the manner proposed in paragraph 12, when the requisite drugs are obtained, and will receive a personal allowance while so engaged of 10 rupees per diem, besides travelling allowance.

5. Application will be made to Her Majesty's Government for a sufficient supply of the various alkaloids and preparations which are to be tested; and meanwhile the chemical examiner will prepare a quantity of quinium, applying to Mr. McIvor for the bark.

Enclosure 2, in No. 4.

From the Officiating Principal Inspector General, Medical Department, to the Secretary to Government, Revenue Department, Fort St. George, 27th April 1866.

1. WITH reference to the Order of Government of 28th March 1866, I have the honour to bring to the notice of the Right Honourable the Governor in Council that Assistant Surgeon J. Keess, Civil Surgeon, Kurnool, has been good enough to volunteer to carry out the experiments now about to be instituted to test the efficacy of the new alkaloids at Goodaloor, in the Wynad.

2. Goodaloor is one of the most feverish places in the feverish district of Wynad. Lately a small dispensary has been established there, to which is attached an assistant apothecary; but, to carry out the inquiry satisfactorily at such a place, it will be a great assistance to have an intelligent officer like Dr. Keess, who might also visit other feverish places in the district.

3. Should his Excellency the Governor in Council be pleased to sanction the employment of Dr. Keess on this duty, as the privation and risk he will be subjected to will be equal to those of Dr. Dougall, I respectfully suggest that he be also placed under the provisions of paragraph 4 of Order No. 764 of 28th March 1866.

4. I beg to forward the tabulated form intended to be sent out, and request you will do me the favour of having it printed on the same description of paper as the form sent, with as much expedition as possible.

5. Each investigator will require at least one sheet or form for each of the three alkaloids, and also one for quinium. I think 1,000 of the tabulated forms will be required, but half the number need only be supplied at first.

ORDER of the Madras Government, 2nd May 1866.

1. THE Government sanction the temporary employment of Dr. Keess in the Wynad Talook, and authorise the grant to him while so employed of a personal allowance of 10 rupees per diem, besides travelling allowance.

2. The Government consider that advantage should be taken of this opportunity to test also the efficacy of the bark, twigs, and leaves of the Neilgherry chinchonas as a simple decoction. Mr. McIvor will furnish Mr. Shaw with such quantities of all three as he may require, and Mr. Shaw will include this experiment in his programme.

3. The Superintendent of the Gazette Press will comply with Mr. Shaw's requisition for forms.

— No. 5. —

From the Secretary of State of India to the Government of Madras.

India Office, 30 November 1866.

I HEREWITH transmit 20 copies of a Report on the specimens of Chinchonæ in the Herbaria at Madrid, for the information of the Superintendent of Chinchona Plantations in your Presidency, and of others interested in the cultivation of Peruvian Bark.

Enclosure in No. 5.

REPORT on the Specimens of CHINCHONÆ in the Herbaria at Madrid.

From C. R. Markham, Esq., to the Under Secretary of State for India.

Sir,

Chinchon, 21 October 1866.

WITH reference to the memorandum which I submitted on the 15th instant, I now have the honour to transmit a Report on the Specimens of Chinchonæ in the Herbaria at Madrid, which contains the results of an examination of all the specimens in the collections of Pavon and Mutis, and of a careful comparison of those of Pavon with specimens from chinchona plants now growing in India.

2. I have requested Sir John Crampton to obtain permission from the Spanish Ministro de Fomento to have a copy made of a portion of the manuscript of the botanist Mutis, which contains descriptions of the chinchona species of New Granada, and which will be useful to the superintendents of plantations in India.

REPORT.

THE expedition of the Spanish botanists, Ruiz and Pavon, to Peru and Chili, in the end of the last century, resulted in the discovery of numerous chinchonæ, some of which are now growing in India. As our Indian chinchonæ are named from the species described by Pavon, it is desirable that specimens from plants grown in India should be compared with those bearing the same name in the collection of the Spanish botanists, so that their identity may be established, or otherwise. The species referred to are *C. nitida*, *C. micrantha*, varieties of *C. officinalis*, and *C. succirubra*. It will be useful, at the same time, to note the whole of the chinchona specimens now preserved in Madrid.

On the return of Ruiz and Pavon, and the receipt of the work of their disciple Tafalla, their magnificent collection of plants was entrusted to a Royal Commission for arrangement and publication. The results of their labours are to be found in the *Flora Peruviana*, the *Quinologia* of Ruiz, with its supplement, and the *Nueva Quinologia* of Pavon, recently edited by Mr. Howard.

When the Commission had completed its labours, the chinchona specimens of Ruiz, Pavon, and Tafalla were deposited in the Herbarium of the Botanical Gardens at Madrid, where they are kept apart in two large bundles.

I.

The first bundle, or *paquete*, is marked *Chinchonarum monographia*, and contains 27 species, some of which are no longer contained in the genus Chinchona. In order that the contents of this interesting bundle may be known, I give the whole of the specimens, with the notes I made upon each.

1. *C. obtusifolia*.—Leaves, flowers, and capsules. Vulgo, "*Cascarilla crespilla mala de Loxa*." The leaves closely resemble those sent home by Cross, as *C. crespilla*. They are small and coriaceous.
2. *C. lucumæfolia*.—Leaves and flowers. Vulgo, "*Cascarilla con hojas de lucuma*." From Loxa. The leaves are similar to those of the former species, only longer.
3. *C. lanceolata*.—Leaves only. "*Cascarilla amarilla boba*." From Muña, in Peru.
4. *C. dichotoma*.—Leaves and capsules; the capsules very long and narrow.
5. *C. stupea*.—Leaves, flowers, and capsules. "*Cascarilla estoposa*." From Cuenca and Loxa.
6. *C. tarontaron*.—Leaves and capsules. Vulgo, "*Cascarilla Tarontaron*." From Jaen.
7. *C. microphylla*.—Leaves and flowers. Vulgo, "*Cascarilla con hojas de roble*." From Loxa. The leaves are small and leathery, resembling those of the two first specimens.
8. *C. Azaharito*.—Leaves, flowers, and capsules. Vulgo, "*Cascarilla Azaharito de Jaen*." Very small flower and long capsules.
9. *C. acutifolia*.—Leaves and a capsule. Found at Chicoplaya, in Peru, in the year 1798.
10. *C. globiflora*.—Leaves and flowers. Vulgo, "*Cascarilla de uñas de gato*." Found in the forests of Guayaquil, in 1779. This bears no resemblance to a chinchona; and De Candolle places it amongst the *Naucleæ* (*Prodromus*, p. 345).

11. *C. hirsuta*.

11. *C. hirsuta*.—Leaves, flowers, capsules, and seeds. Vulgo, "*Cascarilla fina delgada*." Found at Pillao and Achapatuman, in Peru. There is another packet containing varieties of *C. hirsuta*.
12. *C. magniflora*.—Leaves, flowers, and capsules. Vulgo, "*Cascarilla canela de Guayaquil*." Leaf very large; flower in close clusters.
13. *C. ovata*.—Leaves, flowers, and capsules. Vulgo, "*Cascarilla boba de pata de gallareta*." Found at Panao and Pillao, in Peru.
14. *C. purpurea*.—Leaves, flowers, and capsules. Vulgo, "*Cascarilla boba de hoja morada*."
15. *C. parabolica*.—Leaves and flowers. Vulgo, "*Cascarilla con hojas rugosas*."
16. *C. macrocalyx*.—Leaves, flowers, and capsules. Vulgo, "*Cascarilla con hoja redonda*." From Cuenca. Leaves ovate, small, and coriaceous.
17. *C. palalpa*.—Leaves and flowers. Vulgo, "*Cascarilla palo blanco*." A variety called "*Cascarilla con hojas de Zamba*."
18. *C. decurrentifolia*.—Leaves and flowers. Vulgo, "*Cascarilla crespilla humada*." From Loxa.
19. *C. rugosa*.—Leaves only. Vulgo, "*Cascarilla crespilla de Cuenca*. Leaves resembling those of Specimen No. 1.
20. *C. magnifolia*.—Leaves and capsules. Vulgo, "*Cascarilla flor de Azar*." Leaves very large, and capsules long.
21. *C. viridiflora*.—Leaves only. "*Cascarilla cucharilla*." Found at Chinchao in Peru, in 1795. Leaves much attenuated at the base.
22. *C. rosea*.—Leaves and flowers. Vulgo, "*Cascarilla Asmonich*." From Pozuzu in Peru.
23. *C. lutea*.—Leaves and flowers. Vulgo, "*Cascarilla amarilla de ynta*." 1804.
24. *C. succirubra*.—Leaves, flowers, and capsules. Vulgo, "*Cascarilla colorada de los cerros de San Antonio*." This does not appear to be exactly the same plant as the very valuable kind now growing in India under the same name. The flowers are smaller, and the capsules not quite the same shape. The leaves are the same. This specimen of Pavon is a variety grown apparently at a lower elevation, and in a less favourable locality.
25. *C. coccinea*.—Leaves, flowers, and capsules. Vulgo, "*Cascarilla serrano y pata de gallinazo*." Found near Guayaquil in 1804.
26. *C. erythrantha*.—Leaves and flowers. From Guayaquil.
27. *C. ferruginea*.—Leaves, flowers, and capsules. Vulgo, "*Cascarilla azahar macho*." Found near Jaen in 1805. Large panicles of flowers, and very coarse leaves. This is not a Chinchona; it is the *Remigia ferruginea* of De Candolle's *Pro-dromus*.

II.

The second bundle has a label on which is written, "*Hay diez especies de Chinchona glandulifera*;" but this is an erroneous description of its contents. It contains 15 specimens (the last three of which are from the collection of Mutis), as follows:—

1. *C. undulata glandulifera* (olim).—Leaves and flowers. Vulgo, "*Cascarilla negrilla de Chicoplaya*;" discovered by Tafalla. There seems to be a very slight difference between this specimen and those of *C. micrantha* from plants growing in India.
2. *C. Chahuarguera*.—Leaves and flowers. Vulgo, "*Cascarilla amarilla fina del rey*." From Loxa. Four bundles of beautifully preserved specimens. This plant is identical with that growing on the Neilgherries under the name of *C. officinalis* var. *Bonplandiana*.
3. *C. violacea*.—Leaves only. Vulgo, "*Cascarilla de hojas angostas*." Found near Cuenca in 1805.
4. *C. nitida*.—Leaves, flowers, and capsules. Vulgo, "*Cascarilla fina del Peru*." From Cuchero, Casape, Casapillo, and Pampamarca, in Peru. With the exception of the colour of the flowers, this plant appears to be identical with the *C. micrantha* of the Neilgherries.
5. *C. Condaminea* (H. et B.).—Leaves and flowers. Vulgo, "*Cascarilla fina de Uri-tusinga de Loxa*." Beautifully preserved specimens. Identical with the *C. officinalis* of the Neilgherries.
6. *C. suberosa*.—Leaves and flowers. Vulgo, "*Cascarilla pata de gallinazo*." Another variety, with leaves and capsules, from Jaen.
7. *C. Palton*.—Leaves and flowers. Vulgo, "*Cascarilla con hojas de Palton*." From Loxa.
8. *C. heterophylla*.—Leaves and flowers. Vulgo, "*Cascarilla con hojas un poco vel-ludas*." Found near Cuenca in 1805.
9. *C. micrantha*.—Leaves, flowers, and capsules. Vulgo, "*Cascarilla fina del Pueblo Nuevo*." A note is added in the handwriting of the botanist La Gasca, as follows:—"Inter glanduliferas numerari debet *C. corymbosa*, affinis de Née." The flowers are very small and white; the leaves large. This is undoubtedly the same plant as the *C. micrantha* of the Neilgherries, and probably only a variety of the *C. nitida* and *C. glandulifera* of this collection.

10. *C. villosa*.—Leaves, capsules, and seeds. Vulgo, "*Cascarilla peluda*." Found near Jaen in 1805. The capsules small and round.
11. *C. umbellulifera*.—Leaves and capsules. Vulgo, "*Cascarilla crespilla de Jaen*." Leaves very leathery; capsules small and round. Date 1805. There is a note attached, as follows:—"Inter glanduliferas collocari debet."
12. *C. conglomerata*.—Leaves, capsules, and seeds. Vulgo, "*Cascarilla colorada de Jaen*."
13. *C. cordifolia* (Mutis).—Leaves and capsules. *Quina amarilla* of Mutis.
14. *C. oblongifolia* (Mutis).—Vulgo, "*Flor de Azahar*;" *Quina naranjada* of Mutis. A note is added, in Pavon's handwriting, as follows:—"Es nuestro Chinchona magnifolia." This is not a Chinchona at all.
15. *C. ovalifolia* (Mutis).—Leaves, capsules, and seeds. *Quina blanca* of Mutis. It is the *C. macrocarpa* of Vahl.

Besides these two bundles forming Pavon's collection, there are a few specimens of Chinchonæ in the general Herbarium. They appear to have been presented either to the general Herbarium direct, or to the botanists Cavanilles* and Rodriguez who bequeathed them to the Herbarium; by Pavon, Ortega, and Née; and are marked accordingly. They are in the cupboard marked *Rubiaceæ*, in the packet No. 84, and are numbered from 4 to 19 inclusive. Many of them are not true Chinchonæ, but it will be well to enumerate them, in order that the list of Chinchonæ at Madrid may be complete. They are as follows:—

4. *Chinchona?* ex Ins. Philipicis. "Née iter."—Cavanilles.
5. *C. Chahuarguera*.—Flowers and leaves. From the collection of Pavon.—Rodriguez.
6. *C. nitida*. This is in reality *C. magnifolia* of Ruiz and Pavon. "Née dedit."—General.
7. *C. ovata*.—Leaves and flowers. There is a note as follows:—"Proxima et forte tantum varietas est *C. lanceolata*."—Cavanilles.
8. *C. hirsuta*.—Leaves and flowers. There is a note as follows:—"Se vende tan caro como la *C. nitida*." Abs dubio est *C. hirsuta*."—Cavanilles.
9. *C. purpurea*.—Leaves, flowers, and capsules.—Cavanilles.
10. *C. Uritusinga*.—Leaves and flowers, beautifully preserved. From the collection of Ruiz and Pavon.—Rodriguez.
11. *C. magnifolia*.—Leaves and capsules. "Née iter."—Rodriguez.
12. *C. macrocarpa*, of Vahl. From Santa Fé. Very large leaves and capsules. "Dedit Ortega, anno 1786."—Rodriguez.
13. *C. dichotoma*.—Leaves only. From Huanuco. "Née iter."—General.
14. *C. micrantha* ex Guaranda? "Née iter."—Leaves and flowers. The flower white and very small.—Cavanilles.
15. *C. rosea*.—Leaves and flowers. From Quito and Guayaquil. "Née iter."—Rodriguez.
16. *C. suberosa*. Leaves and flowers. From the collection of Pavon.—Rodriguez.
17. *C. ovalis?*—Leaves and capsules. "Sp. nov.;" from Peru. Small leathery leaves.—Cavanilles.
18. *C. grandiflora* or *obtusifolia*.—Very large leaves and capsules. This is not a Chinchona, but a *Cosmibuena obtusifolia*.—Rodriguez.
19. *C. Caribæa*.—Leaves and capsules. From Cuba. Not a Chinchona, though so placed by Linnæus. It is *Exostemma Caribæa*.—Cavanilles.
20. *C. Philipica*.—Leaves and flowers. This is also an *Exostemma*, found near Manilla. Presented by Cavanilles in 1803.—Cavanilles.

The conclusions which I have arrived at, from a careful comparison of the Chinchona specimens from plants grown on the Neilgherry Hills with those at Madrid, are as follows:—The specimens of Pavon's collection marked *C. Chahuarguera*, *C. Uritusinga*, and *C. Condaminea* are identical with our *C. officinalis*, varieties *Condaminea* and *Bonplandiana*. I have been unable to identify the *C. officinalis* var. *crispa* of our plantations, as I only have specimens of leaves sent home by Cross; but these leaves closely resemble those of *C. obtusifolia*, *C. lucumæfolia*, and *C. rugosa* in the collection of Pavon. The native names of the first and last of these are *Cascarilla crespilla*, the one from Cuenca, the other from Loxa. The *C. succirubra* of our plantations is slightly different, in the flower, from the specimens at Madrid. As regards the Peruvian species yielding grey bark, I am of opinion that the plants growing on the Neilgherries are identical in species, though varying in appearance from local causes, with the specimens in Pavon's collection which are marked *C. micrantha*, *C. nitida*, and *C. glandulifera*. I understand that Mr. Howard has come to the same conclusion, and that he proposes to group the whole of the grey bark Chinchonæ, which are peculiarly Peruvian, under one species, to be called *C. Peruviana*. It will be observed that the Spanish botanist La Gasca has made a note under the *C. micrantha* specimen, to the effect that "*Inter glanduliferas numerari debet*."

In addition to the collection of Ruiz and Pavon, the whole of the results of the expedition commanded by Mutis are now buried in cupboards in a building at the Botanical Gardens

* Author of the History of Valencia.

Gardens of Madrid. As Mutis is the chief authority on all matters relating to New Granada barks, I considered it important to bring away as much information as was attainable from the Mutis collections. One of the most valuable of our Indian species, *C. lancifolia*, is from New Granada, and additional information respecting the New Granada Chinchonæ is, therefore, a desideratum.

In 1783 Don José Celestino Mutis was nominated "Chief Director of the botanical expedition to the New Kingdom of Granada," and he was employed in this service until his death at Bogota in 1808. Besides rearing several men of science, such as Zea and Caldas, who became his disciples in botany, a number of young South Americans were taught to draw plants. The results of the expedition were a large and valuable collection of dried plants, upwards of 5,000 beautiful coloured drawings, and numerous manuscript notes by Mutis and his disciple Caldas. Mutis died in 1808, and while his disciples were engaged in arranging his collections the revolution broke out. The brutal Spanish General Morillo marched to Bogota, shot Caldas in the back, burnt his manuscripts, and sent all the other results of the expedition of Mutis that he could lay his hands upon to Madrid. They are now in a room at the Botanical Gardens, but in a state of great confusion.

There is one large bundle of dried specimens marked *Chinchonæ*, but there are no labels or notes to each specimen, and only one is a true Chinchona. There are also a number of coloured drawings of Chinchonæ; but the drawings are in such confusion that I was unable to find those representing the Chinchonæ of Mutis, although I searched for a long time. Finally, there is a very important manuscript on the subject of the Chinchonæ of New Granada, drawn up from the rough notes of Mutis. I was informed that the portion of this manuscript relating to the medicinal virtues of Chinchona bark was transcribed and published by a Dr. Gregorio in 1828. After a long search amongst the numerous old book stalls in Madrid, I at length succeeded in procuring a copy of this book, and I propose hereafter to translate such portions as appear likely to be useful or interesting to Chinchona cultivators or medical men in India. But that portion of the manuscript which contains botanical descriptions of the Chinchonæ of New Granada has never been printed. I have, therefore, requested Sir John Crampton to obtain permission from the Ministro de Fomento to have it transcribed. It contains constant references to the drawings, which might easily be photographed.

It seems very desirable that the superintendent of Chinchona plantations on the Neilgherries should be in possession of all the information that was collected by Mutis, and which now lies buried at Madrid, with reference to the Chinchona trees of New Granada, one species of which is thriving in India, and will hereafter form, with the varieties of *C. officinalis*, the plantations on the higher elevations of the Neilgherries and Koondahs.

Clements R. Markham.

Chinchon, 21 October 1866.

— No. 6. —

From the Government of Madras to the Secretary of State for India.

Madras, 26 June 1866.

We have the honour to forward for your information the accompanying Tabular Report on the number, condition, &c. of the Chinchona plants on the Neilgherries on the 31st May 1866.

Enclosure in No. 6.

REPORT on the Number, Distribution, and Condition of Chinchona Plants on the Neilgherries on the 31st May 1866.

Species.	Botanical Names.	Commercial Names.	Number of Plants.	Value per lb. of Dry Bark in the London Market.	REMARKS.	
				s. d. s. d.		
1	C. Succirubra - -	Red Bark - -	2,98,408	2 0 10 8 9	The weather being favourable, planting operations have commenced. The number of plants planted out during the month being 2,860, making the total number permanently planted out, 2,49,550.	
2	C. Calisaya - -	Yellow Bark - -	40,181	2 10 „ 7 -		
	Var. Frutex - -					
	Var. Vera - -					
3	C. Officinalis - -	Original Loxa Bark -	580	2 10 „ 7 -		The increase by propagation is 32,494, being 21,639 under the average of the last six months, making the total number of plants, 11,56,070.
	Var. Condamenia - -					
	(C. Uritusinga) - -	Select Crown Bark -	7,82,049	2 10 „ 7 -		
4	Ditto - -					
	Var. Bonplandiana - -	Fine Crown Bark -	4,380	2 10 „ 6 -		
	(C. Chahuarguera) - -					
5	C. Crespilla - -	Pitayo Bark - -	231	1 8 „ 2 10		
6	C. Lanceifolia - -	Genuine Grey Bark -	2,786	1 8 „ 2 9		
7	C. Nitida - -	Fine Grey Bark -	8,500	1 8 „ 2 10		
8	C. Species without name.					
9	C. Micrantha - -	Grey Bark - -	15,141	1 8 „ 2 9		
10	C. Peruviana - -	Finest Grey Bark -	3,389	1 8 „ 2 10		
11	C. Pabudiana - -	Unknown - -	425	Unknown.		
TOTAL Number of Plants - - -			11,56,070			

TABLE II.

MEMORANDUM of the Growth of Eleven Plants of C. Succirubra, Planted on the Second Denison Plantation at Neddivuttum, on the 30th August 1862.

Number of Plants.	Height in Inches when Planted on the 30th August 1862.	Height in Inches on the 30th April 1863.	Height in Inches on the 31st May 1866.	Growth in Inches during May 1866.	By whom Planted.	REMARKS.
1	28	136½	139	2½	His Excellency Sir W. Denison.	Table II. exhibits the growth of 11 plants of C. Succirubra, planted out by his Excellency the late Governor and other gentlemen at Neddivuttum, on the 30th August 1862. The average growth of these plants during the month is 2½ inches, or 1½ inches above the growth of last month.
2	16½	119½	122	2½		
3	19	123	125½	2½		
4	15	111½	113½	2½		
5	27	141½	143	1½		
6	20	109	109	-	J. W. Brecks, Esq.	One of the two plants cut down on the 20th March 1863 for the bark, submitted to Mr. Howard for analysis, has made strong shoots of 83 inches in height.
7	20	124½	126	1½		
8	18	126½	129½	3		
9	20	131	135½	4½	J. D. Sim, Esq.	
10	20	134½	138½	4½	Lieutenant McLeod.	
11	18	116	119	3	P. Grant, Esq.	
12	-	83	83	-	Plant cut down for bark.	

TABLE III.

Showing the Height of Twelve Plants of *C. Officinalis* planted on the Dodabetta Plantation at Ootacamund on the 30th September 1863.

Number of Plants.	Height in Inches when Planted on the 30th September 1863.	Height in Inches on the 30th April 1866.	Height in Inches on the 31st May 1866.	Growth in Inches during May 1866.	REMARKS.
1	19	114	117	3	The 12 plants of <i>C. Officinalis</i> (a shrubby species) on the Dodabetta Plantation gives an average growth of about three inches, or half-an-inch above the growth of last month.
2	14½	101	103	2	
3	28	116½	118½	2	
4	22	112	115	3	
5	21½	118½	122½	4	
6	28	125	128	3	Several plants of <i>C. Succirubra</i> Calisaya and Condamenia have furnished a good supply of fine seeds, which are now germinating freely.
7	22½	110½	115	4½	
8	21½	110½	114½	4	
9	21½	121½	123	1½	
10	19½	115	117½	2½	
11	24	118½	120½	1½	
12	24	118	123	5	

TABLE IV.

Register of Chinchona Plants Distributed.

NAMES.	STATIONS.	Number of Plants.	REMARKS.
Mr. F. N. Maltby -	Travancore -	16	The number of plants issued to the public during the month is 69, making the total distributed, 1,00,757.
Dr. Junghun -	Java -	56	
Mr. A. R. Lascelles -	Ootacamund -	12	
Mr. M. Anderson -	Jamaica -	2	
Dr. Wiehe -	Bombay -	10	
Dr. T. Anderson -	Calcutta -	554	
Dr. Jamieson -	Saharanpore -	107	
Professor Lees -	Calcutta -	547	
Rajah of Travancore -	Travancore -	521	
Major Morgan -	Ootacamund -	1,534	
Mr. E. T. Fitzgerald -	Calcutta -	558	
Mr. J. W. B. Money -	- ditto -	1,369	
Mr. W. Bourne -	- ditto -	532	
Captain Cox -	Wynad -	6	
Mr. Hollock -	- ditto -	2	
Mr. T. Sheffield -	Ootacamund -	12	
Dr. F. Day -	Cochin -	100	
Mr. Brown -	Tellicherry -	12	
Mr. J. Hall -	Ootacamund -	156	
Mr. T. Knop -	- ditto -	18	
Captain Lees -	Bengal -	386	
Mr. W. H. Rayne -	Manantoddy -	424	
Rev. Sawyer -	Ootacamund -	1,018	
Mr. Frend -	- ditto -	512	
Mr. Hollock -	- ditto -	1	
Mr. J. Pierie -	Seegoor -	12	
Colonel Scott -	Ootacamund -	1,236	
Mr. Berend -	Cachar -	275	
Rev. J. Hunter -	Coonoor -	12	
Mr. J. Mullaly -	- ditto -	160	
Mr. W. H. Stanes -	- ditto -	1,262	
Colonel R. Conper -	Kotagherry -	12	
Mr. F. Cockburn -	- ditto -	12	
Colonel Woodfall -	Coonoor -	12	
Mr. C. Anderson -	- ditto -	24	
Colonel Angelo -	Ootacamund -	12	
Rev. E. Laseron -	- ditto -	12	
Captain R. N. Taylor -	Coorg -	96	

TABLE IV.—Register of Chinchona Plants Distributed—*continued*.

NAMES.	STATIONS.	Number of Plants.	REMARKS.
Major W. Agnew - - - -	Assam - - - -	139	
Mr. V. H. Levinge - - - -	Madura - - - -	12	
Chief Commissioner of - - - -	Nagpore - - - -	28	
Mr. Fletcher - - - -	Ootacamund - - - -	24	
Gool Mahomed - - - -	- ditto - - - -	20	
General McCleverty - - - -	New Zealand - - - -	23	
Mr. W. Robinson - - - -	Kotagherry - - - -	230	
Mr. Croke - - - -	Wynad - - - -	12	
Mr. H. R. Dawson - - - -	Seegoor - - - -	12	
Captain Mann - - - -	Coorg - - - -	48	
Mr. E. Roberts - - - -	- ditto - - - -	530	
Mr. H. Russell - - - -	Wynad - - - -	52	
Reverend Wait - - - -	Coonoor - - - -	2	
Collector of Belgaum - - - -	Belgaum - - - -	28	
Collector of Honore - - - -	Honore - - - -	28	
Dr. Ross - - - -	- ditto - - - -	15	
His Excellency the Governor - - - -	Bombay - - - -	158	
Mr. H. Hinde - - - -	Wynad - - - -	12	
Mr. E. B. Thomas - - - -	Coonoor - - - -	74	
Rajah of Poonganoor - - - -	Poonganoor - - - -	12	
Major Grant - - - -	Wellington - - - -	226	
Messrs. Thomson, Shaw & Co. - - - -	Poonganoor - - - -	28	
Mr. J. H. Triuson - - - -	- ditto - - - -	31	
Dr. Muller - - - -	Melbourne - - - -	28	
Mr. Tyrrell - - - -	Mysore - - - -	12	
Dr. Sayers - - - -	Vellore - - - -	12	
Major C. P. Taylor - - - -	Ootacamund - - - -	5,250	
Doctor Wilson - - - -	- ditto - - - -	6	
Mr. Schnarrie - - - -	- ditto - - - -	15,000	
Captain Fuller - - - -	Coonoor - - - -	417	
Dr. Drummond - - - -	Ootacamund - - - -	224	
Captain Jennings - - - -	- ditto - - - -	1,756	
Lieut. H. B. Montmorency - - - -	Bangalore - - - -	6	
Mr. McHutchin - - - -	Ootacamund - - - -	3	
Colonel Molesworth - - - -	- ditto - - - -	6	
Mr. C. Gray - - - -	Coonoor - - - -	12	
Mr. H. B. Leddell - - - -	Ootacamund - - - -	12	
Mr. Minchin - - - -	Wynad - - - -	1,600	
His Excellency the Governor - - - -	Vizagapatam - - - -	35	
Mr. R. F. Phillips - - - -	Kotagherry - - - -	1,117	
Colonel Cooke - - - -	- ditto - - - -	24	
Mr. G. J. Glasson - - - -	Wynad - - - -	1,000	
Dr. Macpherson - - - -	Mercara - - - -	400	
Mr. W. H. Kerr - - - -	Coorg - - - -	3,100	
Mr. James - - - -	Ootacamund - - - -	1,000	
Colonel Whish - - - -	Bangal - - - -	82	
Mr. K. Mair - - - -	Calcutta - - - -	1,180	
Mr. W. Shakespear - - - -	- ditto - - - -	61	
Mr. E. E. Meakin - - - -	- ditto - - - -	168	
Mr. C. Ackland - - - -	- ditto - - - -	150	
Mr. K. Molver - - - -	- ditto - - - -	124	
Mr. Havelock - - - -	Ootacamund - - - -	12	
Mr. H. de Facien - - - -	Kartaury - - - -	6,821	
Major Sweet - - - -	- ditto - - - -	910	
Captain Campbell - - - -	Bangalore - - - -	6	
Royal Gardens - - - -	Mauritius - - - -	36	
Honourable W. R. Arbuthnot - - - -	Wynad - - - -	93	
Mr. H. Maxwell - - - -	Bombay - - - -	50	
Mrs. C. Smith - - - -	Wynad - - - -	316	
Captain Beekley - - - -	Wellington - - - -	200	
Mr. Walsh - - - -	Salem - - - -	100	
His Excellency the Governor General - - - -	Java - - - -	175	
Captain Richardson - - - -	Kulhatty - - - -	509	
Rajah of Poonganoor - - - -	Poonganoor - - - -	24	
His Excellency the Governor - - - -	Madras - - - -	24	
Mr. J. W. B. Money - - - -	Ootacamund - - - -	25,000	
Captain Mitcheson - - - -	- ditto - - - -	50	
Mr. R. H. Elliot - - - -	Munjerabad - - - -	157	
His Excellency the Governor General - - - -	Goa - - - -	252	
Colonel Phayre - - - -	Rangoon - - - -	153	
Mr. Ryall - - - -	Kotagherry - - - -	24	

TABLE IV.—Register of Chinchona Plants Distributed—continued.

NAMES.	STATIONS.	Number of Plants.	REMARKS.
Mr. J. Gordon - - - -	Coonoor - - - -	1,701	
Mr. J. Rohde - - - -	Neddivuttum - - -	11,689	
Mr. J. Higginbotham - - -	Goodaloor - - - -	12	
Mr. S. Pitot - - - -	Mauritius - - - -	36	
Mr. J. Horne - - - -	- ditto - - - -	36	
M. Edouard Cremary - - -	Reunion - - - -	51	
For the French Government - - -	Algiers - - - -	45	
Mr. J. B. Norton - - - -	Shevaroy - - - -	50	
Mr. Mackay - - - -	Punjab - - - -	50	
Mr. W. Forsyth - - - -	Central Provinces - - -	169	
Colonel Cadell - - - -	Coorg - - - -	62	
Mr. J. L. Browning - - - -	Wynad - - - -	4	
Mr. H. Leeds - - - -	Burmah - - - -	112	
Maloo Sait - - - -	- ditto - - - -	6	
Mr. A. D. Brown - - - -	Dimhutty - - - -	53	
Mr. J. C. Misquith - - - -	Ootacamund - - - -	300	
Mr. J. L. Transsen - - - -	Coonoor - - - -	8	
Captain Fitzgerald - - - -	Calcutta - - - -	150	
Mr. J. Macpherson - - - -	Ootacamund - - - -	12	
Major Travers - - - -	- ditto - - - -	5,000	
Mr. S. Preger - - - -	Vithry, Wynad - - -	69	
TOTAL Number of Plants - - -		1,00,757	

Ootacamund,
18 June 1866.

(signed) W. G. McIvor,
Superintendent Government Chinchona Plantations.

Order of the Madras Government, 23rd June 1866.

1. Ordered to be forwarded to the Secretary of State; to the Supreme Government, and to the other Governments in India; also to the Superintendent Chinchona Plantations in Java.
2. Ordered also to be laid on the Editor's table.

(True Extract.)

(signed) W. Hudleston,
Acting Secretary to Government.

— No. 7. —

From the Madras Government to the Secretary of State for India.

Madras, 26 June 1866.

1. WITH reference to your Despatch, dated 9th May 1866, we have to intimate to you that three parcels, containing 120,000 seeds of Chinchona Succirubra, 90,000 seeds of C. Calisaya, and 25,000 seeds of C. Officinalis have been forwarded by steamer to your address for the Mexican Government.
2. Mr. McIvor's Manual on Chinchona Cultivation is under revision, and copies of the new edition will be transmitted to you as soon as it is printed.

Enclosure in No. 7.

From the Superintendent Government, Chinchona Plantations, to the Acting Secretary to the Madras Government.

Ootacamund, 22 June 1866.

1. WITH reference to the order of Government, under date the 16th June 1866, I have the honour to forward herewith three parcels containing 120,000 seeds of Chinchona Succirubra, 90,000 seeds of C. Calisaya, and 25,000 seeds of C. Officinalis, for transmission to the Right Honourable the Secretary of State for India.
2. Only

2. Only one edition of my Manual on Chinchona cultivation has been published, and of this not a single copy is now in my possession, and a further edition is much needed, which, with the approval of Government, I will at once prepare. In the meantime, I beg to enclose a short paper on the germination and growth of seeds of the medicinal Chinchonas, which, should the Government approve, I would respectfully solicit the favour of fifty copies being printed and furnished to me for distribution with the seeds we are at present issuing to the public.

Order of the Madras Government, 26 June 1866.

1. Ordered that the seeds be forwarded to the Right Honourable the Secretary of State for India, with reference to his Despatch, dated 9th May 1866.
2. One hundred and fifty copies of the Memorandum will be printed, of which 20 copies will be sent to the Secretary of State, 20 copies to the Government of Batavia, 20 copies to the Government of Mauritius, 50 copies to Mr. McIvor, as requested, and 20 copies to Dr. Cleghorn. The remainder will be retained in store.
3. Mr. McIvor will prepare a new edition of the Manual for the press, as proposed by him, and forward the MS. to the Government Office when ready.

(True Extract.)
(signed) W. Hudleston,
Acting Secretary to Government.

— No. 8. —

From the Government of Madras to the Secretary of State for India.

Madras, 26 July 1866.

We have the honour to forward for your information the accompanying Tabular Report on the number, condition, &c. of the Chinchona plants on the Neilgherries on the 30th June 1866.

Enclosure in No. 8.

REPORT on the Number, Distribution, and Condition of Chinchona Plants on the Neilgherries, on the 30th June 1866.

Species.	Botanical Names.	Commercial Names.	Number of Plants.	Value per lb. of Dry Bark in the London Market.	REMARKS.
1	C. succirubra - -	Red Bark - -	3,00,201	s. d. s. d. 2 6 to 8 9	The number of plants planted out during the month is 82,145, making the total permanently planted out in the plantations 3,31,695. The increase by propagation is 42,376, being 11,143 plants under the average of the last six months, making the total number 11,96,494.
2	C. Calisaya, var. Frutex, var. Vera	Yellow Bark - -	40,481	2 10 to 7 -	
3	C. officinalis, var. Condamenia (C. Uritusinga).	Original Loxa Bark -	580	2 10 to 7 -	
4	C. officinalis, var. Bonplandiana (Chahuarguera).	Select Crown Bark -	8,20,380	2 10 to 7 -	
5	C. Crespilla - -	Fine Crown Bark -	4,380	2 10 to 6 -	
6	C. Lancifolia - -	Pitayo Bark - -	281	1 8 to 2 10	
7	C. Nitida - -	Genuine Grey Bark -	2,786	1 8 to 2 9	
8	C. Species without name.	Fine Grey Bark -	8,500	1 8 to 2 10	
9	C. Micrantha - -	Grey Bark - -	15,141	1 8 to 2 9	
10	C. Peruviana - -	Finest Grey Bark -	3,329	1 8 to 2 10	
11	C. Pahudiana - -	Unknown - -	425	Unknown.	
TOTAL Number of Plants - - -			11,96,494		

TABLE II.

MEMORANDUM of the Growth of Eleven Plants of *C. succirubra*, Planted on the Second Denison Plantation, at Neddivuttum, on the 30th August 1862.

Number of Plants.	Height in Inches when Planted on the 30th August 1862.	Height in Inches on the 31st May 1866.	Height in Inches on the 30th June 1866.	Growth in Inches during June 1866.	By whom Planted.	REMARKS.
1	23	139	139½	½	His Excellency Sir W. Denison.	Table II. exhibits the growth of 11 plants of <i>C. Succirubra</i> , planted out by his Excellency the late Governor and other gentlemen at Neddivuttum on the 30th August 1862. The average growth of these plants during the month is ¾ths of an inch, or 2½ inches under the growth of last month.
2	16½	123	122½	½		
3	19	125½	126	½		
4	15	113½	114	½		
5	27	143	143	- -		
6	20	109	110	1	J. W. Breeks, Esq. Dr. Sanderson. J. D. Sim, Esq. Lieutenant M'Leod. P. Grant, Esq. Plant cut down for bark.	One of the two plants cut down on the 20th March 1863 for the bark, submitted to Mr. Howard for analysis, has made strong shoots of 83 inches in height.
7	20	126	126	- -		
8	18	129½	129½	- -		
9	20	135½	135½	- -		
10	20	138½	138½	- -		
11	18	119	119	- -		
12	- -	83	83	- -		

TABLE III.

SHOWING the Height of Twelve Plants of *C. officinalis*, Planted on the Dodabetta Plantation at Ootacamund, on the 30th September 1863.

Number of Plants.	Height in Inches when Planted on the 30th Sept. 1863.	Height in Inches on the 31st May 1866.	Height in Inches on the 30th June 1866.	Growth in Inches during June 1866.	REMARKS.
1	19	117	119½	2½	The 12 plants of <i>C. officinalis</i> (a shrubby species) on the Dodabetta Plantation, gives an average growth of 2½ inches, or half an inch under the growth of last month. Several plants of <i>C. succirubra</i> , <i>Calisaya</i> , and <i>Condamenia</i> , have furnished a good supply of fine seeds, which are now germinating freely.
2	14½	103	105	2	
3	28	118½	121½	3	
4	22	115	117½	2½	
5	21½	122½	126	3½	
6	23	128	130	2	
7	22½	115	117½	2½	
8	21½	114½	117½	3	
9	21½	123	126	2	
10	19½	117½	120	2½	
11	24	120½	122½	2	
12	24	123	125½	2½	

TABLE IV.—Register Chinchona Plants Distributed.

NAMES.	STATIONS.	Number of Plants.	REMARKS.
Mr. F. N. Maltby - - - -	Trevandrum - - - -	16	The number of plants issued to the public during the month is 1,952, making the total distributed 1,02,709.
Dr. Junghun - - - -	Java - - - -	56	
Mr. A. R. Lascelles - - - -	Ootacamund - - - -	12	
Mr. M. Anderson - - - -	Jamaica - - - -	2	
Dr. Wiche - - - -	Bombay - - - -	10	
Dr. T. Anderson - - - -	Calcutta - - - -	554	
Dr. Jamieson - - - -	Saharanpore - - - -	107	
Professor Lees - - - -	Calcutta - - - -	547	
Rajah of Travancore - - - -	Travancore - - - -	521	
Major Morgan - - - -	Ootacamund - - - -	1,534	
Mr. E. T. Fitzgerald - - - -	Calcutta - - - -	558	
Mr. J. W. B. Money - - - -	- ditto - - - -	1,369	
Mr. W. Bourne - - - -	- ditto - - - -	532	
Captain Cox - - - -	Wynaad - - - -	6	
Mr. Hollock - - - -	- ditto - - - -	2	
Mr. T. Sheffield - - - -	Ootacamund - - - -	12	
Dr. F. Day - - - -	Cochin - - - -	100	
Mr. Brown - - - -	Tellicherry - - - -	12	
Mr. J. Hall - - - -	Ootacamund - - - -	156	
Mr. T. Knop - - - -	- ditto - - - -	18	
Captain Lees - - - -	Bengal - - - -	386	
Mr. W. H. Rayne - - - -	Munantoddy - - - -	424	
Reverend Sawyers - - - -	Ootacamund - - - -	1,018	
Mr. Frend - - - -	- ditto - - - -	512	
Mr. Hollock - - - -	- ditto - - - -	1	
Mr. J. Pierie - - - -	Seegoor - - - -	12	
Colonel Scott - - - -	Ootacamund - - - -	1,236	
Mr. Berend - - - -	Cachar - - - -	275	
Reverend J. Hunter - - - -	Coonoor - - - -	12	
Mr. T. Mullaly - - - -	- ditto - - - -	160	
Mr. W. H. Stanes - - - -	- ditto - - - -	1,262	
Colonel R. Cooper - - - -	Kotagherry - - - -	12	
Mr. F. Cockburn - - - -	- ditto - - - -	12	
Colonel Woodfall - - - -	Coonoor - - - -	12	
Mr. C. Anderson - - - -	- ditto - - - -	24	
Colonel Angelo - - - -	Ootacamund - - - -	12	
Reverend E. Laseron - - - -	- ditto - - - -	12	
Captain R. N. Taylor - - - -	Coorg - - - -	96	
Major W. Agnew - - - -	Assam - - - -	139	
Mr. V. H. Levinge - - - -	Madura - - - -	12	
Chief Commissioner of - - - -	Nagpore - - - -	28	
Mr. Fletcher - - - -	Ootacamund - - - -	24	
Gool Mahomed - - - -	- ditto - - - -	20	
General McCleverty - - - -	New Zealand - - - -	23	
Mr. W. Robinson - - - -	Kotagherry - - - -	330	
Mr. Clarke - - - -	Wynaad - - - -	12	
Mr. H. R. Dawson - - - -	Seegoor - - - -	12	
Captain Mann - - - -	Coorg - - - -	48	
Mr. E. Roberts - - - -	- ditto - - - -	530	
Mr. H. Russell - - - -	Wynaad - - - -	52	
Reverend Wait - - - -	Coonoor - - - -	2	
Collector of Belgaum - - - -	Belgaum - - - -	28	
Collector of Honore - - - -	Honore - - - -	28	
Dr. Ross - - - -	- ditto - - - -	15	
His Excellency the Governor - - - -	Bombay - - - -	158	
Mr. H. Hinde - - - -	Wynaad - - - -	12	
Mr. E. E. Thomas - - - -	Coonoor - - - -	274	
Rajah of Poonganoor - - - -	Poonganoor - - - -	12	
Major Grant - - - -	Wellington - - - -	226	
Messrs. Thomas, Shaw & Co. - - - -	Poonganoor - - - -	28	
Mr. J. H. Trinson - - - -	- ditto - - - -	31	
Dr. Muller - - - -	Melbourne - - - -	28	
Mr. Tyrrell - - - -	Mysore - - - -	12	
Dr. Sayers - - - -	Vellore - - - -	12	
Major C. P. Taylor - - - -	Ootacamund - - - -	5,250	
Dr. Wilson - - - -	- ditto - - - -	6	
Mr. Schannarrie - - - -	- ditto - - - -	15,000	
Captain Fuller - - - -	Coonoor - - - -	417	
Dr. Drummond - - - -	Ootacamund - - - -	224	
Captain Jennings - - - -	- ditto - - - -	1,756	
Lieutenant H. B. Montmorency - - - -	Bangalore - - - -	6	
Mr. McHutchin - - - -	Ootacamund - - - -	3	

OF CHINCHONA PLANTS IN INDIA.

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TABLE IV.—Register of Chinchona Plants Distributed—*continued*.

NAMES.	STATIONS.	Number of Plants.	REMARKS.
Colonel Molesworth	Ootacamund	6	
Mr. C. Gray	Coonoor	12	
Mr. H. B. Liddell	Ootacamund	12	
Mr. Minchin	Wynaad	1,600	
His Excellency the Governor	Vizagapatam	35	
Mr. R. F. Phillips	Kotagherry	1,117	
Colonel Cooke	- ditto	24	
Mr. G. J. Glasson	Wynaad	1,000	
Dr. Macpherson	Mercara	400	
Mr. W. H. Kerr	Coorg	3,100	
Mr. James	Ootacamund	1,000	
Colonel Whish	Bengal	82	
Mr. K. Mair	Calcutta	1,180	
Mr. W. Shakespear	- ditto	61	
Mr. E. E. Meakin	- ditto	168	
Mr. C. Ackland	- ditto	150	
Mr. K. McIver	- ditto	124	
Mr. Havelock	Ootacamund	12	
Mr. H. de Facien	Kartairy	6,821	
Major Sweet	- ditto	910	
Captain Campbell	Bangalore	6	
Royal Gardens	Mauritius	36	
Honourable W. R. Arbuthnot	Wynaad	98	
Mr. H. Maxwell	Bombay	50	
Mrs. C. Smith	Wynaad	316	
Captain Meekley	Wellington	200	
Mr. Walsh	Salem	150	
His Excellency the Governor General	Java	175	
Captain Richardson	Kulbuitty	509	
Rajah of Poonganoor	Poonganoor	24	
His Excellency the Governor	Madras	24	
Mr. J. W. B. Money	Ootacamund	25,000	
Captain Mitcheson	- ditto	50	
Mr. R. H. Elliot	Munjerabad	157	
His Excellency the Governor General	Goa	252	
Colonel Phayre	Rangoon	152	
Mr. Ryall	Kotagherry	24	
Mr. J. Gordon	Coonoor	3,401	
Mr. J. Rohde	Neddivuttum	11,689	
Mr. J. Higginbotham	Goordaloor	12	
Mr. S. Pital	Mauritius	36	
Mr. J. Horne	- ditto	36	
Mr. Edouard Cremary	Reunion	51	
For the French Government	Algiers	45	
Mr. J. B. Norton	Shevaroy	50	
Mr. Mackay	Punjab	50	
Mr. W. Forsyth	Central Provinces	169	
Colonel Cadell	Coorg	62	
Mr. J. L. Browning	Wynaad	4	
Mr. H. Leeds	Burmah	112	
Maleo Sait	- ditto	6	
Mr. A. D. Brown	Dimhutty	58	
Mr. J. C. Misquith	Ootacamund	300	
Mr. J. L. Pransen	Coonoor	8	
Captain Fitzgerald	Calcutta	150	
Mr. J. Macpherson	Ootacamund	12	
Major Travers	- ditto	5,000	
Mr. S. Preger	Vithry, Wynaad	69	
Reverend Wenger	Kaity	2	
TOTAL Number of Plants		102,709	

Ootacamund,
21 July 1866.(signed) *W. G. McIvor*,
Superintendent Government Chinchona Plantations.

Order of the Madras Government, 26th July 1866.

1. Ordered to be forwarded to the Secretary of State; to the Supreme Government,
and to the other Governments in India; also to the Superintendent, Chinchona Planta-
tions, in Java.

(True Extract.)

(signed) *J. Grose*,

Under Secretary to Government.

— No. 9. —

From the Madras Government to the Secretary of State for India,
Madras, 12 September 1866.

1. We have the honour to forward, for your information, the accompanying Tabular Report on the number, condition, &c. of the Chinchona plants on the Neilgherries, on the 31st July 1866.
2. We beg to be informed whether, in future, a quarterly or half-yearly return of this kind would not be sufficient.

Enclosure in No. 9.

REPORT on the Number, Distribution, and Condition of Chinchona Plants on the Neilgherries, on the 31st July 1866.

Species.	Botanical Names.	Commercial Names.	Number of Plants.	Value per Lb. of Dry Bark in the London Market.	REMARKS.
				s. d. s. d.	
1	<i>C. succirubra</i> - -	Red Bark - -	400,519	2 6 to 8 9	The number of plants planted out during the month is 69,516, making the total permanently planted out in the plantations 401,211. The increase by propagation is 128,600, being 76,918 plants above the average of the last six months, making the total number 1,317,090.
2	<i>C. Calisaya</i> ; <i>C. frut-</i> <i>tex</i> ; <i>C. vera</i> .	Yellow Bark - -	40,427	2 10 to 7 -	
	<i>C. officinalis</i> .				
3	<i>C. condamenia</i> - -	Original - -	50,215	2 10 to 7 -	
4	<i>Bonplandiana</i> - -	Loxa Bark - -	791,047	2 10 to 7 -	
5	<i>C. crespa</i> - -	Fine Crown Bark - -	4,380	2 10 to 6 -	
6	<i>C. lancifolia</i> - -	Pitayo Bark - -	261	1 8 to 2 10	
7	<i>C. nitida</i> - -	Genuine Grey Bark -	2,786	1 8 to 2 9	
8	<i>C. species</i> without name.	Fine Grey Bark -	8,500	1 8 to 2 10	
9	<i>C. micrantha</i> - -	Grey Bark - -	15,141	1 8 to 2 9	
10	<i>C. Peruviana</i> - -	Finest Grey Bark -	3,389	1 9 to 2 10	
11	<i>C. Pahudiana</i> - -	Unknown - -	425	Unknown.	
TOTAL Number of Plants - - -			1,317,090		

TABLE II.

MEMORANDUM of the Growth of Eleven Plants of *C. succirubra*, planted on the Second Denison Plantation, at Neddivuttum, on the 30th August 1862.

Number of Plants.	Height in Inches when Planted on the 30th August 1862.	Height in Inches on the 30th June 1863.	Height in inches on the 31st July 1866.	Growth in Inches during July 1866.	By whom Planted.	REMARKS.
1	23	139½	141	1½	Sir W. Denison.	Table II. exhibits the growth of 11 plants of <i>C. succirubra</i> , planted out by Sir W. Denison and other gentlemen at Neddivuttum on the 30th August 1862. The average growth of these plants during the month is about 2 inches, or 1½ inch above the growth of last month. One of the two plants cut down on the 20th March 1863 for the bark submitted to Mr. Howard for analysis, has made strong shoots of 85½ inches in height, giving the growth of 2½ inches during the month.
2	16½	122½	123½	1		
3	19	126	128½	2½		
4	15	114	116½	2½		
5	27	143	144½	1½		
6	20	100	102½	2½	J. W. Breeks, Esq.	
7	20	126	128½	2½	Dr. Sanderson.	
8	18	129½	131½	1½	J. D. Sim, Esq.	
9	20	135½	138	2½	Lieutenant McLeod.	
10	20	138½	140½	1½	P. Grant, Esq.	
11	18	119	120½	1½	Plant cut down for bark.	
12	—	63	85½	2½		

TABLE III.
SHOWING the Height of Twelve Plants of *C. officinalis* planted on the Dodabetta Plantation, at Ootacamund, on the 30th September 1863.

Number of Plants.	Height in Inches when Planted on the 30th September 1863.	Height in Inches on the 30th June 1866.	Height in Inches on the 31st July 1866.	Growth in Inches during July 1866.	REMARKS.
1	19	119½	120	½	The 12 plants of <i>C. officinalis</i> (a shrubby species) on the Dodabetta Plantation, gives an average growth of ⅔ths of an inch, or 1½ inch under the growth of last month.
2	14½	105	106	1	
3	28	121½	122	½	
4	22	117½	118	½	Several plants of <i>C. succirubra</i> , <i>Calisaya</i> , and <i>Condamenia</i> , have furnished a good supply of fine seeds, which are now germinating freely.
5	21½	126	126½	½	
6	28	130	131	1	
7	22½	117½	118	½	
8	21½	117½	118½	1	
9	21½	125	125½	½	
10	19½	120	121½	1½	
11	24	122½	123	½	
12	24	125½	126	½	

TABLE IV.
REGISTER of Chinchona Plants Distributed.

NAMES.	STATIONS.	Number of Plants.	REMARKS.
Mr. F. N. Maltby - - -	Trevandrum - - -	16	The number of plants issued to the public during the month, is 8,004, making the total distributed 110,713.
Dr. Junghun - - -	Java - - -	56	
Mr. A. R. Lascelles - - -	Ootacamund - - -	12	
Mr. M. Anderson - - -	Jamaica - - -	2	
Dr. Wiche - - -	Bombay - - -	10	
Dr. T. Anderson - - -	Calcutta - - -	554	
Dr. Jamieson - - -	Saharanpore - - -	107	
Professor Lees - - -	Calcutta - - -	547	
Rajah of Travancore - - -	Travancore - - -	521	
Major Morgan - - -	Ootacamund - - -	1,534	
Mr. E. T. Fitzgerald - - -	Calcutta - - -	558	
Mr. J. W. B. Money - - -	- ditto - - -	1,369	
Mr. W. Bourne - - -	- ditto - - -	532	
Captain Cox - - -	Wynaad - - -	6	
Mr. Hollock - - -	- ditto - - -	2	
Mr. T. Sheffield - - -	Ootacamund - - -	12	
Dr. F. Day - - -	Cochin - - -	100	
Mr. Brown - - -	Tellicherry - - -	12	
Mr. J. Hall - - -	Ootacamund - - -	156	
Mr. T. Knop - - -	- ditto - - -	18	
Captain Lees - - -	Bengal - - -	386	
Mr. W. H. Rayne - - -	Manantoddy - - -	424	
Rev. Sawyers - - -	Ootacamund - - -	1,018	
Mr. Frend - - -	- ditto - - -	512	

TABLE IV.—Register of Chinchona Plants Distributed—*continued*.

NAMES.	STATIONS.	Number of Plants.	REMARKS.
Mr. Hollock - - - -	Ootacamund - - -	1	
Mr. J. Pierie - - - -	Seegoor - - - -	12	
Colonel Scott - - - -	Ootacamund - - -	1,236	
Mr. Berend - - - -	Cachar - - - -	275	
Rev. J. Hunter - - - -	Coonoor - - - -	12	
Mr. T. Mullaly - - - -	- ditto - - - -	160	
Mr. W. H. Stanes - - - -	- ditto - - - -	1,262	
Col. R. Cooper - - - -	Kotagherry - - -	12	
Mr. F. Cockburn - - - -	- ditto - - - -	12	
Colonel Woodfall - - - -	Coonoor - - - -	12	
Mr. C. Anderson - - - -	- ditto - - - -	24	
Colonel Angelo - - - -	Ootacamund - - -	12	
Rev. E. Laseron - - - -	- ditto - - - -	12	
Captain R. N. Taylor - - - -	Coorg - - - -	96	
Major W. Agnew - - - -	Assam - - - -	139	
Mr. V. H. Levinge - - - -	Madura - - - -	12	
Chief Commissioner of - - - -	Nagpore - - - -	28	
Mr. Fletcher - - - -	Ootacamund - - -	24	
Gool Mahomed - - - -	- ditto - - - -	20	
General McCleverty - - - -	New Zealand - - -	23	
Mr. W. Robinson - - - -	Kotagherry - - -	330	
Mr. Clarke - - - -	Wynaad - - - -	12	
Mr. H. R. Dawson - - - -	Seegoor - - - -	12	
Captain Mann - - - -	Coorg - - - -	48	
Mr. E. Roberts - - - -	- ditto - - - -	530	
Mr. H. Russell - - - -	Wynaad - - - -	52	
Reverend Wait - - - -	Coonoor - - - -	2	
Collector of Belgaum - - - -	Belgaum - - - -	28	
Collector of Honore - - - -	Honore - - - -	28	
Dr. Ross - - - -	- ditto - - - -	15	
His Excellency the Governor - - - -	Bombay - - - -	158	
Mr. H. Hinde - - - -	Wynaad - - - -	12	
Mr. E. B. Thomas - - - -	Coonoor - - - -	274	
Rajah of Poonganoor - - - -	Poonganoor - - -	12	
Major Grant - - - -	Wellington - - -	226	
Messrs. Thomas, Shaw & Co. - - - -	Poonganoor - - -	28	
Mr. J. H. Trinson - - - -	- ditto - - - -	31	
Dr. Muller - - - -	Melbourne - - -	28	
Mr. Tyrrell - - - -	Mysore - - - -	12	
Dr. Sayers - - - -	Vellore - - - -	12	
Major C. P. Taylor - - - -	Ootacamund - - -	5,250	
Doctor Wilson - - - -	- ditto - - - -	6	
Mr. Schanarrie - - - -	- ditto - - - -	15,000	
Captain Fuller - - - -	Coonoor - - - -	417	
Dr. Drummond - - - -	Ootacamund - - -	224	
Captain Jennings - - - -	- ditto - - - -	1,756	
Lieut. H. B. Montmorency - - - -	Bangalore - - -	6	
Mr. McHutchin - - - -	Ootacamund - - -	3	
Colonel Molesworth - - - -	- ditto - - - -	6	
Mr. C. Gray - - - -	Coonoor - - - -	12	
Mr. H. B. Liddell - - - -	Ootacamund - - -	12	
Mr. Minchin - - - -	Wynaad - - - -	1,600	
His Excellency the Governor - - - -	Vizagapatam - - -	35	
Mr. R. F. Phillips - - - -	Kotagherry - - -	1,117	
Colonel Cooke - - - -	- ditto - - - -	24	
Mr. G. T. Glasson - - - -	Wynaad - - - -	1,000	
Dr. Macpherson - - - -	Mercara - - - -	400	
Mr. W. H. Kerr - - - -	Coorg - - - -	3,100	
Mr. James - - - -	Ootacamund - - -	1,000	
Colonel Whish - - - -	Bengal - - - -	82	
Mr. K. Mair - - - -	Calcutta - - - -	1,180	
Mr. W. Shakespear - - - -	- ditto - - - -	61	
Mr. E. E. Meakin - - - -	- ditto - - - -	168	
Mr. C. Ackland - - - -	- ditto - - - -	150	
Mr. K. McIver - - - -	- ditto - - - -	124	
Mr. Havelock - - - -	Ootacamund - - -	12	
Mr. H. de Facien - - - -	Kartairy - - - -	6,821	
Major Sweet - - - -	- ditto - - - -	910	
Captain Campbell - - - -	Bangalore - - -	6	
Royal Gardens - - - -	Mauritius - - -	36	
Honourable W. R. Arbuthnot - - - -	Wynaad - - - -	93	
Mr. H. Maxwell - - - -	Bombay - - - -	50	

TABLE IV.—Register of Chinchona Plants Distributed—continued.

NAMES.	STATIONS.	Number of Plants.	REMARKS.
Mrs. C. Smith - - - -	Wynaad - - -	316	
Captain Meekley - - - -	Wellington - - -	200	
Mr. Walsh - - - -	Salem - - -	150	
His Excellency the Governor General.	Java - - -	175	
Captain Richardson - - - -	Kulhatty - - -	509	
Rajah of Poonganoor - - - -	Poonganoor - - -	24	
His Excellency the Governor	Madras - - -	24	
Mr. J. W. B. Money - - - -	Ootacamund - - -	25,000	
Captain Mitcheson - - - -	- ditto - - -	50	
Mr. R. H. Elliot - - - -	Munjerabad - - -	276	
His Excellency the Governor General.	Goa - - -	252	
Colonel Phayre - - - -	Rangoon - - -	152	
Mr. Ryall - - - -	Kotagherry - - -	24	
Mr. J. Gordon - - - -	Coonoor - - -	6,087	
Mr. J. Rohde - - - -	Neddivuttum - - -	11,889	
Mr. J. Higginbotham - - - -	Goodaloor - - -	12	
Mr. S. Pital - - - -	Mauritius - - -	36	
Mr. J. Horne - - - -	- ditto - - -	36	
Mr. Edouard Cremary - - - -	Reunion - - -	51	
For the French Government	Algiers - - -	45	
Mr. J. B. Norton - - - -	Shevaroy - - -	50	
Mr. Mackay - - - -	Punjab - - -	50	
Mr. W. Forsyth - - - -	Central Provinces - - -	169	
Colonel Cadell - - - -	Coorg - - -	62	
Mr. J. L. Browning - - - -	Wynaad - - -	4	
Mr. H. Leeds - - - -	Burmah - - -	112	
Maloo Sait - - - -	- ditto - - -	6	
Mr. A. D. Brown - - - -	Dimhatty - - -	53	
Mr. J. C. Misquith - - - -	Ootacamund - - -	300	
Mr. J. L. Fransen - - - -	Coonoor - - -	8	
Captain Fitzgerald - - - -	Calcutta - - -	150	
Mr. J. Macpherson - - - -	Ootacamund - - -	12	
Major Travers - - - -	- ditto - - -	5,000	
Mr. S. Preger - - - -	Vithry, Wynaad - - -	69	
Reverend Wenger - - - -	Kaity - - -	2	
Mr. G. W. Forbes - - - -	Dhumsala - - -	55	
Major C. Elliot - - - -	Mysore - - -	5,044	
Collector of Salem - - - -	Salem - - -	100	
TOTAL Number of Plants - - -		110,713	

Ootacamund,
25 August 1866.

(signed) W. G. McIvor,
Superintendent Government Chinchona Plantations.

ORDER thereon of the Madras Government, 8th September 1866.

1. Ordered to be forwarded to the Secretary of State; to the Supreme Government, and to the other Governments in India; also to the Superintendent, Chincona Plantations, in Java.

(signed) J. D. Sim,
Secretary to Government.

— No. 10. —

From the Government of Madras to the Secretary of State for India.

Madras, 10 October 1866.

WE have the honour to forward, for your information, the accompanying Tabular Report on the number, condition, &c. of the Chinchona plants on the Neilgherries, on the 31st August 1866.

Enclosure in No. 10.

REPORT on the Number, Distribution, and Condition of Chinchona Plants on the Neilgherries, on the 31st August 1866.

Species.	Botanical Names.	Commercial Names.	Number of Plants.	Value per Lb. of Dry Bark in the London Market.	REMARKS.
				<i>s. d. s. d.</i>	
1	<i>C. succirubra</i> - -	Red Bark - -	519,479	2 6 to 8 9	The total number of plants permanently planted out in the plantations remain the same as in last month, viz., 401,211.
2	<i>C. Calisaya</i> - -	Yellow Bark - -	40,421	2 10 „ 7 -	
	„ <i>frutex</i> - -				
	„ <i>vera</i> - -				The increase by propagation is 131,898, being 71,902 plants above the average of the last six months, making the total number 1,446,932.
3	<i>C. officinalis</i>				
	„ <i>condamania</i> -	Original Loxa Bark	61,215	2 10 „ 7 -	
	„ <i>bonplandiana</i>	Select Crown Bark -	790,947	2 10 „ 7 -	
	„ <i>crispa</i> - -	Fine Crown Bark -	4,380	2 10 „ 6 -	
4	<i>C. lancifolia</i> - -	Pitayo Bark - -	249	1 8 „ 2 10	
5	<i>C. nitida</i> - -	Genuine Grey Bark	2,786	1 8 „ 2 9	
6	<i>C. species</i> without name.	Fine Grey Bark -	8,500	1 8 „ 2 10	
7	<i>C. micrantha</i> - -	Grey Bark - -	15,141	1 8 „ 2 9	
8	<i>C. Peruviana</i> - -	Finest Grey Bark -	3,389	1 8 „ 2 10	
9	<i>C. Pahudiana</i> - -	Unknown - -	425	Unknown.	
TOTAL Number of Plants - - -			1,446,932		

TABLE II.

MEMORANDUM of the Growth of Eleven Plants of *C. succirubra*, planted on the Second Denison Plantation, at Nedddivuttum, on the 30th August 1862.

Number of Plants.	Height in Inches when Planted on the 30th August 1862.	Height in Inches on the 31st July 1866.	Height in Inches on the 31st August 1866.	Growth in Inches during August 1866.	By whom Planted.	REMARKS.
1	23	141	141½	½	Sir W. Denison.	Table II. exhibits the growth of 11 plants of <i>C. succirubra</i> , planted out by Sir W. Denison and other gentlemen at Niddivittum on the 30th August 1862. The average growth of these plants during the month is 1½, or 1½ inches under the growth of last month.
2	16½	123½	126½	3		
3	19	128½	131	2½		
4	15	116½	119	2½		
5	27	144½	145	½		
6	20	102½	106	3½		
7	20	128½	128½	-	J. W. Brecks, Esq.	One of the two plants cut down on the 20th March 1863 for the bark submitted to Mr. Howard for analysis, has made strong shoots of 87½ inches in height, giving the growth of two inches during the month.
8	18	131½	133	1½	Dr. Sanderson.	
9	20	138	138	-	J. D. Sim, Esq.	
10	20	140½	141	½	Lieutenant McLeod.	
11	18	120½	124	3½	P. Grant, Esq.	
12	-	85½	87½	2	Plant cut down for bark.	

TABLE III.

SHOWING the Height of Twelve Plants of *C. officinalis* planted on the Dodabetta Plantation, at Ootacamund, on the 30th September 1863.

Number of Plants.	Height in Inches when Planted on the 30th Sept. 1863.	Height in Inches on the 31st July 1866.	Height in Inches on the 31st August 1866.	Growth in Inches during August 1866.	REMARKS.
1	19	120	120½	½	The 12 plants of <i>C. officinalis</i> (a shrubby species) on the Dodabetta plantation, gives an average growth of half an inch, or a quarter of an inch under the growth of last month.
2	14½	106	106½	½	
3	28	122	122½	½	
4	22	118	118½	½	
5	21½	126½	127½	½	Several plants of <i>C. succirubra</i> , <i>calisaya</i> , and <i>condamania</i> , have furnished a good supply of fine seeds, which are now germinating freely.
6	28	131	131½	½	
7	22½	118	118½	½	
8	21½	118½	119	½	
9	21½	125½	126½	½	
10	19½	121½	122	½	
11	24	123	123½	½	
12	24	126	126½	½	

TABLE IV.

REGISTER of Chinchona Plants Distributed.

NAMES.	STATIONS.	Number of Plants.	REMARKS.
Mr. F. N. Maltby	Trevandrum	16	The number of plants issued to the public during the month is 2,066, making the total distributed 112,769.
Dr. Junghun	Java	56	
Mr. A. R. Lascelles	Ootacamund	12	
Mr. M. Anderson	Jamaica	2	
Dr. Wiche	Bombay	10	
Dr. T. Anderson	Calcutta	554	
Dr. Jamieson	Saharanpore	107	
Professor Lees	Calcutta	547	
Rajah of Travancore	Travancore	521	
Major Morgan	Ootacamund	1,534	
Mr. E. T. Fitzgerald	Calcutta	558	
Mr. J. W. B. Money	- ditto -	1,369	
Mr. W. Bourne	- ditto -	532	
Captain Cox	Wynaad	6	
Mr. Hollock	- ditto -	2	
Mr. T. Sheffield	Ootacamund	12	
Dr. F. Day	Cochin	100	
Mr. Brown	Tellicherry	12	
Mr. J. Hall	Ootacamund	156	
Mr. T. Knop	- ditto -	18	
Captain Lees	Bengal	386	
Mr. W. H. Rayne	Manantoddy	424	

TABLE IV.—Register of Chinchona Plants Distributed—*continued*.

NAMES.	STATIONS.	Number of Plants.	REMARKS.
Reverend Sawyers - - -	Ootacamund - -	1,018	
Mr. Frend - - -	- ditto - - -	512	
Mr. Hollock - - -	- ditto - - -	1	
Mr. J. Pierie - - -	Seegoor - - -	12	
Colonel Scott - - -	Ootacamund - -	1,236	
Mr. Berend - - -	Cachar - - -	275	
Reverend J. Hunter - - -	Coonoor - - -	12	
Mr. T. Mullaly - - -	- ditto - - -	160	
Mr. W. H. Stanes - - -	- ditto - - -	1,262	
Colonel R. Cooper - - -	Kotagherry - -	12	
Mr. F. Cockburn - - -	- ditto - - -	12	
Colonel Woodfall - - -	Coonoor - - -	12	
Mr. C. Anderson - - -	- ditto - - -	24	
Colonel Angelo - - -	Ootacamund - -	12	
Reverend E. Laseron - - -	- ditto - - -	12	
Captain R. N. Taylor - - -	Coorg - - -	96	
Major W. Agnew - - -	Assam - - -	139	
Mr. V. H. Levinge - - -	Madura - - -	12	
Chief Commissioner of - - -	Nagpore - - -	28	
Mr. Fletcher - - -	Ootacamund - -	524	
Gool Mahomed - - -	- ditto - - -	20	
General McCleverty - - -	New Zealand - -	23	
Mr. W. Robinson - - -	Kotagherry - -	330	
Mr. Clarke - - -	Wynaad - - -	12	
Mr. H. R. Dawson - - -	Seegoor - - -	12	
Captain Mann - - -	Coorg - - -	48	
Mr. E. Roberts - - -	- ditto - - -	530	
Mr. H. Russell - - -	Wynaad - - -	52	
Reverend Wait - - -	Coonoor - - -	2	
Collector of Belgaum - - -	Belgaum - - -	28	
Collector of Honore - - -	Honore - - -	28	
Dr. Ross - - -	- ditto - - -	15	
His Excellency the Governor - - -	Bombay - - -	158	
Mr. H. Hinde - - -	Wynaad - - -	12	
Mr. E. B. Thomas - - -	Coonoor - - -	474	
Rajah of Poonganoor - - -	Poonganoor - -	12	
Major Grant - - -	Wellington - -	226	
Messrs. Thomson, Shaw, & Co. - - -	Poonganoor - -	28	
Mr. J. H. Trinson - - -	- ditto - - -	31	
Dr. Muller - - -	Melbourne - -	28	
Mr. Tyrrell - - -	Mysore - - -	12	
Dr. Sayers - - -	Vellore - - -	12	
Major C. P. Taylor - - -	Ootacamund - -	5,250	
Doctor Wilson - - -	- ditto - - -	6	
Mr. Schnarrie - - -	- ditto - - -	15,000	
Captain Fuller - - -	Coonoor - - -	417	
Dr. Drummond - - -	Ootacamund - -	224	
Captain Jennings - - -	- ditto - - -	1,756	
Lieut. H. B. Montmorency - - -	Bangalore - -	6	
Mr. McHutchin - - -	Ootacamund - -	3	
Colonel Molesworth - - -	- ditto - - -	6	
Mr. C. Gray - - -	Coonoor - - -	12	
Mr. H. B. Liddell - - -	Ootacamund - -	12	
Mr. Minchin - - -	Wynaad - - -	1,600	
His Excellency the Governor - - -	Vizagapatam - -	85	
Mr. R. F. Phillips - - -	Kotagherry - -	1,117	
Colonel Cooke - - -	- ditto - - -	24	
Mr. G. F. Glasson - - -	Wynaad - - -	1,000	
Dr. Macpherson - - -	Mercara - - -	400	
Mr. W. H. Kerr - - -	Coorg - - -	3,100	
Mr. James - - -	Ootacamund - -	1,000	
Colonel Whish - - -	Bengal - - -	82	
Mr. K. Mair - - -	Calcutta - - -	1,180	
Mr. W. Shakespear - - -	- ditto - - -	61	
Mr. E. E. Meakin - - -	- ditto - - -	168	
Mr. C. Ackland - - -	- ditto - - -	150	
Mr. K. McIver - - -	- ditto - - -	124	
Mr. Havelock - - -	Ootacamund - -	12	
Mr. H. DeFacien - - -	Kartairy - - -	6,821	
Major Sweet - - -	- ditto - - -	910	
Captain Campbell - - -	Bangalore - -	6	
Royal Gardens - - -	Mauritius - - -	36	

TABLE IV.—Register of Chinchona Plants Distributed—*continued*.

NAMES.	STATIONS.	Number of Plants.	REMARKS.
Honourable W. R. Arbuthnot -	Wynaad - - -	93	
Mr. H. Maxwell - - -	Bombay - - -	50	
Mrs. C. Smith - - -	Wynaad - - -	316	
Captain Meekley - - -	Wellington - - -	200	
Mr. Walsh - - -	Salem - - -	150	
His Excellency the Governor General.	Java - - -	175	
Captain Richardson - - -	Kulhatty - - -	509	
Rajah of Poonganoor - - -	Poonganoor - - -	24	
His Excellency the Governor	Madras - - -	24	
Mr. J. W. B. Money - - -	Ootacamund - - -	25,018	
Captain Mitcheson - - -	- ditto - - -	50	
Mr. R. H. Elliot - - -	Munjerabad - - -	276	
His Excellency the Governor General.	Goa - - -	252	
Colonel Phayre - - -	Rangoon - - -	152	
Mr. Ryal - - -	Kotagherry - - -	24	
Mr. J. Gordon - - -	Coonoor - - -	6,325	
Mr. J. Rohde - - -	Neddivuttum - - -	11,689	
Mr. J. Higginbotham - - -	Goodaloor - - -	12	
Mr. S. Pital - - -	Mauritius - - -	36	
Mr. J. Horne - - -	- ditto - - -	36	
Mr. Edouard Cremary - - -	Reunion - - -	51	
For the French Government	Algiers - - -	45	
Mr. J. B. Norton - - -	Shevaroy - - -	50	
Mr. Mackay - - -	Punjab - - -	50	
Mr. W. Forsyth - - -	Central Provinces - - -	169	
Colonel Cadell - - -	Coorg - - -	62	
Mr. J. L. Browning - - -	Wynaad - - -	4	
Mr. H. Leeds - - -	Burmah - - -	112	
Maloo Sait - - -	- ditto - - -	6	
Mr. A. D. Brown - - -	Dimhatty - - -	53	
Mr. J. C. Misquith - - -	Ootacamund - - -	300	
Mr. J. L. Transen - - -	Coonoor - - -	8	
Captain Fitzgerald - - -	Calcutta - - -	150	
Mr. Macpherson - - -	Ootacamund - - -	12	
Major Travers - - -	- ditto - - -	5,000	
Mr. S. Prager - - -	Vithry, Wynaad - - -	69	
Reverend Wenger - - -	Kaity, Ootacamund - - -	2	
Mr. G. W. Forbes - - -	Dhumsala - - -	55	
Major C. Elliot - - -	Mysore - - -	5,044	
Collector of Salem - - -	Salem - - -	100	
Collector of Tinnevely - - -	Tinnevely - - -	500	
Colonel Denison - - -	Ootacamund - - -	550	
Conservator of Forests - - -	- ditto - - -	50	
TOTAL Number of Plants - - -		112,769	

Ootacamund,
29 September 1866.

(signed) *W. G. McIvor*,
Superintendent Government Chinchona Plantations.

ORDER of the Madras Government, 10th October 1866.

Ordered to be forwarded to the Secretary of State, to the Supreme Government, and to the other Governments in India; also to the Superintendent, Chinchona Plantations, in Java.

(signed) *J. D. Sim*,
Secretary to Government.

— No. 11. —

From the Government of Madras to the Secretary of State for India.

Madras, 26 October 1866.

Proceedings of Government, dated 25 October 1866, Nos. 571, 572.

1. In continuation of our Despatch, 25th May 1866, No. 24, we have the honour to forward tabular reports, as far as they have been printed, of the therapeutic effects of the Chinchona alkaloids received from England for experimental trial, together with the letter from the Principal Inspector General, Medical Department, giving cover to these returns.

• To England, 25 May 1866, No. 24, paragraph 3.

2. We beg to inform you that we have not as yet* received any supply of "Quinium."

Enclosure in No. 11.

From the Principal Inspector General, Medical Department, to the Secretary to Government, Revenue Department.

Fort St. George, 11 October 1866.

1. With reference to the Despatch from the Secretary of State for India, printed with the Proceedings of Government, dated 12th March 1866, I have the honour to forward, for submission to the Home Government, a copy of each of the tabulated reports, as far as they have been printed, of the therapeutic effects of the Chinchona alkaloids received from England for experimental trial.

2. Further reports, when printed, and the observations of the Members of the Commission, will be forwarded in due course.

MEMORANDUM.

	Chincho- nine.	Chincho- nidine.	Quinidine.	Chinchona Leaves and Bark.
By Dr. Walter -	1	1	1	—
„ Dr. Cleveland -	2	2	2	1
„ Dr. Houston -	1	1	1	—
„ Dr. Whitton -	1	1	1	—
„ Dr. Keess -	5	3	3	1
„ Dr. Foy -	1	1	1	—

ORDER of the Madras Government, 25th October 1866, No. 2879.

This letter, with the reports received with it, will be forwarded to the Home Government.

(True Extract.)

(signed) J. D. Sim,
Secretary to Government.

To the Principal Inspector General, Medical Department.

— No. 12. —

From the Madras Government to the Secretary of State for India.

Madras, 12 November 1866.

WE have the honour to advise you of the transmission, by the steamer conveying this mail, of a box containing eight samples of Neilgherry Chinchona bark, to be submitted to Mr. Howard for analysis and report. A memorandum of the bark will be found in the enclosed letter from Mr. McIvor.

Enclosure in No. 12.

From the Superintendent Government Chinchona Plantations to the Secretary to Government, Revenue Department, Fort Saint George, Ootacamund, 25th October 1866.

1. I HAVE the honour to inform you that I have this day forwarded, by banghy, a box containing eight samples of Neilgherry Chinchona bark for transmission to the Right Honourable the Secretary of State for India, to be submitted to Mr. Howard for analysis and report.

2. These barks were removed from the trees in September and October 1866.

Memorandum of Contents.

- Specimen No. 1, Chinchona succirubra, is the third crop of bark renewed under moss.
- „ No. 2, Chinchona succirubra, original bark, six months under moss.
 - „ No. 3, Chinchona succirubra, original bark, unmossed.
 - „ No. 4, Chinchona officinalis, B. Condaminea, the second crop of bark renewed under moss.
 - „ No. 5, Chinchona officinalis, B. Condaminea, original bark, nine months under moss.
 - „ No. 6, Chinchona, officinalis, B. Condaminea, original quill bark under moss.
 - „ No. 7, Chinchona, Pahudiana, original bark, nine months under moss.
 - „ No. 8, Chinchona, officinalis, S. Crispa, original bark, unmossed.

ORDER of the Madras Government, 7th November 1866.

Ordered to be forwarded, together with the box, to the Secretary of State.

(True Extract.)

(signed) J. D. Sim,
Secretary to Government.

— No. 13. —

From the Government of Madras to the Secretary of State for India.

Madras, 12 November 1866.

1. We have the honour to forward, for your information, the accompanying Tabular Report on the number, condition, &c. of the Chinchona plants on the Neilgherries, on the 30th September 1866.

2. We beg to request your attention to paragraph 2 of our Despatch, 12th September 1866, No. 38, in which we inquired whether quarterly or half-yearly returns will, in future, satisfy your requirements. At all events the third Table appended to the Report, might, we think, be limited to a specification of the distribution during the month, the aggregate of previous distributions being given in one sum.

Enclosure in No. 13.

REPORT on the Number, Distribution, and Condition of Chinchona Plants on the Neilgherries, on the 30th September 1866.

Species.	Botanical Names.	Commercial Names.	Number of Plants.	Value per Lb. of Dry Bark in the London Market.		REMARKS.
				s.	d.	
1	<i>C. succirubra</i> - -	Red Bark - -	659,613	2	6 to 8 9	The planting season having passed, the number of plants permanently planted out in the plantations is the same as in last month, viz., 401, 211. The increase by propagation is 176,349, being 101,521 plants above the average of the last six months, making the total number 1,610,871.
2	<i>C. Calisaya</i> - -	Yellow Bark - -	40,421	2	10 to 7 -	
	" <i>Frutex</i> - -					
	" <i>Vera</i> - -					
3	<i>C. Officinalis</i>					
	<i>A. uritusinga</i> - -	Original Loxa Bark -	87,509	2	10 to 7 -	
	<i>B. condamenia</i> - -	Select Crown Bark -	787,903	2	10 to 7 -	
	<i>C. crispa</i> - -	Fine Crown Bark -	4,380	2	10 to 6 -	
4	<i>C. lancifolia</i> - -	Pitayo Bark - -	304	1	8 to 2 10	
5	<i>C. nitida</i> - -	Genuine Grey Bark -	2,786	1	8 to 2 9	
6	<i>C. species, without name.</i>	Fine Grey Bark -	8,500	1	8 to 2 10	
7	<i>C. micrantha</i> - -	Grey Bark - -	15,141	1	8 to 2 9	
8	<i>C. Peruviana</i> - -	Finest Grey Bark -	3,389	1	8 to 2 10	
9	<i>C. Pahudirna</i> - -	Unknown - -	426	Unknown.		
TOTAL Number of Plants - - -			1,610,371			

TABLE II.

MEMORANDUM of the Growth of Eleven Plants of *C. succirubra*, planted on the Second Denison Plantation, at Neddivuttum, on the 30th August 1862.

Number of Plants.	Height in Inches when Planted on 30 August 1862.	Height in Inches on 31 August 1865.	Height in Inches on 30 September 1866.	Growth in Inches during September 1866.	By whom Planted.	REMARKS.
1	23	141½	148	1½	Sir W. Denison.	Table II. exhibits the growth of 11 plants of <i>C. succirubra</i> , planted out by Sir W. Denison and other gentlemen at Neddivuttum, on the 30th August 1862. The average growth of these plants during the month is 1 inch, or about ¼ths of an inch under the growth of last month.
2	16½	126½	127	½		
3	19	131	133	2		
4	16	119	120	1		
5	27	145	147	2		
6	20	108	108	2		
7	20	128½	128½	-	J. W. Brecks, Esq.	One of the two plants cut down on the 20th March 1863, for the bark submitted to Mr. Howard for analysis, has made strong shoots of 88 inches in height, giving the growth of ½ an inch during the month.
8	18	133	133	-	Dr. Sanderson.	
9	20	138	138	-	J. D. Sim, Esq.	
10	20	141	142	1	Lieutenant McLeod.	
11	18	124	125	1	P. Grant, Esq.	
12	-	87½	88	½	Plant cut down for bark.	

TABLE III.

SHOWING the Height of Twelve Plants of *C. officinalis*, planted on the Dodabetta Plantation, at Ootacamund, on the 30th September 1863.

Number of Plants.	Height in Inches when Planted on the 30th September 1863.	Height in Inches on the 31st August 1866.	Height in Inches on the 31st September 1866.	Growth in Inches during September 1866.	REMARKS
1	19	120½	121	½	The 12 plants of <i>C. officinalis</i> (a shrubby species on the Dodabetta Plantation, gives an average growth of ¾ths of an inch, or about ¼th of an inch above the growth of last month.
2	14½	106½	107	½	
3	28	122½	123½	½	
4	22	118½	119	½	
5	21½	127½	128½	½	
6	28	131½	132½	½	Several plants of <i>C. succirubra</i> , <i>calisaya</i> , and <i>condamenia</i> , have furnished a good supply of fine seeds, which are now germinating freely.
7	22½	118½	118½	0	
8	21½	119	119½	½	
9	21½	126½	127	½	
10	19½	122	122½	½	
11	24	123½	124½	½	
12	24	126½	127½	½	

TABLE IV.

REGISTER of Chincona Plants Distributed.

NAMES.	STATIONS.	Number of Plants.	REMARKS.
Mr. F. N. Maltby -	Trevandrum -	16	The number of plants issued to the public during the month, is 12,910, making total distributed 125,679.
Dr. Junghun -	Java -	56	
Mr. A. R. Lascelles -	Ootacamund -	12	
Mr. M. Anderson -	Jamaica -	2	
Dr. Wiehe -	Bombay -	10	
Dr. T. Anderson -	Calcutta -	554	
Dr. Jamieson -	Saharanpore -	107	
Professor Dees -	Calcutta -	547	
Rajah of Travancore -	Travancore -	521	
Major Morgan -	Ootacamund -	1,534	
Mr. E. T. Fitzgerald -	Calcutta -	558	
Mr. J. W. B. Money -	- ditto -	1,369	
Mr. W. Bourne -	- ditto -	532	
Captain Cox -	Wynsadd -	6	
Mr. Hollock -	- ditto -	2	
Mr. T. Sheffield -	Ootacamund -	12	
Dr. F. Day -	Cochin -	100	
Mr. Brown -	Tellicherry -	12	
Mr. J. Hall -	Ootacamund -	156	
Mr. T. Knop -	- ditto -	18	
Captain Lees -	Bengal -	386	
Mr. W. H. Rayne -	Manantoddy -	424	
Rev. Sawyers -	Ootacamund -	1,018	
Mr. Friend -	- ditto -	512	
Mr. Hollock -	- ditto -	1	
Mr. J. Pieris -	Seegoor -	12	
Colonel Scott -	Ootacamund -	1,236	
Mr. Berend -	Cachar -	275	
Rev. J. Hunter -	Coonoor -	12	
Mr. T. Mullaly -	- ditto -	160	
Mr. W. H. Stanes -	- ditto -	1,262	
Colonel R. Cooper -	Kotagherry -	12	
Mr. F. Cockburn -	- ditto -	12	
Colonel Woodfall -	Coonoor -	12	
Mr. C. Anderson -	- ditto -	24	
Colonel Angelo -	Ootacamund -	12	
Rev. E. Laseron -	- ditto -	12	
Captain R. N. Taylor -	Coorg -	96	
Major W. Agnew -	Assam -	139	
Mr. V. H. Levinge -	Madura -	12	
Chief Commissioner -	Nagpore -	28	
Mr. Fletcher -	Ootacamund -	524	
Gool Mahomed -	- ditto -	20	
General McCleverty -	New Zealand -	33	
Mr. W. Robinson -	Kotagherry -	330	
Mr. Clarke -	Wynsadd -	12	
Mr. H. R. Dawson -	Seegoor -	12	
Captain Mann -	Coorg -	48	

TABLE IV.—Register of Chinchona Plants Distributed—*continued*.

NAMES.	STATIONS.	Number of Plants.	REMARKS.
Mr. E. Roberts - - - - -	Coorg - - - - -	530	
Mr. H. Russell - - - - -	Wynaad - - - - -	52	
Reverend Wait - - - - -	Coonoor - - - - -	2	
Collector of Belgaum - - - - -	Belgaum - - - - -	28	
Collector of Honore - - - - -	Honore - - - - -	28	
Dr. Ross - - - - -	- ditto - - - - -	15	
His Excellency the Governor	Bombay - - - - -	158	
Mr. H. Hinde - - - - -	Wynaad - - - - -	12	
Mr. E. B. Thomas - - - - -	Coonoor - - - - -	874	
Rajah of Poonganoor - - - - -	Poonganoor - - - - -	12	
Major Grant - - - - -	Wellington - - - - -	226	
Messrs. Thomson, Shaw & Co.	Poonganoor - - - - -	28	
Mr. J. H. Trinson - - - - -	- ditto - - - - -	31	
Dr. Muller - - - - -	Melbourne - - - - -	28	
Mr. Tyrrell - - - - -	Mysore - - - - -	12	
Dr. Sayers - - - - -	Vellore - - - - -	12	
Major C. P. Taylor - - - - -	Ootacamund - - - - -	5,250	
Doctor Wilson - - - - -	- ditto - - - - -	6	
Mr. Schnarrie - - - - -	- ditto - - - - -	15,000	
Captain Fuller - - - - -	Coonoor - - - - -	417	
Dr. Drummond - - - - -	Ootacamund - - - - -	224	
Captain Jennings - - - - -	- ditto - - - - -	1,756	
Lieut. H. B. Montmorency - - - - -	Bangalore - - - - -	6	
Mr. McHutchin - - - - -	Ootacamund - - - - -	8	
Colonel Molesworth - - - - -	- ditto - - - - -	6	
Mr. C. Gray - - - - -	Coonoor - - - - -	12	
Mr. H. B. Liddell - - - - -	Ootacamund - - - - -	12	
Mr. Minchim - - - - -	Wynaad - - - - -	1,600	
His Excellency the Governor	Vizagapatam - - - - -	35	
Mr. R. F. Phillips - - - - -	Kotagherry - - - - -	1,117	
Colonel Cooke - - - - -	- ditto - - - - -	24	
Mr. G. F. Glasson - - - - -	Wynaad - - - - -	1,000	
Dr. Macpherson - - - - -	Mercara - - - - -	400	
Mr. W. H. Kerr - - - - -	Coorg - - - - -	3,100	
Mr. James - - - - -	Ootacamund - - - - -	1,000	
Colonel Whish - - - - -	Bengal - - - - -	82	
Mr. K. Muir - - - - -	Calcutta - - - - -	1,180	
Mr. W. Shakespear - - - - -	- ditto - - - - -	61	
Mr. E. E. Meakin - - - - -	- ditto - - - - -	168	
Mr. C. Ackland - - - - -	- ditto - - - - -	150	
Mr. K. Melver - - - - -	- ditto - - - - -	124	
Mr. Havelock - - - - -	Ootacamund - - - - -	12	
Mr. H. de Facien - - - - -	Kartairy - - - - -	6,821	
Major Sweet - - - - -	- ditto - - - - -	910	
Captain Campbell - - - - -	Bangalore - - - - -	6	
Royal Gardens - - - - -	Mauritius - - - - -	36	
Honourable W. R. Arbuthnot - - - - -	Wynaad - - - - -	98	
Mr. H. Maxwell - - - - -	Bombay - - - - -	50	
Mrs. C. Smith - - - - -	Wynaad - - - - -	316	
Captain Meekly - - - - -	Wellington - - - - -	200	
Mr. Walsh - - - - -	Salem - - - - -	150	
His Excellency the Governor General	Java - - - - -	175	
Captain Richardson - - - - -	Kulhatty - - - - -	509	
Rajah of Poonganoor - - - - -	Poonganoor - - - - -	24	
His Excellency the Governor	Madras - - - - -	24	
Mr. J. W. B. Money - - - - -	Ootacamund - - - - -	25,018	
Captain Mitcheson - - - - -	- ditto - - - - -	50	
Mr. R. H. Elliot - - - - -	Munjerabad - - - - -	276	
His Excellency the Governor General	Goa - - - - -	252	
Colonel Phayre - - - - -	Rangoon - - - - -	152	
Mr. Ryal - - - - -	Kotagherry - - - - -	24	
Mr. J. Gordon - - - - -	Coonoor - - - - -	6,325	
Mr. J. Rohde - - - - -	Neddivuttum - - - - -	11,689	
Mr. J. Higginbotham - - - - -	Goodaloor - - - - -	12	
Mr. S. Pital - - - - -	Mauritius - - - - -	36	
Mr. J. Horne - - - - -	- ditto - - - - -	36	
Mr. Edouard Cremary - - - - -	Reunion - - - - -	51	
For the French Government - - - - -	Algiers - - - - -	45	
Mr. J. B. Norton - - - - -	Shevaroy - - - - -	50	
Mr. Muckay - - - - -	Punjab - - - - -	50	
Mr. W. Forsyth - - - - -	Central Provinces - - - - -	189	
Colonel Cadell - - - - -	Coorg - - - - -	62	
Mr. J. L. Browning - - - - -	Wynaad - - - - -	4	

TABLE IV.—REGISTER of Chinchona Plants distributed—continued.

NAMES.	STATIONS.	Number of Plants.	REMARKS.
Mr. H. Leeds - - - - -	Burmah - - - - -	112	
Maloo Sait - - - - -	- ditto - - - - -	6	
Mr. A. D. Brown - - - - -	Dimhutty - - - - -	53	
Mr. J. C. Misquith - - - - -	Ootacamund - - - - -	300	
Mr. J. L. Transen - - - - -	Coonoor - - - - -	8	
Captain Fitzgerald - - - - -	Calcutta - - - - -	150	
Mr. Macpherson - - - - -	Ootacamund - - - - -	12	
Major Travers - - - - -	- ditto - - - - -	5,000	
Mr. S. Prager - - - - -	Vithry, Wynnad - - - - -	69	
Reverend Wenger - - - - -	Kaity, Ootacamund - - - - -	2	
Mr. G. W. Forbes - - - - -	Dhurmisala - - - - -	55	
Major C Elliot - - - - -	Mysore - - - - -	5,044	
Collector of Salem - - - - -	Salem - - - - -	100	
Collector of Tinnevely - - - - -	Tinnevely - - - - -	500	
Colonel Denison - - - - -	Ootacamund - - - - -	550	
Conservator of Forests - - - - -	- ditto - - - - -	50	
Mr. J. Ouchterlony - - - - -	- ditto - - - - -	300	
Mr. R. C. Elwin - - - - -	Neddivuttum - - - - -	12,510	
TOTAL Number of Plants - - - - -		1,25,679	

Ootacamund, }
26 October 1866.

(signed) W. G. McIvor,
Superintendent Government Chinchona Plantations.

ORDER of the Madras Government, 8 November 1866.

1. Ordered to be forwarded to the Secretary of State, to the Supreme Government, and to the other Governments in India; also to the Superintendent, Chinchona Plantations in Java.

(signed) J. D. Sim,
Secretary to Government.

— No. 14. —

From the Secretary of State for India to the Government of Madras.

India Office, 16 January 1867.

I HAVE received and considered in Council your Despatches in the Revenue Department of the numbers and dates noted in the margin on the subject of Chinchona cultivation.

The reports from medical men in various parts of your presidency, on the efficacy of the Chinchona alkaloids, other than quinine, in cases of fever, appear to be satisfactory; but I await the results of further trials, and the receipt of the observations of the members of the Commission, before making any remarks upon the subject.

The specimens of Chinchona bark received with your Despatch, dated 12th November 1866, have been duly forwarded to Mr. Howard for analysis and report.

With reference to your inquiry whether a quarterly or half-yearly return, showing the progress of Chinchona cultivation will not be sufficient, I have to request that the returns may be drawn up and transmitted to me for the future in the following form: The returns to be made at the end of every half-year, instead of monthly as heretofore; and to show in separate columns the number of plants, the half-yearly average and maximum growth, and the height of the

22 May 1866
26 June "
26 "
26 July "
12 Sept. "
10 Oct. "
26 "
12 Nov. "
" " "

tallest tree of each year's growth with its girth near the ground, for each species. A second table to show the total number of plants, the total number planted out, and the total number distributed to private individuals during the half-year. The return should also contain remarks on the growth and thickness of bark, the flowering and fruiting of the plants, and the germination of the seeds; and general remarks on the effects of any extraordinary rains or droughts. Tables II. III. and IV. of the present monthly returns can in future be omitted. The Superintendent of Chinchona Plantations will of course submit an annual report on the general progress of cultivation as heretofore, in addition to these tabular half-yearly returns; and the reports submitted by Mr. Broughton should also be forwarded to me as soon as received.

— No. 15. —

From the Secretary of State for India to the Government of Madras.

India Office, 7 March 1867.

WITH reference to your Excellency's Despatch, in the Revenue Department, dated 12th November 1866, I now transmit 50 copies of Mr. Howard's report of an analysis of the fifth remittance of bark from the Neilgherry Chinchona Plantations.

You will perceive that there is a very remarkable increase in the yield of febrifuge alkaloids from the red barks, and that this result appears to be due to the system of mossing. The bark renewed under moss is richer than the original growth. It is also very satisfactory to find that the Bonplandiana variety of the *C. Officinalis*, of which there are now as many as 800,000 plants on the Neilgherry Plantations is an exceedingly valuable kind, and that it is even now superior to the best South American barks.

Mr. Howard considers this remittance of bark to be the most instructive and encouraging that has hitherto arrived from India; and the cultivators should work in the direction indicated by the results of his analysis. All persons engaged in Chinchona cultivation, as well as the Government Superintendent, should be furnished with copies of Mr. Howard's report.

Enclosure in No. 15.

REPORT of an Analysis of the Fifth Remittance of BARK from India, by
J. E. Howard, Esq., F.L.S.

To the Under Secretary of State for India.

Sir,

4 February 1867.

I HAVE to report that the specimens of bark removed from trees in September and October 1866 reached me in good condition. The No. 1 specimen shows at once its superiority, and approaches nearly in appearance to the fine red bark grown in South America. No. 2 does not differ much at first sight, except in the absence of lichens, from No. 3. Amongst the barks of this parcel suited for sale at public auction, the broker at once selected the specimen of *C. Pahudiana* as the most likely to give satisfaction, and as likely to realise at the present time from 1s. 6d. to 1s. 8d. per pound. Next to this, and at about the same value comes No. 6, which is very much like the original specimen of this bark, as gathered by Mr. Cross, and now in my possession, together with a very well preserved specimen of a flowering branch of this sort, the *Colorada del Rey* of Pavon, and now named *C. officinalis*, var. *Bonplandiana*. (See "Mr. Markham's Memorandum, at page 5 of the Parliamentary Return (Chinchona) of June 18th 1866.") I make this correction on the strength of the corresponding appearance with the specimen brought by Mr. Cross, and beg to direct particular attention to the discrimination of the varieties of *C. officinalis*, which, though classed together in some returns, and in others declared to be "not distinguishable," will be seen to be of totally different value for cultivation. Of this the *C. officinalis*, var. *crispa*, is a remarkable illustration. I pointed out in 1852 the great inferiority of produce in alkaloids of this, the "fine Loja bark" of modern commerce, to the original Loja barks. This characteristic is not altered by the new place of growth, and this sort also preserves its peculiarly black appearance, and its very crisp fracture, from which peculiarities it was called *Cascarilla crespilla negra* by the Spanish dealers.

It

It is, however, no longer noted in its new place of growth for the aroma (compared by Professor Guibourt to that of tobacco), nor has it the same pleasing appearance as when grown on the mountains of Loja. It would fetch probably 1s. 4d. to 1s. 5d. per pound in the market. The remaining parcels would not at first command a ready sale as they differ so widely in appearance from any now in the market.

The quantity sent this time, especially of the earlier numbers, was more favourable for examination, affording the opportunity of correction by a second or third analysis of any point left obscure, an opportunity which I should desire for a future re-examination of No. 8, though I do not suppose that the result would be more favourable than it is this time.

No. 1. *C. succirubra*.—Third crop of bark, renewed under moss.

Crystallised sulphates, per 100 parts	-	-	-	-	-	-	-	8.45
Alkaloids soluble in ether, viz., chinchonidine and quinine,	-	-	-	-	-	-	-	1.14
Insoluble in ether (chinchonicine)	-	-	-	-	-	-	-	0.20
								9.79

Memo.—The sulphates (of mixed quinine and chinchonidine) refine well, but do not stand the ether test.

No. 2. *C. succirubra*.—Original bark, six months under moss.

Crystallised sulphates	-	-	-	-	-	-	-	4.57
Alkaloids soluble in ether, chinchonidine and quinine	-	-	-	-	-	-	-	3.78
Insoluble in ether, chinchonine	-	-	-	-	-	-	0.80	
Chinchonicine	-	-	-	-	-	-	0.11	
								0.91
								9.26

Memo.—The sulphates as No. 1, but less easily refined.

No. 3. *C. succirubra*.—Original bark, unmossed.

Crystallised sulphates	-	-	-	-	-	-	-	4.50
Alkaloids soluble in ether	-	-	-	-	-	-	-	1.71
Insoluble in ether, chinchonine crest	-	-	-	-	-	-	0.40	
Chinchonicine	-	-	-	-	-	-	0.34	
								0.74
								6.95

Memo.—The sulphates as under No. 2.

No. 4. *C. officinalis* var. β *Condaminea* (*Bonplandiana*?).—Second crop of bark renewed under moss.

Crystallised sulphates	-	-	-	-	-	-	-	6.52
Alkaloids soluble in ether, quinine and chinchonidine	-	-	-	-	-	-	-	1.35
Insoluble in ether, chinchonicine	-	-	-	-	-	-	-	0.15
								8.02

Memo.—The sulphate refines well, and stands the ether test.

No. 5. *C. officinalis*, var. β *Condaminea* (*Bonplandiana*?).—Original bark, nine months under moss.

Crystallised sulphates	-	-	-	-	-	-	-	6.66
Alkaloids soluble in ether, quinine and chinchonidine	-	-	-	-	-	-	-	0.56
Insoluble in ether, chinchonicine	-	-	-	-	-	-	-	0.15
								7.37

Memo.—As No. 4.

No. 6. *C. officinalis*, var. β *Condaminea* (*Bonplandiana*?).—Original quill bark under moss.

Crystallised sulphates	-	-	-	-	-	-	-	2.58
Alkaloids soluble in ether, quinine and chinchonidine	-	-	-	-	-	-	-	2.10
Insoluble in ether, chinchonicine	-	-	-	-	-	-	-	0.05
								4.73

Memo.—As No. 5.
 No. 7. *C. pahudiana*.—Original bark nine months under moss.

Crystallised sulphates	-	-	-	-	-	-	-	-	0.581
Alkaloids soluble in ether, quinine chiefly	-	-	-	-	-	-	-	-	0.180
Insoluble in ether, chinchonine, a trace	-	-	-	-	-	-	-	-	—
									0.761

Memo.—The quinine refined (with some loss) and separated from a very little chinchonidine (apparently) gave 0.580 per cent.
 No. 8. *C. officinalis*, var. *crispa*.—Original bark, unmossed

Crystallised sulphates	-	-	-	-	-	-	-	-	0.259
Alkaloids soluble in ether, chiefly quinine	-	-	-	-	-	-	-	-	0.370
Insoluble in ether, chinchonine, a trace	-	-	-	-	-	-	-	-	—
									0.629

Memo.—The quinine refined as above, still retaining a characteristic tinge of green, gave 0.590 per cent. Two specimens of this fine Loja in 1851 and 1854 gave me,—
 1854. A particularly fine and unmixed parcel:—

Quinidine and uncrystallisable quinine	-	-	-	-	-	-	-	-	0.40
Chinchonine	-	-	-	-	-	-	-	-	0.03
									0.43

1851. Another parcel, slightly mixed with “rusty brown”:—

Quinidine	-	-	-	-	-	-	-	-	0.57
Chinchonine	-	-	-	-	-	-	-	-	0.06
									0.63

(See Pereira’s “Mat. Med.,” Vol. II., Part II., p. 1639, and “Pharmaceutical Journal,” August 1854.)

I trust that these trials will be useful in the guidance of the cultivation in India. It is evident that the plan adopted in No. 1 is the best. This was practised to some extent in the old times of collection of the Loja barks (as described by Ruiz in a MS. in the British Museum, under the name of *Cascarillas resacas*), but unless the bark is covered with moss immediately, as discovered by Mr. M’Ivor, the subjacent woody portion suffers serious injury. On the other hand, if this is attended to, the operation may be repeated with advantage, increasing, as it would seem, for every time of renewal. Not only is the gross per-centage of alkaloids larger in the last decortication, but of this a more considerable per-centage consists of quinine, and that less intimately combined with the yellow colouring matter, so as to be more easily purified. The structure reminds of the granulated formation of flesh over a wound, and does not exhibit the customary liber fibres, or at least in a very much smaller proportion to the mass of the bark. This great richness in alkaloids does not seem to consist, therefore, with the views entertained by Wigand and others, that these liber fibres are the seat of the alkaloids. The improvement is less apparent in the present sample of the *C. officinalis* (No. 4), but it is probable that some slight alteration might add a large portion of the at present uncrystallised 1.35 per cent. of alkaloid soluble in ether to the previous amount of crystallised sulphates. In the meantime, the examination of No. 4 and No. 5 discloses a most gratifying success, in the excellence of what I conclude to be the predominant variety cultivated in India.* It is only in very few instances that the best Bolivian bark approaches the good quality which this *Colorado del Rey* has already attained in India.

I have not yet had specimens for examination of the East Indian *C. officinalis*, var. *Uritusinga*, but have reason to suppose this must also be a valuable species, whilst it must be evident that the var. *crispa* should not be propagated, as it will not repay the expense of cultivation. The same remark, in my opinion, applies to the *C. calisaya*, var. *Frutex* (as the sort hitherto chiefly cultivated is very properly named by Mr. M’Ivor†); also to the

* 753,272 plants out of 1,123,645 in May 1866. See “Report,” p. 253.
 † “Return,” p. 203, &c.

the *C. pahudiana*, which yields me much the same amount of alkaloid soluble in ether that it has done to Dr. De Vry. It is a pity to plant this sort; but where, as in Java, it is so extensively grown, it were equally a pity, as I think, not to turn the bark to some useful purpose in the way of decoctions.

I think the variety of *C. officinalis*, which bore the name of *Cascarilla amarilla del Rey*, and which would now be *C. officinalis*, var. *Bonplandiana lutea*, should also be introduced into the Indian cultivation. The bark of this sort fetches a high price in the market, as it is excellent for pharmaceutical preparations, and contains quinine in a very pure state.

It seems to me, that some of the small quill barks intended for sale to the druggists should be mossed, as the natural appearance of the bark would be more acceptable to the general dealer.

The effect of the application of moss for a few months to No. 2 does not show, as compared with the original unmossed bark of No. 3, so much real advantage as might have been expected. There is an increase in alkaloid, but this bears more upon the most uncrystallisable portion of the quinine (as I ascertained by repeated experiment), and also upon the chinchonine, which was apparently doubled in the mossed bark at the expense of the chinchonidine. I cannot account for this fact, but perhaps Mr. M'Ivor may gain some light upon it.

The chinchonidine in these two samples was obtained in a beautifully crystalline form as alkaloid, and afterwards in its characteristic crystallisation as sulphate. Chinchonidine, the residuary product, insoluble in ether, and of rather uncertain composition.

On the whole, the present remittance of barks is unquestionably the most instructive, and the most encouraging that I have had the opportunity of examining from India.*

* "The Chemist and Druggist." (15 May 1867.)

PARIS UNIVERSAL EXHIBITION.—CLASS XLIV.

CHEMICAL AND PHARMACEUTICAL PRODUCTS.

Paris, May 11.

On entering the dismal precincts of Class XLIV., the first object that strikes the eye is Howard & Son's fine collection of chinchona barks and salts. No less than 160 specimens of true and false chinchona barks are shown by this firm. Amongst them are a series of specimens from our East Indian chinchona plantations, which are already yielding bark of a quality far surpassing all expectations. There are also examples of the salts extracted from them, being the first ever exhibited. Below them are a magnificent series of salts of the alkaloids, quinine, quinidine, chinchonine, and chinchonidine, exhibiting the most singular differences in colour and crystalline form. With respect to the Indian barks, it is a curious fact that although the *chinchona succirubra* contains rather more quinine than the South American, it also yields a comparatively larger per-centage of chinchonidine and quinidine. The British Government have consequently issued a large amount of the salts of the last two alkaloids to the different hospitals in each presidency, in order to decide authoritatively on their relative therapeutical value. The result is not known yet, but as soon as it is we shall not fail to inform our readers of it. Amongst the salts of the four alkaloids some singular anomalies occur; thus, the chloroplatinate of quinine and chinchonine are crystalline, while those of quinidine and chinchonidine are amorphous. In the case of the chloraurates, all four of them yield crystalline salts. The chlorates are all fine salts. The chlorate of quinine is coming into use as a remedy in cases of virulent typhus fever, and is said to be of the greatest possible value. The specimens of crystallised aricine and its sulphate are also of the greatest interest. The whole number might be filled with descriptions of these salts, but nothing short of actual inspection will give any idea of this very valuable collection. While on the subject of barks, it may be worth while to inform our readers that a Blue Book containing the most important reports on the chinchona plantations in British India has just been issued. We shall probably return to this subject later, and give a digest of the very valuable information contained in the volume just mentioned. Besides chinchona alkaloids, Messrs. Howard exhibit fine specimens of borax, boracic acid, both crude and pure, and borate of manganese, which has lately come into great requisition as a drier in painting. Their tartaric and citric acids are beautifully crystallised, the crystals of the latter being singularly perfect. There are also fine samples of iodide and bromide of potassium, Rochelle salt in nearly perfect crystals, camphor, borotartrate of potash, soda crystals, a few salts of morphine, and a fine crystalline mass of bicarbonate of soda.

— No. 16. —

From the Government of Madras to the Secretary of State for India.

Madras, 23 December 1866.

WE have the honour to forward for your information the accompanying Tabular Report on the number, condition, &c., of the Chinchona plants on the Neilgherries on the 31st October 1866.

Enclosure in No. 16.

REPORT on the Number, Distribution, and Condition of Chinchona Plants on the Neilgherries on 31st October 1866.

Species.	Botanical Names.	Commercial Names.	Number of Plants.	Value per lb. of Dry Bark in the London Market.	REMARKS.
				<i>s. d. s. d.</i>	
1	C. Succirubra - -	Red Bark - -	7,39,545	2 6 to 8 9	The planting season having passed, the total number of plants perma- nently planted out in the planta- tions is the same as in last month, viz., 4,01,211.
2	C. Calisaya - -	Yellow Bark - -	40,421	2 10 to 7 -	
"	" Frutex - -				
"	" Vera - -				
3	C. Officinalis - -				The increase by propagation is 80,000, being 14,300 plants under the average of the last six months, making the total number 16,90,303.
"	" " A Uritusinga	Select Crown Bark - -	87,509	2 10 to 7 -	
"	" " B Condaminea	Original Loxa Bark - -	7,87,903	2 10 to 7 -	
"	" " S Crispa	Fine Crown Bark - -	4,380	2 10 to 6 -	
4	C. Lancifolia - -	Pitayo Bark - -	304	1 8 to 2 10	
5	C. Nitida - -	Genuine Grey Bark - -	2,786	1 8 to 2 9	
6	C. Species without name.	Fine Grey Bark - -	8,500	1 8 to 2 10	
7	C. Micrantha - -	Grey Bark - -	15,141	1 8 to 2 9	
8	C. Peruviana - -	Finest Grey Bark - -	3,889	1 8 to 2 10	
9	C. Pahudiana - -	Unknown - -	425	Unknown.	
TOTAL Number of Plants - - -			16,90,303		

TABLE II.

MEMORANDUM of the Growth of Eleven Plants of *C. succirubra*, planted on the Second Denison Plantation at Neddivuttum on 30 August 1862.

Number of Plants.	Height in Inches when Planted on 30 August 1862.	Height in Inches on 30 September 1866.	Height in Inches on 31 Oct. 1866.	Growth in Inches during October 1866.	By whom Planted.	REMARKS.
1	28	143	144½	1½	Sir W. Denison. J. W. Breeks, Esq. Dr. Sanderson. J. D. Sim, Esq. Lieutenant McLeod P. Grant, Esq. Plant cut down for bark.	TABLE II. exhibits the growth of eleven plants of <i>C. succirubra</i> , planted out by Sir W. Denison and other gentlemen at Neddivuttum on the 30th August 1862. The average growth of these plants during the month is 1½ inches or ⅓ths of an inch above the growth of last month. One of the two plants cut down on the 20th of March 1863, for the bark submitted to Mr. Howard for analysis, has made strong shoots of 89½ inches in height, giving the growth of 1½ inches during the month.
2	16½	127	128	1		
3	19	138	134	1		
4	16	120	121½	1½		
5	27	147	148	1		
6	20	108	111	3		
7	20	128½	128½	-		
8	18	138	134½	1½		
9	20	138	138½	½		
10	20	142	144	2		
11	18	125	126	1		
12	-	88	89½	1½		

TABLE III.

SHOWING the Height of Twelve Plants of *C. officinalis*, planted on the Dodabetta Plantation at Ootacamund on 30 September 1863.

Number of Plants.	Height in Inches when planted on 30 September 1863.	Height in Inches on 30 September 1866.	Height in Inches on 31 October 1866.	Growth in Inches during October 1866.	REMARKS.
1	19	121	122	1	The twelve plants of <i>C. Officinalis</i> (a shrubby species) on the Dodabetta plantation, gives an average growth of $1\frac{5}{8}$ inches, or $\frac{5}{8}$ ths of an inch above the growth of last month. Several plants of <i>C. Succirubra</i> , <i>Calisaya</i> , and <i>Condamenia</i> , have furnished a good supply of fine seeds, which are now germinating freely.
2	14 $\frac{1}{2}$	107	109	2	
3	28	123 $\frac{1}{2}$	124 $\frac{1}{2}$	1 $\frac{1}{2}$	
4	22	119	120	1	
5	21 $\frac{1}{2}$	128 $\frac{1}{2}$	130	1 $\frac{1}{2}$	
6	28	132 $\frac{1}{2}$	133 $\frac{1}{2}$	1 $\frac{1}{2}$	
7	22 $\frac{1}{2}$	118 $\frac{1}{2}$	120	1 $\frac{1}{2}$	
8	21 $\frac{1}{2}$	119 $\frac{1}{2}$	120 $\frac{3}{4}$	1	
9	21 $\frac{1}{2}$	127	128 $\frac{1}{2}$	1 $\frac{1}{2}$	
10	19 $\frac{1}{2}$	122 $\frac{3}{4}$	124	1 $\frac{1}{2}$	
11	24	124 $\frac{1}{2}$	126 $\frac{1}{2}$	2	
12	24	127 $\frac{1}{2}$	129	1 $\frac{3}{4}$	

TABLE IV.

REGISTER of Chinchona Plants Distributed.

NAMES.	Stations.	No. of Plants.	REMARKS.
Mr. F. N. Maltby	Trevandrum	16	The number of plants issued to the public during the month is 68, making the total distributed 1,25,747.
Dr. Junghun	Java	56	
Mr. A. R. Lascelles	Ootacamund	12	
Mr. M. Anderson	Jamaica	2	
Dr. Wiche	Bombay	10	
Dr. T. Anderson	Calcutta	554	
Dr. Jamieson	Saharanpore	107	
Professor Lees	Calcutta	547	
Rajah of Travancore	Travancore	521	
Major Morgan	Ootacamund	1,584	
Mr. E. T. Fitzgerald	Calcutta	558	
Mr. J. W. B. Money	- ditto -	1,369	
Mr. W. Bourne	- ditto -	532	
Captain Cox	Wynaad	6	
Mr. Hollock	- ditto -	2	
Mr. T. Sheffield	Ootacamund	12	
Dr. F. Day	Cochin	100	
Mr. Brown	Tellicherry	12	
Mr. J. Hall	Ootacamund	150	
Mr. T. Knop	- ditto -	18	
Captain Lees	Bengal	386	
Mr. W. H. Rayne	Manantoddy	424	
Reverend Sayers	Ootacamund	1,018	
Mr. A. Frend	- ditto -	512	
Mr. Hollock	- ditto -	1	
Mr. J. Pierie	Seegoor	12	
Colonel Scott	Ootacamund	1,236	
Mr. Berend	Caohar	275	
Rev. J. Hunter	Coonoor	12	
Mr. T. Mullaly	- ditto -	212	
Mr. W. H. Stanes	- ditto -	1,262	
Colonel R. Cooper	Kotagherry	12	
Mr. F. Cockburn	- ditto -	12	
Colonel Woodfall	Coonoor	12	
Mr. C. Anderson	- ditto -	24	
Colonel Angelo	Ootacamund	12	
Rev. E. Laseron	- ditto -	12	
Captain R. N. Taylor	Coorg	96	

TABLE IV.—REGISTER of Chinchona Plants Distributed—*continued.*

NAMES.	STATIONS.	Number of Plants.	Remarks.
Major W. Agnew - - - -	Assam - - - -	139	
Mr. V. H. Levinge - - - -	Madura - - - -	12	
Chief Commissioner of - - - -	Nagpore - - - -	28	
Mr. Fletcher - - - -	Ootacamund - - - -	524	
Gool Mahomed - - - -	- ditto - - - -	20	
General McCleverty - - - -	New Zealand - - - -	23	
Mr. W. Robinson - - - -	Kotagherry - - - -	330	
Mr. Clarke - - - -	Wynaad - - - -	12	
Mr. H. R. Dawson - - - -	Seegoor - - - -	12	
Captain Mann - - - -	Coorg - - - -	48	
Mr. E. Roberts - - - -	- ditto - - - -	530	
Mr. H. Russell - - - -	Wynaad - - - -	52	
Rev. Wait - - - -	Coonoor - - - -	2	
Collector of Belgaum - - - -	Belgaum - - - -	28	
Collector of Honore - - - -	Honore - - - -	28	
Dr. Ross - - - -	- ditto - - - -	15	
His Excellency the Governor - - - -	Bombay - - - -	158	
Mr. H. Hinde - - - -	Wynaad - - - -	12	
Mr. E. B. Thomas - - - -	Coonoor - - - -	874	
Rajah of Poonganoor - - - -	Poonganoor - - - -	12	
Major Grant - - - -	Wellington - - - -	226	
Messrs. Thomson, Shaw & Co. - - - -	Poonganoor - - - -	28	
Mr. J. H. Trinson - - - -	- ditto - - - -	31	
Dr. Muller - - - -	Melbourne - - - -	28	
Mr. Tyrrell - - - -	Mysore - - - -	12	
Dr. Sayers - - - -	Vellore - - - -	12	
Major C. P. Taylor - - - -	Ootacamund - - - -	5,250	
Doctor Wilson - - - -	- ditto - - - -	6	
Mr. Schnarrie - - - -	- ditto - - - -	15,000	
Captain Fuller - - - -	Coonoor - - - -	417	
Dr. Drummond - - - -	Ootacamund - - - -	224	
Captain Jennings - - - -	- ditto - - - -	1,756	
Lieut. H. B. Montmorency - - - -	Bangalore - - - -	6	
Mr. McHutchin - - - -	Ootacamund - - - -	3	
Colonel Molesworth - - - -	- ditto - - - -	6	
Mr. C. Gray - - - -	Coonoor - - - -	12	
Mr. H. B. Liddell - - - -	Ootacamund - - - -	12	
Mr. Minchin - - - -	Wynaad - - - -	1,600	
His Excellency the Governor - - - -	Vizagapatam - - - -	35	
Mr. R. F. Phillips - - - -	Kotagherry - - - -	1,117	
Colonel Cooke - - - -	- ditto - - - -	24	
Mr. G. F. Glasson - - - -	Wynaad - - - -	1,000	
Dr. Macpherson - - - -	Mercara - - - -	400	
Mr. W. H. Kerr - - - -	Coorg - - - -	3,100	
Mr. James - - - -	Ootacamund - - - -	1,000	
Colonel Whish - - - -	Bengal - - - -	82	
Mr. K. Mair - - - -	Calcutta - - - -	1,180	
Mr. W. Shakespear - - - -	- ditto - - - -	61	
Mr. E. E. Meakin - - - -	- ditto - - - -	168	
Mr. C. Ackland - - - -	- ditto - - - -	150	
Mr. K. McIver - - - -	- ditto - - - -	124	
Mr. Havelock - - - -	Ootacamund - - - -	12	
Mr. H. de Facien - - - -	Kartairy - - - -	6,821	
Major Sweet - - - -	- ditto - - - -	910	
Captain Campbell - - - -	Bangalore - - - -	6	
Royal Gardens - - - -	Mauritius - - - -	36	
Honourable W. R. Arbuthnot - - - -	Wynaad - - - -	93	
Mr. H. Maxwell - - - -	Bombay - - - -	50	
Mrs. C. Smith - - - -	Wynaad - - - -	316	
Captain Meekly - - - -	Wellington - - - -	200	
Mr. Walsh - - - -	Salem - - - -	150	
His Excellency the Governor General - - - -	Java - - - -	175	
Captain Richardson - - - -	Kulhatty - - - -	509	
Rajah of Poonganoor - - - -	Poonganoor - - - -	24	
His Excellency the Governor - - - -	Madras - - - -	24	
Mr. J. W. B. Money - - - -	Ootacamund - - - -	25,018	
Captain Mitcheson - - - -	- ditto - - - -	50	
Mr. R. H. Elliot - - - -	Munjerabad - - - -	276	
His Excellency the Governor General - - - -	Goa - - - -	252	
Colonel Phayre - - - -	Rangoon - - - -	152	

OF CHINCHONA PLANTS IN INDIA.

41

TABLE IV.—REGISTER of Chinchona Plants Distributed—continued.

NAMES.	STATIONS.	Number of Plants.	REMARKS.
Mr. Ryal - - - - -	Kotagherry - - -	24	
Mr. J. Gordon - - - - -	Coonoor - - - - -	6,325	
Mr. J. Rohde - - - - -	Neddivuttum - - -	11,689	
Mr. J. Higginbotham - - - - -	Gooduloor - - - -	28	
Mr. S. Pital - - - - -	Mauritius - - - -	36	
Mr. J. Horne - - - - -	- ditto - - - - -	36	
Mr. Edward Cremary - - - - -	Reunion - - - - -	51	
For the French Government - - - - -	Algiers - - - - -	45	
Mr. J. B. Norton - - - - -	Shevaroy - - - - -	50	
Mr. Mackay - - - - -	Punjaub - - - - -	50	
Mr. W. Forsyth - - - - -	Central Provinces - - -	169	
Colonel Cadell - - - - -	Coorg - - - - -	62	
Mr. J. L. Browning - - - - -	Wynaad - - - - -	4	
Mr. H. Leeds - - - - -	Burmah - - - - -	112	
Maloo Sait - - - - -	- ditto - - - - -	6	
Mr. A. D. Brown - - - - -	Dimhutty - - - - -	53	
Mr. J. C. Misquith - - - - -	Ootacamund - - - -	300	
Mr. J. L. Transen - - - - -	Coonoor - - - - -	8	
Captain Fitzgerald - - - - -	Calcutta - - - - -	150	
Mr. Macpherson - - - - -	Ootacamund - - - -	12	
Major Travers - - - - -	- ditto - - - - -	5,000	
Mr. S. Prager - - - - -	Vithry, Wynaad - - -	69	
Rev. Wenger - - - - -	Kaity, Ootacamund - -	2	
Mr. G. W. Forbes - - - - -	Dhurmsala - - - - -	55	
Major C. Elliot - - - - -	Mysore - - - - -	5,044	
Collector of Salem - - - - -	Salem - - - - -	100	
Collector of Tinnevely - - - - -	Tinnevely - - - - -	500	
Colonel Denison - - - - -	Ootacamund - - - -	553	
Conservator of Forests - - - - -	- ditto - - - - -	50	
Mr. J. Ouchterlony - - - - -	- ditto - - - - -	300	
Mr. R. C. Elwin - - - - -	Neddivuttum - - -	12,510	
TOTAL Number of Plants - - -		1,25,747	

Ootacamund,
27 November 1866.

(signed) W G. McIvor,
Superintendent Government Chinchona Plantations.

ORDER of the Madras Government, 11th December 1866.

1. Ordered to be forwarded to the Secretary of State, to the Supreme Government, and to the other Governments in India; also to the Superintendent Chinchona Plantations in Java.

(signed) J. D. Sim,
Secretary to Government.

— No. 17. —

From the Government of *Madras* to the Secretary of State for *India*.

Madras, 22 January 1867.

WE have the honour to forward, for your information, the accompanying Tabular Report on the number, condition, &c., of the *Chinchona* plants on the Neilgherries on the 30th November 1866.

Enclosure in No. 17.

REPORT on the Number, Distribution, and Condition of *Chinchona* Plants on the Neilgherries, on the 30th November 1866.

Species.	Botanical Names.	Commercial Names.	Number of Plants.	Value per Lb. of Dry Bark in the London Market.	REMARKS.
				s. d. s. d.	
1	C. Succirubra - -	Red Bark - -	7,89,545	2 6 to 8 9	The total number of plants per- manently planted out in the plan- tations remain the same as in last month, viz., 4,01,211.
2	C. Calisaya - -	Yellow Bark - -	40,421	2 10 to 7 -	
	" Frutex - -				
	" Vera - -				
3	C. Officinalis	Original Loxa Bark -	87,509	2 10 to 7 -	The increase by propagation is 50,000, being 48,619 plants under the average of the last six months, making the total number 17,40,303.
	" " A Uritusinga -	Select Crown Bark -	7,87,903	2 10 to 7 -	
	" " B Condamenia	Fine Crown Bark -	4,880	2 10 to 6 -	
	" " S Crispa - -	Pitayo Bark - -	304	1 8 to 2 10	
4	C. Lancifolia - -	Genuine Grey Bark -	2,786	1 8 to 2 9	
5	C. Nitida - -	Fine Grey Bark -	8,500	1 8 to 2 10	
6	C. species without name.	Grey Bark - -	15,141	1 8 to 2 9	
7	C. Micrantha - -	Finest Grey Bark -	3,389	1 8 to 2 10	
8	C. Peruviana - -	Unknown - -	425	Unknown.	
9	C. Pahudiana - -				
TOTAL Number of Plants - - -			17,40,303		

TABLE II.

MEMORANDUM of the Growth of Eleven Plants of *C. Succirubra*, planted on the Second Denison Plantation at Neddivuttum, on the 30th August 1862.

Number of Plants.	Height in Inches when Planted on 30 August 1862.	Height in Inches on 30 October 1862.	Height in Inches on 30 Nov. 1862.	Growth in Inches during November 1862.	By whom Planted.	REMARKS.
1	23	144½	144½	-	Sir W. Denison.	Table II. exhibits the growth of 11 plants of <i>C. succirubra</i> , planted out by Sir W. Denison and other gentlemen at Neddivuttum on the 30th August 1862. The average growth of these plants during the month is ½ of an inch, or ¼ of an inch under the growth of last month.
2	16½	128	129	1		
3	19	134	135	1		
4	16	121½	121½	-		
5	27	148	148½	½	J. W. Breeks, Esq. Dr. Sanderson. J. D. Sim, Esq. Lieutenant McLeod. P. Grant, Esq.	One of the two plants cut down on the 20th of March 1863 for the bark, submitted to Mr. Howard for analysis, has made strong shoots of 90 inches in height, giving the growth of half-an-inch during the month.
6	20	111	112½	1½		
7	20	128½	128½	-		
8	18	134½	135	½		
9	20	138½	138½	-	P. Grant, Esq.	
10	20	144	145	1		
11	18	126	128	2		
12	-	69½	90	½	Plant cut down for bark.	

TABLE III.

SHOWING the Height of Twelve Plants of *C. Officinalis*, planted on the Dodabetta Plantation at Ootacamund, on the 30th September 1863.

Number of Plants.	Height in Inches when Planted, on 30 September 1863.	Height in Inches on 31 October 1863.	Height in Inches on 30 November 1863.	Growth in Inches during November 1863.	REMARKS.
1	19	122	124	2	The 12 plants of <i>C. officinalis</i> (a shrubby species) on the Dodabetta Plantation, gives an average growth of $1\frac{1}{4}$ inches, or $\frac{1}{4}$ th of an inch above the growth of last month. Several plants of <i>C. succirubra</i> , <i>calisaya</i> , and <i>condamenia</i> have furnished a good supply of fine seeds, which are now germinating freely.
2	14 $\frac{1}{2}$	109	111	2	
3	28	124 $\frac{1}{2}$	126	1 $\frac{1}{2}$	
4	22	120	121 $\frac{1}{2}$	1 $\frac{1}{2}$	
5	21 $\frac{1}{2}$	130	131 $\frac{1}{2}$	1 $\frac{1}{2}$	
6	28	133 $\frac{1}{2}$	134 $\frac{1}{2}$	1 $\frac{1}{2}$	
7	22 $\frac{1}{2}$	120	121 $\frac{1}{2}$	1 $\frac{1}{2}$	
8	21 $\frac{1}{2}$	120 $\frac{1}{2}$	122	1 $\frac{1}{2}$	
9	21 $\frac{1}{2}$	128 $\frac{1}{2}$	129	$\frac{1}{2}$	
10	19	124	125 $\frac{1}{2}$	1 $\frac{1}{2}$	
11	24	126 $\frac{1}{2}$	128	1 $\frac{1}{2}$	
12	24	129	130 $\frac{1}{2}$	1 $\frac{1}{2}$	

TABLE IV.

REGISTER of Chinchona Plants Distributed.

NAMES.	STATIONS.	Number of Plants.	REMARKS.
Mr. F. N. Maltby	Trevandrum	16	The total number of plants distributed to the public up to this month is 1,25,747.
Dr. Junghun	Java	56	
Mr. A. R. Lascelles	Ootacamund	12	
Mr. M. Anderson	Jamaica	2	
Dr. Wiche	Bombay	10	
Dr. T. Anderson	Calcutta	554	
Dr. Jamieson	Saharanpore	107	
Professor Lees	Calcutta	547	
Rajah of Travancore	Travancore	521	
Major Morgan	Ootacamund	1,534	
Mr. E. T. Fitzgerald	Calcutta	558	
Mr. J. W. B. Money	- ditto	1,369	
Mr. W. Bourne	- ditto	532	
Captain Cox	Wynaad	6	
Mr. Hollock	- ditto	2	
Mr. T. Sheffield	Ootacamund	12	
Dr. F. Day	Cochin	100	
Mr. Brown	Tellicherry	12	
Mr. J. Hull	Ootacamund	166	
Mr. T. Knop	- ditto	18	
Captain Lees	Bengal	386	
Mr. W. H. Rayne	Manantoddy	424	
Rev. — Sayers	Ootacamund	1,018	
Mr. A. Friend	- ditto	512	
Mr. Hollock	- ditto	1	
Mr. J. Pierie	Seegoor	12	
Colonel Scott	Ootacamund	1,236	
Mr. Berend	Cachar	275	
Rev. J. Hunter	Coonoor	12	
Mr. T. Mullaly	- ditto	160	
Mr. W. H. Stanes	- ditto	1,262	
Colonel R. Cooper	Kotagherry	12	
Mr. F. Cockburn	- ditto	12	
Colonel Woodfall	Coonoor	12	
Mr. C. Anderson	- ditto	24	
Colonel Angelo	Ootacamund	12	
Rev. E. Laseon	- ditto	12	
Captain R. N. Taylor	Coorg	96	
Major W. Agnew	Assam	139	
Mr. V. H. Levings	Madura	12	
• Chief Commissioner of	Nagpore	18	

TABLE IV.—Register of Chinchona Plants Distributed—*continued*.

NAMES.	STATIONS.	Number of Plants.	REMARKS.
Mr. Fletcher - - - -	Ootacamund - -	524	
Gool Mahomed - - - -	- ditto - -	20	
General McCleverty - - -	New Zealand - -	23	
Mr. W. Robinson - - - -	Kotagherry - -	330	
Mr. Clarke - - - -	Wynaad - -	12	
Mr. H. R. Dawson - - - -	Seegoor - -	12	
Captain Mann - - - -	Coorg - -	48	
Mr. E. Roberts - - - -	- ditto - -	530	
Mr. H. Russell - - - -	Wynaad - -	52	
Reverend Wait - - - -	Coonoor - -	2	
Collector of Belgaum - - -	Belgaum - -	28	
Collector of Honore - - -	Honore - -	28	
Dr. Ross - - - -	- ditto - -	15	
His Excellency the Governor -	Bombay - -	168	
Mr. H. Hinde - - - -	Wynaad - -	12	
Mr. E. B. Thomas - - - -	Coonoor - -	874	
Rajah of Poonganoor - - -	Poonganoor - -	12	
Major Grant - - - -	Wellington - -	226	
Messrs. Thomson, Shaw & Co. -	Poonganoor - -	28	
Mr. J. H. Trinson - - - -	- ditto - -	31	
Dr. Muller - - - -	Melbourne - -	28	
Mr. Tyrrell - - - -	Mysore - -	12	
Dr. Sayers - - - -	Vellore - -	12	
Major C. P. Taylor - - - -	Ootacamund - -	5,250	
Doctor Wilson - - - -	- ditto - -	6	
Mr. Schnarrie - - - -	- ditto - -	15,000	
Captain Fuller - - - -	Coonoor - -	417	
Dr. Drummond - - - -	Ootacamund - -	234	
Captain Jennings - - - -	- ditto - -	1,756	
Lieut. H. B. Montmorency - -	Bangalore - -	6	
Mr. McHutchin - - - -	Ootacamund - -	3	
Colonel Molesworth - - - -	- ditto - -	6	
Mr. C. Gray - - - -	Coonoor - -	12	
Mr. H. B. Liddell - - - -	Ootacamund - -	12	
Mr. Minchin - - - -	Wynaad - -	1,600	
His Excellency the Governor -	Vizagapatam - -	35	
Mr. R. F. Phillips - - - -	Kotagherry - -	1,117	
Colonel Cooke - - - -	- ditto - -	24	
Mr. G. F. Glasson - - - -	Wynaad - -	1,000	
Dr. Macpherson - - - -	Mercara - -	400	
Mr. W. H. Kerr - - - -	Coorg - -	3,100	
Mr. James - - - -	Ootacamund - -	1,000	
Colonel Whish - - - -	Bengal - -	82	
Mr. K. Mair - - - -	Calcutta - -	1,180	
Mr. W. Shakespear - - - -	- ditto - -	61	
Mr. E. E. Meakin - - - -	- ditto - -	168	
Mr. C. Ackland - - - -	- ditto - -	150	
Mr. K. McIver - - - -	- ditto - -	124	
Mr. Havelock - - - -	Ootacamund - -	12	
Mr. H. de Facien - - - -	Kartairy - -	6,621	
Major Sweet - - - -	- ditto - -	910	
Captain Campbell - - - -	Bangalore - -	6	
Royal Gardens - - - -	Mauritius - -	36	
Honourable W. R. Arbuthnot - -	Wynaad - -	93	
Mr. H. Maxwell - - - -	Bombay - -	50	
Mrs. C. Smith - - - -	Wynaad - -	316	
Captain Meekly - - - -	Wellington - -	200	
Mr. Walsh - - - -	Salem - -	150	
His Excellency the Governor General.	Java - -	175	
Captain Richardson - - - -	Kulhatty - -	509	
Rajah of Poonganoor - - - -	Poonganoor - -	24	
His Excellency the Governor -	Madras - -	24	
Mr. J. W. B. Money - - - -	Ootacamund - -	25,018	
Captain Mitcheson - - - -	- ditto - -	50	
Mr. R. H. Elliot - - - -	Munjerabad - -	276	

TABLE IV.—Register of Chinchona Plants Distributed—*continued*.

NAMES.	STATIONS.	Number of Plants.	REMARKS.
His Excellency the Governor General.	Goa - - -	252	
Colonel Playre - - - -	Rangoon - - -	152	
Mr. Ryal - - - -	Kotagherry - -	24	
Mr. J. Gordon - - - -	Coonoor - - -	6,325	
Mr. J. Rohde - - - -	Neddivuttum - -	11,689	
Mr. J. Higginbotham - - -	Goodaloor - - -	12	
Mr. S. Pital - - - -	Mauritius - - -	36	
Mr. J. Horne - - - -	- ditto - - -	36	
Mr. Edoard Cremary - - -	Reunion - - -	51	
For the French Government - - -	Algiers - - -	45	
Mr. J. B. Norton - - - -	Shevaroy - - -	50	
Mr. Muckay - - - -	Punjaub - - -	50	
Mr. W. Forsyth - - - -	Central Provinces - - -	169	
Colonel Cadell - - - -	Coorg - - -	62	
Mr. J. L. Browning - - - -	Wynaad - - -	4	
Mr. H. Leeds - - - -	Burmah - - -	112	
Maloo Sait - - - -	- ditto - - -	6	
Mr. A. D. Brown - - - -	Dimhatty - - -	53	
Mr. J. C. Misquith - - - -	Ootacamund - - -	300	
Mr. J. L. Transen - - - -	Coonoor - - -	8	
Captain Fitzgerald - - - -	Calcutta - - -	150	
Mr. Mucpherson - - - -	Ootacamund - - -	12	
Major Travers - - - -	- ditto - - -	5,000	
Mr. S. Prager - - - -	Vithry, Wynaad - - -	69	
Reverend Wenger - - - -	Kaity, Ootacamund - - -	2	
Mr. G. W. Forbes - - - -	Dhumsala - - -	55	
Major C. Elliot - - - -	Mysore - - -	5,044	
Collector of Salem - - - -	Salem - - -	100	
Collector of Tinnevely - - - -	Tinnevely - - -	500	
Colonel Denison - - - -	Ootacamund - - -	550	
Conservator of Forests - - - -	- ditto - - -	50	
Mr. J. Ouchterlony - - - -	- ditto - - -	300	
Mr. R. C. Elwin - - - -	Neddivuttum - - -	12,510	
Mr. Higginbotham - - - -	Goodaloor - - -	16	
Mr. Mullaly - - - -	Coonoor - - -	52	
TOTAL Number of Plants - - -		1,25,747	

Ootacamund,
December 1866.

(signed) *W. G. McIvor*,
Superintendent Government Chinchona Plantations.

ORDER of the Madras Government, 15 January 1867.

1. ORDERED to be forwarded to the Secretary of State, to the Supreme Government, and to the other Governments in India; also to the Superintendent Chinchona Plantations in Java.

(signed) *J. D. Sim*,
Secretary to Government.

— No. 18 a. —

From the Government of *Madras* to the Secretary of State for *India*.

Madras, 12 February 1867.

1. We have the honour to forward Mr. McIvor's Report on the Chinchona Plantations and Botanical Gardens on the Neilgherries for 1865-66, the general results of which have, as usual, been embodied concisely in our Annual Administration Report.

2. Notwithstanding that the season was adverse, owing to protracted drought and the prevalence of high winds, the progress during the year has been most satisfactory.

3. The number of plants propagated was 5,97,965 (exclusive of untransplanted seedlings), 2,18,975 were permanently set out in our plantations, and 22,145 issued to the public. The condition of the plantations is most promising, and the trees first planted out are now producing seed freely, thus supplying the means of easily and extensively propagating the plant. By the end of the current year Mr. McIvor will have more plants than will be required for our plantations, and will then be able to propagate almost exclusively for sale and distribution.

4. Mr. McIvor, you will observe, is in possession of several new varieties, but the Pitayo bark seeds have unfortunately again failed; we strongly advise that further efforts be made to procure this valuable species.

5. Experience continues to show that cultivation in open ground is the true system, and it is highly gratifying to find that the Crown barks grow as well on grass as on forest land. As cultivation on such land must be considerably less expensive, and this species of Chinchona yields a high per-centage of quinine, we trust that private enterprise will be directed to clothing the numerous grassy hills of the Neilgherries with forest vegetation of this valuable character, thus counterbalancing the destruction of the old sholas.

		Acres.
Neddivuttum -	-	357
Pykara -	-	92
Dodabetta -	-	224
TOTAL -	-	673

6. The total area under actual cultivation in our plantations was 673 acres.

7. The experimental employment of convict labour on the plantations has answered well, and Mr. McIvor reports that nearly all those whose sentences have expired have settled, with their families, as free labourers on the plantations.

8. Mr. Broughton, the quinologist, has arrived, and our next report will, we hope, contain some of the results of his labours in analysing the bark grown in the plantations.

9. The operations in the Botanical Gardens and Tea Plantation have also been of a satisfactory character.

10. We consider that great credit is due to Mr. McIvor for the results above reported. Mr. McIvor speaks in high terms of the majority of his assistants, and especially of Mr. Batcock, whose salary we have lately raised to 200 rupees per mensem from the date on which his agreement with us expired.

G. O.	13th April 1866,	Nos. 164, 165.
"	3rd May	" 78-79.
"	19th June	" 419, 420.
"	12th July	" 253, 254.
"	12th Nov.	" 256, 257.

11. We shall report separately, in due course, on the results of the distribution of Chinchona plants sanctioned in our orders marginally noted, and on the experimental employment of the alkaloids other than quinine.

Enclosure 1, in No. 18 a.

From the Superintendent Government Chinchona Plantations, to the Secretary to Government, Revenue Department, Fort Saint George.

Ootacamund, 20 September 1866.

1. IN continuation to my letter of the 15th instant, I have the honour to forward herewith my administration Report on the Government Chinchona Plantations and Botanical Gardens for the official year 1865-66, and beg to express my regret for the delay in its transmission.

2. The manuscript of the new edition of "Notes on Chinchona Cultivation" contains all information with reference to cultivation, and consequently this subject has been passed over without notice in the present Report.

REPORT on the Government Chinchona Plantations and Botanical Gardens on the Neilgherries for 1865-66.

1. IN submitting this report it is gratifying to be able to state that, notwithstanding an unusually dry season, with high and parching wind, conditions unfavourable to cultivation, our works and planting operations have made more than usual progress, and our plants continue to maintain that luxuriance which has all along characterised their growth on the Neilgherries. The maximum monthly increase by propagation has reached as high as 78,725.

Introductory observations.

Maximum monthly increase by propagation.

2. The average monthly propagation throughout the year being 48,968 against 21,200, the result of last year; the total number of plants on the 1st May 1866 was 11,56,070 against 5,58,105 on the same date last year. Thus the number of plants has been doubled in one year, a result which, at the commencement of the season, we did not anticipate.

Average increase.

Number of plants on the 1st May 1866.

The total number of plants issued to the public is 1,00,757 against 7,8,612, the number issued from the commencement of the undertaking up to the 1st May 1865, giving in this respect also a satisfactory result.

Number of plants issued to the public.

The number of plants permanently planted out up to date is 4,01,211 against 1,82,236, the number planted out on the 31st May last year. Our first plants, which were permanently planted out on the 30th August 1862, have now attained heights varying from 12 to 20 feet, the circumference of the stems being from 11 to 22 inches. Nothing can be more promising than the present condition of these plants. They have already produced many millions of excellent seeds, so that Chinchona plants can now be easily increased to any extent. The seeds have been extensively distributed, and are now germinating by hundreds of thousands in different parts of the country. The bark of our oldest plants has also much increased in thickness and improved in appearance, while the yield of crystallised sulphates has been ascertained by recent analysis to have reached the unprecedented quantity of 10 per cent.

Number of plants permanently planted out.

Height of plants and circumference of stems.

Oldest plants now producing excellent seeds.

Recent analysis shows great increase of alkaloids.

3. The modifications found necessary in the system of cultivation being detailed and illustrated in the new edition of the Manual recently submitted to Government, I consider it unnecessary again to refer to the subject in this report. With these observations I proceed to particulars which, for the sake of convenience, are arranged under the following heads:

Modifications in cultivation noticed in the Manual, therefore not repeated here.

Heads of Report.

	Paras.
1. Propagation - - - - -	4 and 5
2. Plants, condition and growth of - - - - -	6 „ 7
3. „ growth of, in the open ground - - - - -	9
4. „ „ under the shade of living trees - - - - -	8
5. Felling forests, effect of, on water supply - - - - -	10
6. Alkaloids, formation of - - - - -	11 and 12
7. „ effect of the application of moss - - - - -	13 „ 14
8. Establishment - - - - -	15 „ 16
9. Convict labour - - - - -	15
10. Progress of operations - - - - -	19 — 21
11. Botanical Gardens - - - - -	22 and 23
12. Tea Plantations - - - - -	24
13. Concluding remarks - - - - -	25 and 26
14. Appendix A.—Accounts from the commencement of operations to 30th April 1866.	
15. Appendix B.—Meteorological observations at Neddivuttum.	
16. Appendix C.— Ditto - - ditto - at Ootacamund.	

Propagation by seeds.

Offers great facilities for increasing plants.

Alteration in the propagating houses necessary for seedlings.

7,00,000 seedlings raised during the last few months.

Sufficient plants for the Government plantations may be raised by the end of this year.

Some species have yet to be propagated by cuttings.

60,000 plants raised from Mr. Money's Calisaya seed, apparently of three varieties.

Raised a few seeds from Mr. Markham under the name of C. Calisaya.

Probably C. Calisaya Morado. Seeds of Pitayo bark failed to germinate.

Oldest plants in the plantations, planted at twelve feet apart, now meeting.

Bark increased as 16½ to 10.

C. Succirubra continues to be the most luxuriant and best species to cultivate.

Our C. Calisaya ascertained to be the variety Josepheana known as a shrubby kind of inferior value.

The true Bolivian C. Calisaya probably among Mr. Money's seedlings.

Propagation.—4. The majority of our young plants have been recently raised from seed obtained from our oldest plants. The seeds begin to germinate about the sixteenth day after sowing, and from one ounce of seeds from 20,000 to 25,000 plants are obtained. Hence seeds offer far greater facilities for increasing our number of plants than either cuttings or buds, which hitherto was the only means by which we could increase our plants. From the 31st May 1865, to the 31st May 1866, the number of plants has been more than doubled, giving in this respect in one year a greater result than that attained in the four preceding years. Now, with abundance of seeds, our plants can be increased in a very short space of time to any desired number. The growing of seeds instead of cuttings and buds has necessitated a slight alteration in our propagating houses. These alterations have been effected, and we have now accommodation in our houses and hardening pits for about a million of seedlings. During the last few months we have raised about 7,00,000 seedlings, which are not yet all transplanted, and consequently not carried to account in our monthly propagating reports, as in these reports only transplanted plants are entered. By the end of this year we shall have more plants than would be required for the completion of the whole extent of the Government plantations, and then our propagating appliances can be almost entirely devoted to the production of plants for the public. As we have extensively distributed seeds, and these are easily raised, planters now, as a rule, are successful in raising the number of plants required for themselves. We have still, however, to continue the propagation of some of the species by cuttings and buds, such as C. Officinalis, C. Uritusinga, C. Lancifolia, &c., the original plants of these being of more recent introduction have not yet produced seeds. The plants of Uritusinga are, however, this season flowering freely; therefore next year, in all probability, we will have a large supply of seeds of this very valuable species.

5. From the imported seeds of the C. Calisaya, received from Mr. Money, we have reared about 60,000 seedlings, apparently of three varieties; this is most important, as the "yellow bark" is acknowledged to be the best quinine-producing species, especially in some of its varieties. A few seeds from Mr. Markham, also under the name of C. Calisaya, have germinated, and the plants are very distinct in appearance from even Mr. Money's seedlings, and in all probability they may turn out to be the very rare and valuable variety known as C. Calisaya Morado. It is with much regret I have to notice that the last batch of seeds of the Pitayo bark, gathered by Mr. Cross, has again failed. This is a most valuable species, and I hope that further attempts will be made to introduce it, as it is of the utmost importance that we should not rest satisfied till our collection in India possesses every species of known or even reputed value.

6. *Condition and growth of Plants.*—The eleven plants planted out by the late Governor Sir William Denison and staff, on the 30th August 1862, being placed in an exposed situation, they suffered from the violence of the south-west monsoon, consequently have not made such rapid growth as the average of the plantation plants. Our older plants, although planted at 12 feet apart, now meet each other, and have thus caused, during the present year, a greater perpendicular growth than hitherto, which this year is nearly double that of last, while the circumference of the stems has increased as 16½ to 10, which, together with the perpendicular height, gives an increase of the weight of bark in last year's growth upwards of five times as much as the total amount produced in the three preceding years. Therefore, to cut down these plants, would be an enormous loss, as the stems will no doubt increase in this ratio for many years. These remarks refer principally to the C. Succirubra, which still continues to maintain a more robust habit and luxuriant growth than any of the other species, and this, together with its alkaloid-producing power, render it, so far as our observations go, the most profitable and certain plant to cultivate. The growth of our C. Calisaya continues to be unsatisfactory and shrub-like, but this is now accounted for by it being recently ascertained to be the variety known as C. Calisaya Josepheana, which in its natural localities on the Andes is at most a mere shrub, producing bark of very inferior value to the tree Calisaya of the Bolivian forests. The C. Calisaya, apparently Morado, raised from Mr. Markham's seeds, has a very luxuriant growth, in this respect resembling the "red bark," as it also does in general appearance, but differing particularly in the deep red ciliated young leaves. A light foliaged variety, produced among Mr. Money's seeds, also promises to be of a very robust habit, and we have, therefore, every reason to believe that among these varieties we may possess the true and valuable Bolivian tree Calisaya, which may one day outstrip in profitable cultivation the "red bark," because it is more productive in pure quinine; but as there can be little doubt that Chinchonidine and quinidine are medicinally equally as efficacious as quinine, these alkaloids may not hereafter be separated by the manufacturers, and this will give the "red bark" a commercial advantage which it does not now possess. The

"Crown

"Crown Barks," or *C. officinalis* and its varieties, rank next in luxuriance to our "Red Bark," and as the analysis of the bark of this species shows a proportionate high per-centage of Quinine, these plants will doubtless be extensively cultivated, especially as the plant is much more hardy than the Red Bark. It also grows as well upon grass as upon forest land, and luxuriates even on the highest ridges of the Neilgherries, when sheltered from the full force of the monsoon. The "Grey Barks" grow luxuriantly, although they will not bear exposure to fierce gales, and what is most remarkable, these plants under cultivation produce a large per-centage of Quinidine instead of Chinchonine, their usual product in a wild state on the Andes. In this instance, therefore, cultivation has changed an inferior alkaloid into one of comparatively high value, which has also been the result, but in a less degree, with the "Red Bark," and one we may anticipate in the Calisaya, as soon as the plants attain sufficient age.

7. The *C. Pahudiana*, although yielding in its wild state bark worthless in commerce, promises under cultivation to become of some value, but not likely to enter into competition with any of the foregoing species. The plants of *C. Lancifolia* have been planted out in favourable localities, and every stimulant given in order to induce them to produce seeds as rapidly as possible; this species is almost as hardy as the "Crown Barks," and as it yields perhaps a higher per-centage of Quinine than the "Yellow Bolivian Barks," it is very important that we obtain as early as possible the means of increasing this very valuable sort.

8. *Growth of Plants under the Shade of Living Trees.*—Further experience still tends definitely to confirm that none of the species of Chinchona can be successfully grown under the shade of other trees; all our attempts at cultivation in this manner have proved unsatisfactory, notwithstanding the plants have in other respects been placed in the most favourable localities, and received every care and attention. The Calisaya may require a certain degree of shade, but this can only be secured by placing the plants close together, so that they may shade each other, leaving the robust ultimately to destroy the weak in the struggle for space and light. The different species cannot be successfully mixed together, as the luxuriant growing species injure and ultimately destroy the weaker. When Chinchonas are used for ornamental planting, they should be placed in clumps or groups, each group containing a single species, and arranged so as to produce, by the variation of foliage, the desired effect.

9. *Cultivation in the Open Ground.*—During the present season, our planting has only been done in such land as has been entirely cleared of forest; and this in future will have to be the only system adopted. About 70,000 "Crown Barks" have been planted out on grass land, where they are doing well. The plants of this species, placed out on grass land in 1863-64, continue to grow as luxuriantly as the plants planted out at the same time on forest land, consequently, in future these plants will be planted on grass land instead of forest, it being very desirable to cover some of the numerous grassy hills on the Neilgherries, with forest vegetation. All the species of Chinchona are found to thrive best under full exposure to light and air, therefore prior to being planted in forest land, it is necessary to clear away the whole of the original forest.

10. *Felling Forest, effect of, on Water Supply.*—One result of the felling of the forests for Chinchona cultivation has been to establish the fact, that the felling of forests immediately and greatly increases the supply of water in the streams, a result contrary to all received opinions, and being also contrary to anticipation; it led to a series of careful observation, which have established beyond doubt that, when forests are felled, the supply of water is increased in volume from two to three times, according as the streams rise in, or receive their supply from land occupied by forest, and as this increased flow of water has been permanent for five years, it cannot be the result of any accidental peculiarity or accidental circumstance. Both from a scientific and a practical point of view these are very interesting facts, establishing an extraordinary discrepancy in an accepted theory, which shakes the theory itself to its foundation. But when we reflect on the fact that trees exist upon moisture, and have been produced by the moisture of the locality where they exist, they must of necessity be a drain upon the moisture of the land in which they grow, and thus, apart from the great quantity of water which they draw from a depth of the soil, to be evaporated by the leaves and dissipated in the atmosphere. Another great fact attendant upon the production of forests seems to have been overlooked, namely, that it requires more constant and uniform moisture to support a seedling tree than is necessary to maintain a full grown one, this being further an incontestible evidence that all localities must have been more uniformly moist at, and prior to, the time the forest originated, than was necessary after the forest became established. Practically, this question is one of great moment, inasmuch as it shows that the existence of trees at the sources of

C. officinalis and its varieties rank next in luxuriance to the *C. Succirubra*.

Grow equally well on grass as on forest land, also on high ridges when protected from the monsoon.

The Grey Barks grow well, but will not bear exposure to fierce gales.

Produces Quinidine instead of Chinchonine, their usual product on the Andes.

C. Pahudiana under cultivation promises to become of some value.

Chinchona Lancifolia, a valuable kind.

Chinchona cannot be successfully grown under the shade of living trees.

Shade produced when necessary by close planting.

Chinchona when planted for ornament should be in groups, each of a separate species.

70,000 Crown Barks have been planted on grass land, and are doing well.

Well adapted for covering grassy hills.

All the species of *Chinchona* thrive best under full exposure to light and air.

Felling of forests immediately, and greatly increases the flow of water in streams.

Volume of water two to three times as great.

Increased flow maintained for five years.

Trees exist upon moisture, and have been produced by moisture.

Great quantity of water drawn from the soil by trees and dissipated in the atmosphere.

Localities in which forests exist must have been more uniformly moist at the time of their production.

Trees along the banks and at the sources of streams greatly reduce the flow of water.

springs, and along the banks of streams, greatly reduces the flow of water, as the trees are in fact so many pumps continually at work, drawing up the moisture and dissipating it in the air, and converting the residue in the shape of elaborated juice into their own substance.

Discovery of the manner in which the alkaloids are produced within the tree.

Alkaloids observed to be most abundant under the clumps of moss used in staking.

Above and below the moss they were deficient.

Alkaloids are first formed in the leaves in an impure state.

Carried down and deposited in the bark, impure in the liber.

In the cellular bark a superior alkaloid is produced.

On the outer surface of the bark a wasting progress was observed, apparently caused by light and air.

To prevent waste in the alkaloids, it is necessary to exclude light and air.

Leaves must not be destroyed, as they form the laboratory.

Obtaining bark by lopping and pruning quite inadmissible.

Bark may be removed without injury to the tree by the aid of moss.

A covering of moss applied to the outer bark prevents waste;

and the alkaloids increased from 2½ per cent. to 15 or 20 per cent.

By mossing, 30 times the quantity of bark can be procured annually than could be under any other treatment.

By the coppice system, a harvest of bark can only be reaped every sixth or seventh year, and the bark being young, is deficient both in its quantity of alkaloids and in its capacity to receive them.

300 times the quantity of alkaloids can be obtained by mossing than could be by any other treatment.

And thus place this valuable medicine within the reach of the working classes.

11. *Alkaloid, formation of, in the Bark.*—The most valuable discovery made in connection with Chinchona cultivation is the manner in which the alkaloids are formed, how they are deposited and increase in the bark, how they pass from one into another, and how they waste, oxidise, or pass into gum or coloring matter. In the spring of 1863 I observed that the deposit of alkaloids was invariably most abundant in the bark covered by the clumps of moss, which in staking the plants we had placed between the ties and the bark to prevent chafing. In the bark above the clumps of moss, the alkaloids were deficient, and immediately below the moss they were also deficient. This curious and interesting fact led to close observation, and suggested many experiments to test the manner in which the alkaloids were formed or deposited. The combined results of these experiments clearly indicated that the alkaloids are first formed or produced in a crude or impure state in the leaves. In this condition, and intimately combined with the elements of the sap, they are carried down and deposited in the bark, most impurely in the liber or inner bark. As this bark becomes transformed by age into cellular bark, in which the circulation of sap is not so rapid, a superior alkaloid is produced of great purity and easy of separation. It was also observed that a progress of waste or deterioration was in action on the outer cellular part of the bark. This apparently was caused by the action of light and air. Under moss this waste was not perceptible. These observations led to two facts of vital importance in Chinchona cultivation: first, that there is a constant and never ceasing Quinine-producing power going on in the leaves of the plants, while, as if obeying a natural law, to counterbalance the source of production, there is a continual waste in the surface of the bark. To protect the alkaloids from this waste, it is necessary to exclude the action of light and air from the bark, and thus securing the whole advantage of the producing process.

12. So interesting a discovery necessarily caused an entire alteration in our system of cultivation. It is indispensable that the leaves forming the laboratory should not be removed or destroyed. Our previous conceived notions of obtaining bark by means of loppings and prunings, or treating the plants as coppice, are altogether inadmissible, as involving the destruction of the foliage. Now, unless we adopt the policy of "killing the goose that lays the golden egg," we must guard with the utmost care all foliage and leaf-producing branches, only removing such as are necessary to maintain the symmetry of the tree. By the aid of moss we may remove the cellular bark, without injury to the plant, and thus annually secure all the valuable alkaloids, without interrupting their continual formation and deposit.

13. *Effects of Mossing.*—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.

14. As the crown of the tree extends, and the foliage becomes abundant, the deposit of alkaloid yearly increases, while the expansion of the stem gives capacity for the reception of the alkaloid in the ratio of the cube. Thus, if a tree yields in the sixth year quarter of a pound of bark, in the twelfth year it will produce sixteen pounds. By treating the plant as coppice, a harvest of bark can only be obtained every sixth or seventh year, and as the capacity of the stem is, at six years' growth, only one sixty-fourth part of what it would be at twelve years, there is not only by this system the loss of at least five years' produce, but there is also the loss of the yearly increasing Quinine-producing power, and also the capacity to receive the same. Under the mossing system one acre will yield annually three hundred times as much alkaloid as can be produced by any other method. These favourable results of the application of moss cannot, at present, be fully comprehended; but it must shortly render quinine very abundant and cheap, and so place this inestimable medicine within the reach of the working classes of this country.

15. *Establishment.*—* * * I have to thank the majority of my assistants for their hearty co-operation, zeal, and attention in carrying out the various duties entrusted to their charge. Mr. Batcock especially has shown much diligence and skill in conducting the duties of the propagating department.

ment. The employment of convict labour has proved a great boon on the Dodabetta and Neddivuttum plantations, by giving us the advantage of being able to push forward the various operations at their proper seasons, which, in cultivation, is most important, and what we could not perfectly attain when depending only on free labour for the performance of the work. The convicts, as a body, work cheerfully and contentedly, many of them performing from two to three times as much work as can be procured from free labourers. On the Dodabetta plantation the convicts have now been employed for nearly twelve months. They have maintained excellent health, and, after a short location upon the plantations, men weakly and delicate on their arrival become strong and robust. The nature of the labour is healthy, as also the situations of the gaols, therefore our plantations offer the advantages of employing convict labour to the benefit of Government and the well-being of the men. The task of a convict on the plantation is that of a usual day's work of a free labourer. For all work performed over and above this task, the convict receives a reward equivalent to six pice for a quarter of a task, or two annas (3 d.) for a full task. With this money the convicts may purchase any necessary article they require, or, at their option, it is kept for them until their sentence expires. This system of reward stimulates the convict to exertion, and teaches him the advantage to be obtained by constant and steady labour. The consequence is that nearly all the convicts, as they are released, get their families up from the plains, and settle down as free labourers on our plantations, an arrangement much more desirable than that they return to their previous haunts of crime, to be again exposed to temptation and the influence of evil associates.

The convict labour at Dodabetta and Neddivuttum has proved of great assistance.

The convicts work cheerfully, and many of them perform two to three times as much work as a free labourer.

Weakly men become strong and healthy on the plantations.

Convict's task and privileges.

Released convicts remain on the plantation as free labourers.

16. In consequence of the high rate of provisions, free labour has been more plentiful this season than hitherto, and as this state of the labour market is likely to continue, it offers the means of at once pushing forward our works to completion, should the Government consider it desirable.

17. *Progress of Operations.*—In the propagating department a slight alteration has been made in the buildings in order to admit sufficient light for rearing seedlings, as they require more light than necessary to root-cuttings and buds. Our propagating houses and hardening cases afford accommodation for about 10,00,000 seedlings. The seedlings, when transplanted, cannot at once be placed in the nurseries, in consequence of their liability to damage by heavy rains; we have, therefore, had to construct, in the nursery grounds, temporary sheds to keep off the rain until such time as the seedlings are established. This is the only increased accommodation made to our open air nurseries during the present year. The total number of plants produced from the beginning of the undertaking to the 1st May 1866 was 11,23,645, exclusive of 1,00,757 distributed to the public. The number of plants propagated during the official year being 5,87,616. On the 31st July 1866 the number and distribution of our plants stood as follows:—

Total number of plants propagated from the beginning to the 1st of May 1866, was 11,23,645, exclusive of 1,00,757 distributed to the public. Number and distribution of plants on the 31st July 1866.

Plants permanently planted out on the plantations - - -	4,01,211
Plants in the open air nurseries - - - - -	47,000
Rooted plants and transplanted seedlings in propagating houses and hardening cases - - - - -	8,68,779
Estimated number of unrooted cuttings and untransplanted seedlings - - - - -	2,00,000
Total - - -	15,16,990

18. On the Neddivuttum plantations 73 additional acres have been planted, making 357, the total number of acres under cultivation on these plantations. The planting of this season has taken place principally on the Kilgraston, 2nd Denison, and Hooker estates. Here also 25 acres of grass land has been pitted for the reception of the Crown Barks. The roads, drains, fences, and water-courses on the Kilgraston and Hooker plantations have been finished. On the 2nd Denison the fence has been completed and joined to that of the 1st Denison plantation. The gaol is finished, and the convicts located in it since 16th of May last. A range of police lines, covered with corrugated iron, is now in course of construction. The materials collected and being prepared for the construction of a gaol hospital and permanent cook-rooms.

357 acres now under cultivation at Neddivuttum.

25 acres of grass land planted on the Hooker estate.

Convicts located in the gaol at Neddivuttum since 16th May 1866.

19. On the wood plantations at Pycara 21 acres of land have been planted out during this season, which gives a total of 92 acres under cultivation on this plantation; in the newly-planted portion the roads and drains have been formed, and two sides of the plantation inclosed by a ditch and fence so as to exclude wild animals, as this season they have done much damage to the plants, especially in the avenue.

92 acres have been planted on the Wood estate.

20. On the Dodabetta plantations the work has also made satisfactory progress, 72 acres of land being planted during this season, making the total extent 432.

The total number of acres planted on the Dodabetta sites is 224. Convicts located in the Dodabetta Gaol since 20th September last.

under cultivation on these plantations 224 acres. On the 2nd plantation the gaol, police lines, and out-houses attached have been completed. Here 82 convicts have been located since the 20th September last.

21. On the Malakoondah plantation little has been done beyond improving the plantation roads, completing the gaol buildings, and constructing lines for the police.

New orchid and fern house completed.

Plants of valuable Australian Conifers and Burmese Orchids presented by Sir W. Denison.

Himalayan Cherry and Scammong presented by Dr. Cleghorn.

Ferns and Australian seeds from Captain Beddome. Mangosteen from E. B. Thomas, Esq.

Rice Papee plant, Birds nest fern, &c., from Mr. J. Horne, Botanical Gardens, Mauritius.

22. *Botanical Gardens*.—In the Botanical Gardens considerable improvements have been effected, the station parterre, in the centre of the garden, has been extended, three additional fountain basins formed, and the flower borders planted with choice flowers and shrubs. The building of the new orchid and fern-house has been completed, though not yet stocked with plants, in consequence of the space being at present required for Chinchona seedlings. Around this orchid-house, terraces, and parterres are now in course of formation, and being in a sheltered position in the garden, offer great advantages for the cultivation of tender and rare plants. This season has added some interesting plants to our collection. To Sir William Denison we are indebted for further large supplies of valuable timber tree seeds from Australia, as also for fine plants of Arancarias Excelsa, Cunninghamii Biduillii, and Cookii. The valuable Dammara Australis, and an interesting collection of Burmese orchids. To Dr. Cleghorn, Conservator of Forests, we are indebted for seeds of many valuable Himalayan fruit trees; among these the cherry seems to have taken well to the climate, and this year has flowered. To this gentleman we are also indebted for the valuable medicinal Scammong (Convolvulus Scammonia), which also promises to succeed here. To Captain Beddome, Acting Conservator of Forests, for numerous interesting ferns; we have also to thank this gentleman for a collection of Australian seeds; to E. B. Thomas, Esq., for two plants of the Mangosteen; to Mr. J. Horne, Superintendent of the Botanical Gardens, Port Louis, Mauritius, for a case of valuable and interesting plants, containing among others the Chinese rice papee plant (Aralia papyrifera), the Birds nest fern (Neottopteris Indus), &c.

23. The following Table exhibits the distribution of plants and seeds by this garden for the official year 1865-66.

Distribution of Plants and Seeds from the Gardens.

	Fruit Trees and Shrubs.	Timber Trees.	Shrubs and Flowers.	Collection of Seeds.	Amount.
1865 :					Rs. a. p.
May - - -	24	744	484	62	467 10 -
June - - -	8	800	67	44	191 3 -
July - - -	25	9,258	70	26	897 9 7
August - - -	40	7,339	141	21	492 4 -
September - - -	19	833	132	19	168 - -
October - - -	81	916	258	17	211 13 -
November - - -	-	1,313	401	14	147 7 -
December - - -	32	8	166	9	132 5 5
1866 :					
January - - -	-	-	8	6	19 2 -
February - - -	-	-	19	10	48 5 -
March - - -	-	-	36	15	47 1 -
April - - -	7	229	667	85	234 3 2
TOTAL Distribution	236	20,945	2,449	268	2,556 15 2

24. *Tea Plantation.*—The experimental tea plantation, sanctioned by the Government in December 1863, has received an addition of 1,700 plants of the Assam tea, raised from seeds, furnished by Government in March 1865. The plantation now contains 13,500 plants, which are in a promising condition. This year some of the plants are producing flowers, we may therefore shortly expect a supply of tea seeds for distribution. 13,500 tea plants placed in the plantation.

25. *Concluding Remarks.*—By the above details it will be observed that, during the present year, our operations have made great progress. That as the plants have produced abundance of seeds, a very important object has been attained, which renders available the means of increasing the cultivation to an unlimited extent. During the year 166 acres of land has been planted, and many young plants placed out in the spaces between our large plants, which were originally placed at 12 feet apart, as this distance was found to be too great. The number of acres at present under cultivation in the Government plantations is 673.

26. In conclusion, I beg to render my grateful acknowledgments to the Government of Madras for the liberality in which my suggestions have been met; to Mr. Markham, of the India Office, for his hearty co-operation, and the interest he has exhibited in the successful development of this important undertaking; to Mr. J. W. B. Money, for a very valuable collection of seeds of *C. Calisaya*; and to Mr. J. E. Howard, my best thanks are due for the very important information he has so liberally furnished.

(A.)—SANCTIONED ESTIMATED COST of each CHINCHONA PLANTATION

PARTICULARS.	Operations preparatory to Receipt of Plants.	Superintendent and Office Establishment.					Nursery Department.					Dodabetta		
	1860-61.	1861-62.	1862-63.	1863-64.	1864-65.	1865-66.	1861-62.	1862-63.	1863-64.	1864-65.	1865-66.	1861-62.	1862-63.	1863-64.
Grant for the preparation of sites - - -	Rs. 2,000	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
Establishments, including salaries, &c. - -	-	4,200	5,350	5,880	8,180	8,768	3,324	4,305	4,609	5,048	4,048	2,280	5,400	5,700
Buildings - - -	-	-	-	-	-	-	{ 1,200 2,000	-	-	-	-	560	-	-
Tool and store rooms -	-	-	-	-	-	-	-	-	-	-	-	-	250	-
Coolies' quarters - -	-	-	-	-	-	-	-	-	-	-	-	200	500	-
Felling - - -	-	-	-	-	-	-	-	-	-	-	-	400	1,500	-
Clearing - - -	-	-	-	-	-	-	-	-	-	-	-	280	1,500	-
Pitting - - -	-	-	-	-	-	-	-	-	-	-	-	400	1,500	-
Carriage of Plants - -	-	-	-	-	-	-	-	-	-	-	-	150	-	-
Planting and shading -	-	-	-	-	-	-	-	-	-	-	-	200	500	-
Trenching - - -	-	-	-	-	-	-	-	-	-	-	-	1,800	-	-
Inclosing - - -	-	-	-	-	-	-	756	-	-	-	-	-	5,850	-
Road making - - -	-	-	-	-	-	-	-	-	-	-	-	-	2,025	-
Tools - - -	-	-	-	-	-	-	-	-	-	-	-	-	1,200	-
Contingencies - - -	-	-	-	-	-	-	196	-	-	300	500	399	1,200	-
TOTAL - - - Rs.	2,000	4,200	5,350	5,880	8,180	8,768	7,476	4,305	4,609	5,048	4,548	6,669	21,425	5,700

ACTUAL EXPENDITURE on each CHINCHONA PLANTATION

PARTICULARS.	Operations preparatory to Receipt of Plants.	Superintendent and Office Establishment.					Propagation and Nursery Department.					Dodabetta		
	1860-61.	1861-62.	1862-63.	1863-64.	1864-65.	1865-66.	1861-62.	1862-63.	1863-64.	1864-65.	1865-66.	1861-62.	1862-63.	1863-64.
Establishment, including salaries, &c. - -	Rs. a. p. 114 2 3	Rs. 4,347	Rs. 5,343	Rs. 6,437	Rs. 7,971	Rs. 8,142	Rs. a. p. 2,024 11 6	Rs. 3,329	Rs. 3,440	Rs. 3,478	Rs. 4,539	Rs. 1,481	Rs. 2,274	Rs. 2,605
Buildings - - -	-	-	-	-	-	-	2,647 - -	3,578	3,000	1,500	-	865	-	-
Tool and store rooms -	-	-	-	-	-	-	-	-	-	-	-	-	-	230
Coolies' quarters - -	-	-	-	-	-	-	-	-	-	-	-	-	250	500
Felling - - -	309 5 3	-	-	-	-	-	-	-	-	-	-	448	750	500
Clearing - - -	-	-	-	-	-	-	-	-	-	-	-	400	750	400
Pitting - - -	-	-	-	-	-	-	-	-	-	-	-	848	750	1,010
Carriage of plants - -	-	-	-	-	-	-	-	-	-	-	-	245	200	140
Planting and shading -	-	-	-	-	-	-	-	-	-	-	-	355	450	560
Trenching - - -	-	-	-	-	-	-	-	-	-	-	-	-	-	1,200
Inclosing - - -	-	-	-	-	-	-	-	-	-	-	-	-	2,800	-
Road making - - -	300 - -	-	-	-	-	-	-	-	-	-	-	600	700	2,070
Tools - - -	271 - -	-	-	-	-	-	-	-	-	-	170	394	304	600
Contingencies - - -	67 - -	-	-	-	50	200	-	-	-	450	700	124	460	500
TOTAL - - - Rs.	1,004 7 6	4,347	5,343	6,437	8,021	8,343	4,671 11 6	6,907	6,440	5,428	5,409	5,760	9,688	10,315

Ootacamund, 20 September 1866.

from Commencement of Operations to 30th April 1866.

Plantations.		Neddivuttum Plantations.					Pycara Plantations.				Malakoondah Plantations.			TOTAL.
1864-65.	1865-66.	1861-62.	1862-63.	1863-64.	1864-65.	1865-66.	1862-63.	1863-64.	1864-65.	1865-66.	1863-64.	1864-65.	1865-66.	
Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
-	-	-	-	-	-	-	-	-	-	-	-	-	-	2,000
7,248	8,790	5,084	8,412	15,348	12,380	16,260	-	4,033	6,564	7,014	-	5,600	3,120	1,65,805
600	7,000	2,080	-	-	750	8,500	{ 1,530 2,000 }	-	-	-	-	750	2,500	30,270
250	-	250	-	-	400	-	250	-	350	375	125	150	-	2,400
-	200	1,000	1,000	-	300	400	1,000	-	200	-	500	250	-	5,550
550	-	1,500	3,000	-	900	1,500	1,500	-	900	750	6,150	900	-	19,550
550	-	1,500	3,000	-	900	1,500	1,500	-	900	750	-	900	-	13,280
550	-	2,000	3,000	-	900	2,000	-	-	900	1,000	-	900	-	13,150
150	400	450	450	-	400	900	-	-	350	450	-	50	-	3,750
200	350	550	550	-	350	900	-	1,300	250	450	-	-	-	5,600
600	600	4,000	-	-	1,100	900	-	8,000	1,250	700	-	1,250	-	20,100
550	-	3,900	-	-	-	1,350	-	750	-	550	375	300	650	15,031
-	800	1,520	-	-	550	1,000	-	1,350	200	600	675	1,500	500	10,720
800	525	1,282	-	-	900	1,000	-	1,282	500	-	641	700	500	9,330
500	1,000	2,003	1,831	-	600	1,200	-	2,046	350	500	848	250	300	14,021
12,448	19,663	27,099	21,243	15,348	20,410	37,410	7,780	18,761	12,714	13,139	9,312	13,500	7,570	3,30,557

from Commencement of Operations to 30th April 1866.

Plantations.		Neddivuttum Plantations.					Pycara Plantations.				Malakoondah Plantations.			TOTAL.
1864-65.	1865-66.	1861-62.	1862-63.	1863-64.	1864-65.	1865-66.	1862-63.	1863-64.	1864-65.	1865-66.	1863-64.	1864-65.	1865-66.	
Rs.	Rs.	Rs. a. p.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs. a. p.
7,083	5,235	2,910 - -	6,195	5,674	12,507	12,052	-	1,608	1,880	2,086	-	971	1,671	1,15,596 13 9
7,250	4,500	1,560 - -	-	1,000	8,550	4,000	1,683	-	-	-	350	500	890	41,873 - -
-	200	- - -	350	500	460	189	275	-	250	320	-	300	-	3,044 - -
-	308	- - -	1,750	1,000	500	400	1,100	550	250	-	-	260	-	6,858 - -
650	1,300	1,780 7 3	1,500	3,200	800	-	1,500	2,000	750	1,500	2,400	851	-	19,231 12 6
650	1,300	- - -	1,500	2,200	500	700	1,125	2,000	750	1,500	1,125	500	825	16,225 - -
800	2,000	1,680 7 3	858	2,000	700	1,500	-	1,000	600	1,355	-	738	750	16,289 7 3
250	700	540 1 9	900	750	362	959	-	65	350	600	-	-	-	6,061 1 9
700	2,000	640 1 8	900	898	500	1,000	-	65	300	400	-	-	-	8,768 1 8
600	800	- - -	1,972	1,780	1,135	500	-	-	1,000	700	-	-	200	9,887 - -
357	1,300	- - -	1,550	900	-	760	-	679	-	750	-	300	750	10,046 - -
1,000	1,000	1,100 - -	1,000	2,000	327	-	-	1,500	504	400	502	875	800	14,678 - -
499	686	700 - -	400	868	650	900	-	1,500	1,000	250	-	1,000	-	10,192 - -
800	1,510	340 - -	915	850	1,200	1,800	-	400	250	350	100	125	250	11,441 - -
20,339	22,738	11,251 1 11	19,790	22,812	28,181	24,740	5,683	11,367	7,880	10,211	4,477	6,410	6,138	2,90,191 4 11

(signed) W. G. McIvor, Superintendent, Government Chinchona Plantations.

(B.)—METEOROLOGICAL OBSERVATIONS made on the Government Chinchona Plantations at Neddivuttum, from 1st May 1865 to 30th April 1866.

Months.	Hygrometer.		Maximum in Shade.	Minimum in Shade.	Solar Radiation.	Terrestrial Radiation.	Rain in Inches.	Days with Rain.	Days without Rain.
	Dry Bulb.	Wet Bulb.							
May - - - - -	66	62	76	57	77	64	2.95	13	13
June - - - - -	61	58	66	56	63	59	19.25	26	4
July - - - - -	59	53	68	55	62	58	38.33	31	-
August - - - - -	-	-	-	-	-	-	-	-	-
September - - - - -	-	-	-	-	-	-	-	-	-
October - - - - -	62	58	75	56	76	60	3.60	12	19
November - - - - -	61	57	76	56	84	61	1.86	7	23
December - - - - -	64	54	76	51	90	61	1.5	3	28
January - - - - -	62	52	79	50	95	62	0.12	1	30
February - - - - -	-	-	-	-	-	-	-	-	-
March - - - - -	-	-	-	-	-	-	-	-	-
April - - - - -	70	62	68	60	-	70	3.15	6	25
Total - - - - -	-	-	-	-	-	-	70.85	103	142
Mean - - - - -	63.25	57.62	73	55.12	78.14	62	-	-	-

METEOROLOGICAL OBSERVATIONS made at the Botanical Gardens, Ootacamund, from 1st May 1865 to 30th April 1866.

Months.	Hygrometer.		Maximum in Shade.	Minimum in Shade.	Solar Radiation.	Terrestrial Radiation.	Terrestrial Radiation at Night.	Rain in Inches.	Days with Rain.	Days without Rain.
	Dry Bulb.	Wet Bulb.								
May - - - - -	60	58	72	54	114	77	48	8.08	22	9
June - - - - -	68	57	69	53	106	76	60	2.67	14	16
July - - - - -	67	56	65	56	98	71	53	8.83	24	7
August - - - - -	69	58	65	52	102	71	50	2.48	16	15
September - - - - -	57	55	68	51	113	75	45	2.61	11	19
October - - - - -	68	56	69	51	110	71	45	11.22	15	16
November - - - - -	57	53	70	48	114	74	43	2.11	8	22
December - - - - -	63	47	73	46	117	77	38	1.19	4	27
January - - - - -	56	46	71	45	123	77	35	0.58	2	29
February - - - - -	60	48	78	46	132	84	37	-	-	28
March - - - - -	65	52	77	53	135	86	40	0.13	2	29
April - - - - -	63	56	76	54	128	82	40	4.03	19	11
Total - - - - -	-	-	-	-	-	-	-	43.91	137	228
Annual Mean - - - - -	58.58	53.5	71.08	50.75	116	76.75	44.41	-	-	-

Ootacamund, 20 September 1866.

NOTES on the WEATHER at Ootacamund.

1865.	
May -	Rain-fall equally distributed throughout the month; occasional heavy showers, a little thunder towards the end; weather generally open without mist or fog.
June -	Month characterised by fog and mist with high wind; rain-fall not heavy, stormy towards the end of the month; south-west monsoon commenced on the 6th.
July - -	Month generally stormy and wet with heavy rain; direction of clouds observed to be changed on the 23rd, south-west monsoon probably ended.
August -	Beginning of month foggy and dull with moderate rain; end more open with occasional fog and wind.
September	Beginning and end of month rainy; weather throughout generally open with passing clouds; a little fog and mist in the middle of the month.
October -	Month characterized by heavy rain-fall with thunder. Days without rain, hot sunshine with passing clouds.
November	Month generally serene with passing clouds; mist and fog not heavy; rain-fall light.
December	Beginning of month cloudy and rainy; middle and end generally open with light clouds.

1866 :	
January -	Month generally clear and serene; a little rain and cloud in the middle; the end also cloudy.
February	Month generally hot and sunny, with a little cloud; atmosphere more or less hazy.
March -	Month hot and sunny; a few clouds with light rain about the 8th; atmosphere very hazy throughout.
April -	End of the month generally rainy and cloudy with thunder; a little rain with distant thunder in the beginning; intermediate days generally open weather with passing clouds.

(signed) *W. J. McIvor*,
Superintendent Government Chinchona Plantations.

Enclosure 2, in No. 18 a.

From the Collector of Malabar to the Secretary to Government, Revenue Department,
Fort St. George, Manjeri, Ernad Talook, 17th March 1866.

1. ADVERTING to Government Order, dated 10th March 1866, and especially with reference to paragraph 40, &c., of Mr. Markham's Report, I would solicit attention to my letter to the Board of Revenue, dated 27th June 1864, in which I advocated a distribution of Chinchona plants in Wynad.

2. The proposition did not find favour with Government at the time, but I venture again to bring it to notice, convinced that, if the plant will thrive in gardens of the native population of Wynad, what I before suggested is the way to give it a good start. I am sanguine that the result would be a great blessing to the people.

3. If Government are pleased to allow a supply of plants, arrangements will be made for their being brought down and distributed in the end of May or beginning of June. The plants would generally be in sheltered spots, and the beginning of monsoon would be the best time to set them out.

ORDER of the Madras Government, 13th April 1866.

1. THE Government observe that the price of Chinchona plants has lately been reduced to one anna per plant, or one-fourth of the price originally charged. Relying, however, on Mr. Ballard's local knowledge and judgment, they will not refuse to comply with his reiterated recommendation, that 500 plants should be sent to him for gratuitous distribution in Wynad. Mr. McIvor will be instructed to prepare immediately 500 plants of the varieties most likely to succeed in Wynad for dispatch to that talook, whenever applied for by Mr. Ballard, and he will be especially enjoined to send only well-established plants, of a size likely to bear transit, and to succeed with ordinary care on the part of the recipients. He will also furnish Mr. Ballard at once with a memorandum of the mode of culture to be pursued, prepared in the simplest language, so as to admit of being translated into the vernacular, and being easily understood by native planters.

2. The Government will not fetter Mr. Ballard in his distribution of the plants further than by directing that, as a general rule, they should not be given gratuitously to persons of capital, who can well afford to pay the trifling price now charged for them, and who have the means, not possessed generally by the native agriculturists, of correctly appreciating the value of Chinchona culture. Mr. Ballard is, however, quite at liberty to aid such persons in other ways, as, for instance, arranging with Mr. McIvor for the periodical transmission of plants, &c.

3. Mr. Ballard will report the result of the present experiment in due course, and enter in his contingent bills such charges as may be incurred in prosecuting it.

Examined, *S. T. Augustin*.
(signed) *J. D. Sim*,
Secretary to Government.

Enclosure 3, in No. 18 a.

From the Collector of Ganjam, to the Secretary to Government, Revenue Department,
Fort Saint George, Chetterpore, 24th March 1866.

1. IN accordance with Order of Government, 12th March 1866, calling for suggestions on the readiest means of introducing the Chinchona tree as widely as possible in tracts which are likely to favour its growth, I have the honour to observe, that there are many spots in the Khond and Sourah Hills where it would probably flourish, though the elevation in these hills does not average more than 3,000 feet. The detached range called Mahendragiri, however, rises to an average height of 4,000 to 4,500 feet, and has many sheltered slopes suitable for Chinchona plantations, especially on its western side. Mahendragiri is not more than 20 miles from the sea coast, and can be ascended from the side of Kimedya on the south, from the direction of Itchapore on the north, as well as from its eastern face. It enjoys a copious rainfall, and is free from fever. I have a small cottage on the hill, which I shall be happy to place at the disposal of Government, for the occupation of any one whom they may depute to lay out a plantation, or, I can do this myself. The only outlay will be the pay of a couple of Sourahs to water and care for the plants, and the cost of clearing the forest and fencing.

2. In the Khond and Sourah Hills the experiment can be watched by the Sub-Magistrates and Inspectors of Police. A permanent monthly outlay of 20 rupees would be sufficient for all these plantations. I applied for young trees about three years ago, but without success. I should now recommend that three cases of the species called *C. succirubra* (the strongest plants procurable), and a supply of seed should be forwarded in the month of July, one case to be addressed to the Principal Assistant Collector, Chicachole, *viâ* Bimlipatam, and the other two to be landed at Gopalpore, to my address, the dispatch being advised a fortnight beforehand.

3. I would also beg to be informed whether the dried bark pulverised can be used, and in what quantities.

Enclosure 4, in No. 18 a.

From the Collector of Tinnevely, to the Secretary to Government, Revenue Department,
Fort Saint George, Trichendoor, 10th April 1866.

1. WITH reference to paragraph 5 of Government Order, dated 12th March 1866, I have the honour to annex copies of correspondence with my Sub-Collector.

2. At the end of last year I visited the spot which he refers to, and think it will suit. There is ample space for a large plantation; the soil and climate are suitable. I lately prohibited additional destruction of the forest in this locality.

3. I had suggested sowing seed as more economical than incurring the cost and running the risk of the transport of plants, but Mr. MacGregor inclines to the view that the introduction of the improved plant is preferable, and I think with reason.

4. Mr. MacGregor takes so much interest in all subjects connected with district improvement, and is so thoroughly acquainted with his division, that I hope his connection with this district may be permanent.

From the Collector of Tinnevely, to the Acting Sub-Collector of Tinnevely, dated
Trichendoor, 19th March 1866.

1. IN forwarding for your perusal Mr. Markham's Report and Government Order thereon, dated 12th March 1866, No. 617, I have the honour to request to be informed if there is any locality in the mountains within your division, where the Chinchona plants could be successfully introduced, and what measures you would recommend for that purpose.

2. It appears to me that if a locality suitable from its elevation, soil, and climate, can be found, the introduction of the plant would be facilitated by the adoption of the proposed conservancy establishment I recommended to be put under your orders.

3. With the requisite information as to planting and tending, and an allowance for the required expenses thereof, the hill tribes might be instructed and induced to take care of plantations.

4. High

4. High elevation, at least 3,000 feet, as in the Peermade Garden, a rich, well-watered soil, and wind-sheltered, but unshaded cultivation, seem to be requisite for the plant; whether there are localities of this description north of Courtallum I am not aware, but perhaps the General's Hill might be suitable, and perhaps some of the high village clearing between Papanasam and Agusteer Mulla. Some of the plants might be distributed to the owners of coffee estates. It seems doubtful to me whether the plants could be conveyed from Ootacamund to this locality without great risk of loss and very considerable expense, and as the Ootacamund Plantation was originally, I believe, raised from seed, perhaps a supply of seed would be the best means of introducing the plant. I should be glad to have your opinion on this subject.

From the Acting Sub-Collector, to the Collector of Tinnevely, dated Circuit Cutcherry, Trichendoor, 9th April 1866.

1. IN returning the Report of Mr. Markham, received with your letter of the 19th March, I have the honour to state that there is, in my opinion, an admirable site for a nursery of Chinchona on the Papanasam Hills.

2. The spot I should select is west of the hill villagers' clearing. There are here several valleys with rich chocolate soil, sheltered from the wind of both monsoons, though receiving the rainfall of both, and having elevations varying from 3,000 to 4,000 feet.

3. I think the experiment should certainly be made with young plants.

4. We should thus gain the advantage of plants reduced from wild to cultivated by Mr. McIvor's care, and be able the sooner to multiply them by layers and cuttings, as Mr. Levinge is now doing on the Pulneys with those obtained by him from the Neilgherries.

5. The situation of the Papanasam Hill is central, as regards the line of gháts in this district, from Streevilliputdoor to Panagudi, and a good nursery here would enable us to supply all the coffee plantations in both directions.

6. The services of the hill tribes could also be readily obtained for clearing the ground in the first instance, and afterwards keeping up the fences and weeding the plantations, and the conservancy establishment recommended for these hills would give me the means of carrying out the work.

7. I therefore suggest that we may be allowed to incur expenses in carriage of plants, tools, labour, &c., of not more than 1,000 rupees, and that Mr. McIvor be authorised to supply the plants, 500 of *C. succirubra* and 500 of *C. micrantha*.

Enclosure 5, in No. 18 a.

From the Superintendent Government Chinchona Plantations, to the Secretary to Government, Revenue Department, Fort St. George, Ootacamund, 20th April 1866.

1. I HAVE the honour to acknowledge receipt of the Order of Government, under date 12th March 1866, No. 617, and with reference to paragraph 4, would respectfully remark that I consider it unadvisable to establish a system of free distribution of our Chinchona plants, being convinced that such a system would retard rather than facilitate the extended cultivation of this valuable plant; because many parties would apply for and receive plants, who had neither the means nor the application necessary to cultivate them. In this way a great number of these valuable plants would be lost without the slightest anxiety or remorse, inasmuch as they cost nothing, and could be replaced for nothing. In this case the loss of the plants would appear trifling to the individual, but would prove a serious impediment to the progress of the cultivation. When the plants are sold at a fair price, the case is altered, and the interest of the purchaser demands that he give every care and attention to the plants so procured.

2. Even disposing of our plants at the high rates which hitherto prevailed, namely, four annas each, has not, in my opinion, at all impeded the extension of the cultivation; but the contrary, inasmuch as it stimulated purchasers to propagate for themselves, and this has been done in some instances most successfully. Even were it desirable, it is scarcely possible for Government to furnish gratuitously, and in sufficient quantity, any plant for the production of an article of commerce, and almost daily consumption; such can only be effectually secured by the growers propagating their own plants.

3. Our present register bears the names of 19 applicants for a total number of 203,100 Chinchona plants. These are supplied according to priority of date, without reference to the number applied for, and are issued as ready; parties failing to remove their plants when ready, they are supplied to the next applicant who is ready to take them. We have at present 100,000 well grown plants, which are now being issued, and by the end of the year from 300,000 to 400,000 well grown plants will be available. The majority of our well established plants are placed out in the plantation nurseries, and reserved for

the use of the Government; by the end of July or August our nurseries will contain sufficient plants to plant the 1,200 acres required by the Government, and after this date almost the whole of our propagating appliances can be appropriated to propagating plants for distribution to the public.

ORDER of the Madras Government, 3rd May 1866.

1. THE Right Honourable the Governor in Council concurs generally in Mr. McIvor's views, and does not purpose introducing a system of general gratuitous distribution; but this conclusion does not preclude the issue of plants to the officers of Government, with a view to their experimental culture in a variety of soils and climates, and at different elevations.
2. The Collectors of Ganjam and Tinnevely are both disposed to lend their aid in this respect in their districts, in the former of which especially fever is rife and severe, and the Government resolve to avail themselves of the assistance thus offered.
3. Mr. McIvor will accordingly prepare and forward 500 Chincona plants to each of these districts, attending to the instructions conveyed in the last paragraph of Mr. Forbes' letter. The Superintendent of Marine will arrange for the conveyance of the plants to Bimlipatam and Gopaulpore on learning from Mr. McIvor when they will reach Madras.
4. The Collector of Tinnevely will inform Mr. McIvor when and how the plants for that district should be sent. These plants will be placed at Mr. MacGregor's disposal, with instructions to carry out the experiment in the manner that seems most likely to be successful in his judgment.
5. A grant of 500 rupees will be made to each Collector for the purpose in view.
6. It is not the intention of Government to establish regular gardens at other localities than the Neilgherries, and the nurseries which may be formed under this order in Ganjam and Tinnevely will be merely for experiment, and to exhibit the plant to the native cultivators. A portion of the plants should be issued to competent and trustworthy heads of villages who may, as Government servants, be fairly held responsible for their culture and preservation.
7. Mr. McIvor will be especially careful to send only vigorous and well established plants, and to adopt measures for their safe transit.
8. The Government wish to have a report annually on the results of this experiment.

(signed) J. D. Sim,
Secretary to Government.

Enclosure 6, in No. 18 a.

From the Officiating Conservator of Forests, to the Secretary to the Board of Revenue,
Camp at Ootacamund, 14 May 1866.

1. I HAVE the honour to inform you that I do not expect that Chinchona cultivation would ever answer on the Nalla-Malla range in the Kurnool district, as the climate is too dry, and the heat during the months of March, April, and May is excessive.
2. As the experiment proposed by the Collector of Kurnool in paragraphs 5 and 6 of his letter, recorded in the proceedings alluded to, could be carried out at a very small expenditure, a case of Chinchona Succirubra, or any other species which answers at a low elevation, might be sent to the Nalla-Mallas next July.

Ordered that the foregoing letters be submitted for the information and orders of Government, and with the Board's recommendation that the Acting Conservator of Forests be instructed to make arrangements for carrying out the proposal of the Collector for the experimental cultivation of the Chinchona plant on the Nalla-Malla hills in the Kurnool district. Should Captain Beddome's anticipation prove correct, the experiment may be dropped after two years' trial.

ORDER by the Madras Government, 19 June 1866.

MR. MCIVOR will be directed to supply the Acting Conservators of Forests with a small case of well established plants of the Chinchona variety, most likely to succeed at a low elevation, for the proposed experiment, the result of which will be reported in due course.

(signed) W. Hudleston,
Acting Secretary to Government.

— No. 18 b. —

From Mr. Clements R. Markham to the Secretary of State for India.

REPORT on the Coffee-planting District of Wynaad.

February 1868.

THE taluq or district of Wynaad is a plateau, averaging an elevation of 3,000 feet above the sea, in the direct line of the western ghauts, between the mountain knot of the Neilgherries on one side, and that of Coorg on the other. It is about 60 miles long, by 30 broad, and contains an area of some 725,000 acres. On the Malabar side, the upper half of the mountains consists of a succession of stupendous mural precipices, broken here and there by ravines and spurs, and, wherever there is a foothold, the ground is covered with magnificent forest trees, many of them yielding valuable timber. On this western side there are several mountain masses which rise from the plateau to a height of 5,500 and even 6,000 feet, their sides clothed with forest, and terminating in well-defined peaks. One of these, the Velery-mullah, extends far out into Malabar. The others are the Chumbra, the Culpetty, the Koócha-mulla, and the Balasore hills. Their northern aspects are well adapted for Chinchona cultivation, while their southern slopes, receiving the full force of the south-west monsoon, are less favourable to vegetation. Their rainfall is about 160 inches annually. The scenery of this western part of Wynaad is exceedingly beautiful, consisting of precipices of gneiss, rising out of forests clothed in many varied tints, rapid torrents and waterfalls, and wide views of the low country. From the western mountains the land slopes gradually down to the Mysore frontier, in a succession of ridges or low ranges of hills, intersected by swamps or flats, which, when left to nature, are overgrown with *pandanus*, but which are now for the most part covered with paddy cultivation. The ridges and hills consist of long stretches of grass land, dotted over with clumps of bamboos, mango trees with wide-spreading branches, and flowering shrubs, such as *Solanum Indicum*, a *Crotalaria*, a *Lobelia*, called by the planters wild tobacco, and an *Osbeckia* with a very pale purple flower. The leafless, but bright-flowered *Erythrina*, and the wooden-fruited *Bignonia xylocarpa*, are also common. If the bamboos were absent, the central part of Wynaad would look like a beautiful but neglected English park. Occasionally isolated masses of gneiss rise from the plateau, some, like the hills of Nelialum, ending in needle-like peaks, others forming craggy precipices. These are the Nelialum hills and Cheramcottah in South-east Wynaad, Cunjithcottah, Yeddacul near Sultan's battery, the Mee-nangaddy rock, Jiganabettah near Culpetty, and the "Central Hill" of Wynaad. All these are conspicuous landmarks, and will be found on the accompanying map. The eastern side of Wynaad up to the Mysore frontier consists of a belt of dense forest, here and there intersected by paddy flats (and we call these low swampy valleys on each side of a stream *paddy flats*, whether they are actually cultivated or not) for a width of 15 to 20 miles. The climate is here much drier than on the western side, and the trees, consisting chiefly of the deciduous teak, are stunted and undersized. There are extensive fires in dry weather, when the traveller may ride for miles through a hideously desolate forest of trees with charred and blackened stems and leafless branches. The bright little *Indigofera pulchella* by the road-side alone relieves the dreariness of the scene. The Mudamullay forest, on the south-east side of this part of Wynaad, is worked by the Government for its teak and sandal-wood, being rented for 99 years from the Nelemboor Terupad, whose claim to it was very questionable, for 3,500 rupees a year. The rest of the forest near the Mysore frontier belongs to Government, with the exception of a large block, the claim to which by the Pulpully devasum has been allowed. The managers of the pagoda declare that their god does not allow it to be touched, and they will come to no terms with the Government with regard to the timber. The claim of the Tirunelly pagoda to another block of forest has been disallowed.

The drainage of the Wynaad district, excepting the torrents which dash down the western mountains during the south-west monsoon, is entirely to the eastward, the numerous streams uniting to form three rivers, which are tributaries of the Cauvery. The Moyaar drains South-east Wynaad and part of the Neilgherries,

the Noogoo drains South, and the Cubbany North Wynaad. All the streams are fordable in the dry season, though the banks are often steep; but during the monsoon they swell to an immense size, often rising 30, with a width of 200 feet, and dashing furiously along with masses of tangled branches and uprooted trees.

The original inhabitants of Wynaad, before the planting brought in an influx of strangers, belonged to various races. The lords of the soil were generally Nairs of the Malabar country, some of whom were petty princes, and laid claim to very extensive tracts of land. Such was the Numbulacottah Varnavar in South-east Wynaad. A large body of smaller proprietors, of the Chetty caste, were also scattered through the district. (The working class was a slave race called Punniers, a short and sturdy people, with very dark complexions and curly hair.) The wild tribe of Kurumbers inhabited the forest tracts. The Nair and Chetty proprietors generally build their houses on picturesque knolls adjacent to their paddy cultivation. Clumps of mango and jack trees, plantains, and sago palms are planted on the knolls as garden cultivation, and the Punnier slaves are huddled round the houses of their lords. It is amongst these proprietors that, I trust, chinchona cultivation will spread; and the popularity of the present deputy collector, Mr. Herbert Richardson, justifies the hope that such a measure, if my representations are listened to by the Madras Government, will be very successful.*

But, before coffee planting commenced, Wynaad, with the exception of a few patches of cultivation, was a wild and little known region, with a detachment of native troops at Manantoddy to overawe the Nairs and Moplahs. Its products were cardamoms, elephant ivory, wax, honey, and timber.

Coffee planting commenced in Wynaad in about 1840, and I believe the first plantation was on the Club Hill, at Manantoddy. In South Wynaad the first plantation was opened in 1846. Now there are upwards of 200 coffee estates in Wynaad, covering 14,613 acres in 1864-65, of which 9,865 belonged to Europeans, and 4,748 to natives. A great and important interest has thus sprung up in Wynaad, many thousands of pounds have been sunk in it, and very greatly increased wealth has resulted to the neighbouring countries of Malabar and Mysore.

The duties of the Government towards such a district now are, of course, very different from what they were when it was a wild tract, only occasionally visited by shikarees and cardamom gatherers. It will, I think, be generally allowed, that a community cultivating 15,000 acres of such products as coffee and chinchona, employing and feeding thousands of labourers, bringing wealth into the country, and paying taxes, has a right to just and effective laws for the regulation of labour, a sufficient staff to administer the law, and good main lines of road through the district in which they have settled. The roads, more especially, ought to be made by the Government, both because they are imperial lines, and of as much importance to Mysore and to Malabar, as to Wynaad, and because official promises to complete them, made over and over again for the last 10 years, have induced many persons to embark their all in coffee planting. Great loss to some, ruin to others, will be the result of the absence of roads.

Now, in 1866, there is no efficient law to regulate labour, the staff to administer such laws as do exist is utterly inadequate, and there are no roads. When I say that there are no roads, I do not mean that there are no break-neck bridle paths and bullock pitfalls, or even pieces of road a few miles in extent here and there; but I mean that now, in 1866, there is no good cart road by means of which grain can be brought in from Mysore, and coffee be sent down to the coast. General Balfour's definition of a tolerable cart road in India is one on which two bullocks can drag 1,000 pounds at the rate of three miles an hour, and 15 miles a day. Excepting Mr. O'Shaughnessy's work, from Tippoo-cardoo to Nadagany, which I shall describe presently, there is no such road in Wynaad.

These are the reasons which lead me to consider it my duty to furnish the Secretary of State in Council with such information respecting the present state of Wynaad as my personal observations on the spot have enabled me to collect.

For

* See correspondence on the subject of chinchona cultivation in Wynaad, at the end of this Report, Enclosure, No. 1.

For the sake of clearness, I propose to divide my report under the following heads:

1. Journey through South-east Wynaad.
2. " " South Wynaad.
3. " " North Wynaad.
4. Public works establishments in Wynaad.
5. Action of the planters and Public Works Department with regard to contracts.
6. Civil administration.
7. Labour Ordinance and Cross Roads Bill.
8. Concluding remarks.
9. Note on the *jangdars*, and on a new method of crossing the Wynaad rivers.

I enclose a memorandum on the Wynaad Roads, which was drawn up for me by the Superintending Engineer of the 7th Division.*

1. *Journey through South-east Wynaad.*

The road from Calicut to the Carcoor Ghaut is that by which the coffee of South-east Wynaad will be conveyed to the coast, and I therefore examined it carefully from Ediwanna, on the Nelemboor (Beypoor) river, onwards. Below Ediwanna the new road is to go to Areacode, the head of navigation at all seasons on the Beypoor River, and thence by Condotty to Calicut. Carts will eventually go all the way to Calicut, thus saving the breaking of bulk at Areacode, and probably obtaining a return freight.

The line from the coast to the Carcoor Ghaut is in charge of Mr. Bailey, a most meritorious and zealous officer, whose range extends from Mahé to Ponany, and from the foot of the ghauts to the coast. Road and bridge work is in progress from the Carcoor Ghaut to Areacode under his supervision, and on traces, plans, and estimates made by him. The estimated cost of this line is 18,900 £, whereof 2,200 £ is the outlay up to 1st May 1865, 2,150 £, the allotment of the current year, and 5,400 £, the aggregate of the entries in the Draft Budget of 1866-67.

The distance from Ediwanna to the Moplah village of Mombat is four miles, and to Nelemboor four miles more. Between Ediwanna and Mombat the road has been cleared to 18 feet, with side drains, except in two places a few hundred yards long, where the ground dips, and embankments will be necessary. Several large boulders also obstruct the road, and require blasting. Between Mombat and Nelemboor a good deal of embankment across paddy flats, with culverts of laterite blocks, is completed, but much remains to be done. Half way the River Cherapoya falls into the Nelemboor, and here a bridge is required, which will be a formidable and expensive work. The river is, of course, easily fordable during the fair weather, but the floods rise to a great height in the monsoon. The bridge was commenced last year, with laterite abutments and a solid laterite pier in the centre of the river 35 feet high, 16 feet deep at the base, and 8 feet across, facing lengthways to the stream. During last monsoon a great flood came down, rose to within three courses of the top of the pier, undermined the abutments, and washed them down. Mr. Bailey found that laterite, though very hard when exposed to the air, is not so durable in water. He is now getting it from another quarry, and intends to face the wings of the abutments and the sides of the pier facing the flood with granite, which he is blasting out of the bed of the river.

The Conolly teak plantations commence nearly opposite Mombat, and extend for seven miles along the north, and for several miles along both sides of the river. The long vistas of tall and perfectly straight trees present a striking appearance. The stems are often without a branch for a height of 70 feet and upwards. Those planted in 1843 I found to be 5 feet 2 inches in girth at a distance of 3 feet from the ground and 90 feet high; those of 1847 were 3 feet 11 inches in girth and 70 feet high. Several acres are planted every year, and the newest piece, with the nurseries, is now three miles beyond Nelemboor. The finest view of the plantations is from the bed of the river, where there is a foreground of drooping feathery

* See Enclosure, No. 2.

feathery bamboos, above which the stately teak trees appear with their large pale green leaves, while the line of the Neilgherries, crowned by the needle-like peak of Makooty, bounds the distant view.*

While at Nelemboor I called upon the old terupad, whose abode, a number of rambling buildings surrounded by a wall, is beautifully situated on a high bank, overhanging the river, and both then and the next day, when the young heir returned the visit, the conversation turned almost exclusively on their preposterous claim to the chinchona plantations at Neddiwuttum.

From Nelemboor to Yeddacarra the distance is eight miles. The road crosses the river Nelemboor, where a large bridge will be required, the water rising 30 feet in the monsoon. The bridge is not yet commenced, but some laterite bricks for the abutments, and other material, have been collected. The road is good, with side drains and culverts, with laterite abutments, and long slabs of laterite placed across to form the roadway. The forest through which the road passes is composed of magnificent timber, chiefly erul or jambay (*Xylocarpa Indica*), an excessively hard wood, of which the railway bridge near Beypoor is built; the useful *karamarda* (*Terminalia coriacea*) with bark like an armadillo's back, and the ben-teak (*Lagerstromia microcarpa*). At intervals there are open grassy glades, overshadowed by the waving bamboos, forming long vistas along which the peacocks love to strut between sunset and dark.

Yeddacarra is a bungalow, through the roof of which the stars and moon shine, in an extensive open space, surrounded by forest. A party of Brinjarrees, with 500 bullocks, bringing down coffee from South-east Wynaad, was encamped near the bungalow, and the whole party was down with fever. We gave them doses of quinine all round.

Between Yeddacarra and the foot of the Carcoor Ghaut the road is good, but a small bridge is required over the Yeddacarra river, which is not yet commenced.

The

* The following is a Statement of Receipts and Expenditure, with the number of seedlings and acres planted yearly, from the formation of the teak plantations in 1840 up to 1st May 1865:—

Years.	Number of Seedlings Planted.	Acres Planted.	Receipts.	Expenditure.
			£. s. d.	£. s. d.
1840-41	- -	- -	- -	8,450 - -
1842	- -	- -	- -	2,810 13 -
1843	- -	- -	475 7 8	1,766 1 -
1844	24,784	20	- -	2,097 13 8
1845	57,022	50	12 14 -	2,323 6 4
1846	72,964	73	- -	2,909 5 -
1847	101,703	102	- -	3,135 15 -
1848	167,000	107	- -	3,228 12 -
1849	140,800	141	767 1 8	3,217 14 7
1850	103,880	104	427 - -	3,183 13 11
1851	107,500	108	444 8 5	3,438 3 1
1852	123,960	124	819 2 6	2,834 15 1
1853	37,201	37	3,785 12 9	4,542 2 8
1854	50,900	51	538 2 2	3,158 10 11
1855	85,200	85	503 - 2	3,284 - 11
1856	104,314	104	299 8 5	2,870 4 2
1857	93,000	93	257 8 -	3,194 14 -
1858	38,800	38	854 3 1	2,938 11 3
1859	43,403	43	1,768 13 6	2,348 10 10
1860	38,800	39	5,717 2 9	3,935 7 1
1861	41,680	42	4,415 13 2	2,925 1 2
1862	83,700	84	868 - -	3,779 5 6
1863	45,900	46	17,721 10 8	6,766 5 9
1864	71,128	71	6,691 2 4	13,641 2 3
1865	106,863	107	27,168 11 10	16,026 6 4
	1,078,679	1,696	73,465 11 1	108,808 4 5

Total excess of Expenditure over Receipts - - £. 35,842 9 4

The Carcoor Ghaut is the outlet for the produce of South-east Wynaad. Bullocks have struggled down with the coffee for many years; Mr. Ouchterlony, the largest proprietor, usually sending 100 coolies down each season to make the track passable for them. It has happened, I believe, on more than one occasion, that the Carcoor Ghaut was quite impracticable, and the crops have had to be sent over the Neilgherries, and down the Coonoor Ghaut. In 1857 a new trace was made, at a cost of 8,000 rupees, which was abandoned afterwards, and the whole of this sum was thus recklessly squandered. The old road wound up a ravine, and had to cross the River Keilakah-poya twice. The present trace, which was made by Mr. Bailey in 1863, is excellent. It crosses a forest-covered spur, called the Kuniam-para, and then goes straight up the north-west side of it, without a single zigzag, to the summit at Nadagany. After Mr. Bailey had made the trace, Mr. Campbell, a sergeant of Sappers and Miners, went vigorously to work upon it, exposing himself to disease, never sparing himself by night or day, but, at the same time, getting much good work done, until, in May 1864, he died at his post, from overwork and want of medical treatment. It is very sad, and, I think, very impolitic, that his widow, and four children, should be left in a state of destitution on the pittance of nine rupees a month, to which she is entitled as a soldier's widow, and that the services of a public servant such as this should have received no recognition.

Mr. Campbell was succeeded by Mr. Assistant Engineer O'Shaughnessy, who proved an equally good officer, and whose work is almost the only satisfactory thing to be seen in Wynaad. He came in August 1864, and his operations extend over the seasons of 1864-65 and 1865-66.

The Carcoor Ghaut, when I went up it, was completed to 12 feet throughout, with an average gradient of 1 in 19, and the drainage and revetment work of the first three miles was finished, with the exception of three tunnels. The work that remained to be done was widening the whole length of 11 miles to 18 feet, completing the drains with rough stone abutments, and granite slabs across them for the roadway, and a considerable amount of blasting. Most of this blasting work will be for the removal of small rocks obstructing the roadway, but in two places there are some enormous masses to be torn from their sites. One of these is a giant boulder, weighing 1,200 tons, with a forest tree of great height growing on the summit. Mr. O'Shaughnessy intended to place a mine behind it, and send it thundering down the ravine. Such is his energy, and the tact with which he manages labour, that I have no doubt the Carcoor Ghaut would have been completed for carts before the coming monsoon, if he had not been removed from the district.*

At the summit of the Carcoor Ghaut there is a hut called Nadagany, and the road leads thence, across the plateau of South-east Wynaad, to Goodaloor, eight miles, and thence to Tippoo-cardoo, on the Mysore frontier, 11 miles. The whole of this distance is now completed, with a broad practicable cart road on an excellent trace, with substantial temporary bridges. There is much very heavy earthwork, which is done by a peculiar race of tank diggers from the low country, called Wudders. They are paid at so much the cubic yard; their wives and children work with them, generally turning to at early dawn, and late in the afternoon, and resting during the heat of the day. At the rate of 3 annas per cubic yard, a family of Wudders often makes a rupee a day. There is one heavy bridge, over the River Seeputti, between Nadagany and Goodaloor, of 40 feet span. The masonry abutments are completed, and a substantial timber superstructure has been put up, which will be quite efficient until the permanent truss bridge is made. From Goodaloor to Tippoo-cardoo the road passes by several coffee estates, and afterwards through a stunted feverish jungle, with a glorious view of the Chinchona mountains on the right. Two large bridges and many culverts are required on this 11 miles of road. The first, 30 feet span, over the Goodaloor river is completed in the same way as that over the Seeputti.

The

	£.
Estimate for the Carcoor Ghaut - - - - -	10,740
Spent before 1st May 1865 - - - - -	2,000
Allotment for 1865-66 - - - - -	1,000
Entry in Draft Budget List of 1866-67 - - - - -	2,500

The other, over the Bidrahulla, is 45 feet span. The masonry abutments are completed, and fine teak beams are collected for the superstructure, but they are not yet placed across. Meanwhile there is a temporary wooden bridge. From the Bidrahulla to Tippoo-cardoo the road passes through a hot dry forest, where there is no shade from a pitiless sun. Twelve streams, now dry, but which are torrents during the monsoon, cross the road. The masonry abutments for culverts over the whole of them are completed, brick arches for the first three are already turned, and the rest are crossed by very substantial wooden roadways.

Thus there is now a good cart road, which is already much used, from the Mysore frontier to Goodaloor, and onwards to the head of the Carcoor Ghaut. This satisfactory result is due to Mr. O'Shaughnessy. The merits of this officer have already been recognised by the Secretary of State in Council, when he was employed on the Pooniar Anicut (*Despatch, Public Works, 13th November 1862, No. 33*); and his arduous and successful work in South-east Wynaad fully entitles him to equal praise. Working in concert with the planters of his district, and thoroughly understanding the management of labour, he has done more serviceable work in two seasons than has been done in the rest of Wynaad during ten. He has never spared himself, has been on the roads incessantly, encamping in the unhealthiest forests, and suffering often from jungle fever. All this was his duty, a very arduous one, but he has done it right well.

South-east Wynaad, through which this road passes, is now an important district, containing more than 60 coffee estates. Most of the land originally belonged to the Varnavar of Numbulacottah, a large Nair proprietor. The last Varnavar appears to have borrowed money from the Nelemboor Terapad, which he was unable to repay, and, in 1836, a decree of the Zillah Court of Malabar ordered his property to be sold by auction. This was to satisfy a mortgage claim (*Suit No. 279 of 1830*) of the Nelemboor Terapad, who bought in this great territory at a mere nominal price. There was a sister and nephew of the Numbulacottah man, who were brought down to Nelemboor; the sister is now alive and insane, the nephew and heir has disappeared. The whole transaction bears a most suspicious and questionable appearance. When the planting enterprises began to show the immense value of this acquisition, he of Nelemboor put forward the most preposterous claims on the strength of his purchase. He granted Mr. Ouchterlony a small principality of fine forest and grass land, the extent of which is shown by a dotted line on the map. He receives rent from the Government for the Mudamullay forest, and from several planters at Cherambody and Devala, and he actually claims the site of the chinchona plantations, and all the Neilgherry Hills up to the Pycara river. But, fortunately, the names of every hill and piece of land composing the tract to be sold, which can now be identified, are mentioned in the decree of sale; and it appears from this document that the Numbulacottah boundary was at the foot of the Neilgherries, up to the Moyaar river, where it descends from the Pycarrah falls.

A portion of Mr. Ouchterlony's grant, now known as the Ouchterlony Valley, at the foot of the Neilgherries, is one mass of coffee, comprised in several large and flourishing estates. To the left of the road are the estates at Devala and Cherambody, chiefly owned by the Moyaar Coffee Company and Mr. Minchin. They cover a succession of undulating hills, and the upper sides of the western ghauts overlooking Malabar. Other coffee plantations are opened round the Nelialim Hills, in the valley of the Moyaar, and in the neighbourhood of Goodaloor. The town of Goodaloor is the central point of South-east Wynaad. Not many years ago it consisted of three or four huts; now it has a post-office, a catcherry, a dispensary, concerning which more presently, and a long street with one or two shops. But South-east Wynaad, especially the neighbourhood of Goodaloor, is terribly feverish, and disease had broken out unusually early this year. At the foot of the Carcoor Ghaut we found all the Brinjarries stricken with it, several coolies were lying ill with it on the ghaut, our own peons were attacked at Nadagany, a Mr. Browning, a planter, who has been working under Mr. O'Shaughnessy at the Bidrahulla river, was exceedingly ill with it, several deaths had occurred in that pestiferous jungle, and there was a panic amongst the work people. Nearly all the bamboos in Wynaad have flowered, fruited, and died down this season, the first time for 20 years as I was informed, and it has occurred

occurred to me that these masses of fallen and dying vegetable matter may be the cause of the extraordinarily early appearance of fever this year.

At Goodaloor there are cross roads; one to Nadagany, a second to Tippoo-cardoo, a third to Sultan's Battery, and through the centre of the Wynaad plateau to Manantoddy, and a fourth up the Goodaloor Ghaut and through the chinchona plantations to the Neilgherries. A new road, on an improved trace, is now being made down the Goodaloor Ghaut, under the superintendence of Major Farewell. From Goodaloor to Sultan's Battery, 18 miles of the road may be considered within South-east Wynaad, or up to the Noolpully river. A very good road on an excellent trace from Goodaloor to the Noolpully was completed by contract about three years ago, by Mr. Browning, a planter, though the cross drains are not covered over, and Mr. O'Shaughnessy has collected material ready for bridging the Noolpully. It is a proof how very important roads are in Wynaad, that, as soon as this piece of road was opened, 2,000 acres of land were taken up along it, and several hundreds are now cleared and planted. The Noolpully is not yet bridged, but is still crossed during the monsoon by means of a *jangdar* or *pandy*, a stupid contrivance, of which I shall have more to say presently. From the Noolpully to Sultan's Battery the present line crosses several streams and paddy flats, where there are temporary bridges and causeways; the distance is eight miles. A new trace is to be made, but it is not yet commenced.

The boundaries of South-east Wynaad are the Neilgherries on the east, the Mudamullay forest and Mysore frontier on the north, the Noolpully and Noogoo rivers dividing it from South Wynaad on the west, and the ghauts on the south.

2. *A Journey through South Wynaad.*

South, or more properly Central Wynaad, is the most important division of the district, and the worst provided with means of communication. It contains upwards of 60 estates, which are chiefly along the edge of the ghauts, but with northern or western aspects, and round the slopes of the Chumbra and Culpetty hills—lofty masses which extend far into the plateau. The further a coffee estate is from the moisture of the western coast the less profitable is its yield of coffee. The most influential proprietors are the South Indian Coffee Company, whose extensive estates are managed by Mr. James Beaumont, and extend along the western side of the Culpetty hills, and over the Velery-mullah range; Messrs. Rossell, Hinde, and Rimington, who occupy the slopes of the Chumbra hills; Messrs. Boyd & Co., at Lackady, whose manager, Mr. Gordon, was formerly chairman of the Planters' Association; Mr. Glasson; and there are also the extensive plantations of Messrs. Leckie, of Bombay, now for sale.

The line of road, the completion of which is absolutely necessary for the well-being of this great interest, is one which would open up cart traffic from Calicut, up the Tambracherry Ghaut, to Lackady and Vithery, and thence by Sultan's Battery to the Mysore frontier. No such road is now in existence, and, under present arrangements, there is no likelihood that it will be in existence for some years to come. Meanwhile, the most serious consequences threaten the planters from the absence of roads.

From Calicut to the foot of the Tambracherry Ghaut the road is excellent, but the history of the ghaut is a most unsatisfactory one. The old Tambracherry Ghaut went straight down, without a zigzag, from the Wynaad plateau to the plains of Malabar. The gradient varied from one in four to one in one, and the roadway consisted of huge blocks of stone, forming a ruined staircase, down which tradition relates that Tippoo took his field artillery. Coolies come up and down with burdens on their heads, and bullocks laden with coffee are driven down, but it is a frightful spectacle. A new trace was completed in April 1858, by Lieutenant Tennant, when Captain Bean was district engineer of Malabar, and the estimate for a cart road was then 2,04,000 rupees. In March 1859, the Madras Government determined not to proceed with the Tambracherry Ghaut; in July, they again changed their minds, and resolved to make a 10-foot path for bullocks, but not a cart road; and afterwards they changed again, and agreed

to make a cart road. From 1860 to the present time, Captain Kennedy, formerly of the Madras Sappers and Miners, has had charge of the ghaut.

The first great mistake was in ever selecting the Tambracherry Ghaut at all it being the most inaccessible point in the whole range; more especially as there is a ghaut at Teriote, within a few miles to the westward, where a perfectly easy trace might have been found. The next mistake was in the selection, by Captain Bean and Colonel Ouchterlony, of the most difficult trace that could possibly be found, consisting of a zigzag up the face of a perpendicular precipice; contrary to the advice of Captain Kennedy, as he informs me. The latter officer would have taken the trace only once along the precipice, and then by easy gradients down into the plain, between two spurs to the westward.

It is, however, too late to talk of all this now; and I therefore proceed to describe the present state of affairs on the Tambracherry Ghaut.

In previous years 5,000*l.* have been spent on the Tambracherry Ghaut, and 14,640*l.* are sanctioned for its completion; 5,300*l.* is the allotment for the current year, and 5,600*l.* the entry for 1866-67.

The Tambracherry Ghaut is a rocky, forest-covered slope up to within 500 feet of the summit; but the last 500 feet is a sheer precipice of very hard gneiss. The lower part is nearly completed for cart traffic, the road having a gradient of 1 in 19. There is a good deal of excellent revetment work, and in some places the road crosses a ravine having a masonry embankment on either side. On reaching the foot of the precipice, the new trace crosses the old ghaut, and is taken for a mile and a half across the face of the precipice, then turns, and has to cross it a second time into Lackady. Thus there are three miles of sheer precipice composed of excessively hard rock, out of which a cart-road 18 feet wide is to be cut. Meanwhile the traffic goes down the old break-neck ghaut to the point where the new ghaut crosses it, and then follows the line of the new ghaut. The fearful passage down this bit of the old ghaut, on which so many bullocks annually die, is known as the "500 feet." I have been over many passes in the wildest parts of the Andes; but I never saw anything worse than the upper part of the old Tambracherry Ghaut, the only existing line of communication between the coffee district of South Wynaad and its port of shipment at Calicut.

Captain Kennedy began work in 1860-62, with one company of Madras Sappers and Miners. They had to get a foothold by chipping out rock with a chisel, and then Captain Kennedy made the trace by walking along on their hands, while they held on by their toenails and eyelids. In 1863-64 there were two companies on the ghaut, and a good deal of blasting was got through; but they were removed in May, on the pretext of the unhealthiness of the climate. In the same year, Colonel Hill, who commands the Sappers and Miners at Bangalore got Captain Kennedy removed from the corps, accusing him of neglecting the drill of the men while paying exclusive attention to the work on the ghaut. He was thus punished for his zeal in doing his duty; and the further great inconvenience arose that he no longer commanded his own labourers, but had to transmit his orders through another commanding officer. In 1864-65 three companies of Sappers and Miners were sent up, with three officers, and they remained during the present season; but it is feared that some pretext will be found to move them down to Bangalore, again next March; and thus another great loss of time will accrue. These Sappers and Miners are very good, but excessively expensive workmen. Each company nominally consists of 300 men, who get, according as they are first, second, or third-class men, from one and a half to three annas a day, besides compensation for difference in the price of rice. Their wives and children increase their means by working on the neighbouring coffee estates. Each man has a certain daily task, and on an average they get 11 rupees to 12 rupees a month, or 3,600 rupees a month for the three companies, exclusive of the pay of three officers.

At present the work is so far advanced that it is easy to walk along the mile and a half of the first half of the zigzag, a great deal of rock has been blasted, and much revetment work built up. Yet much remains to be done, and the second half, which looks the most difficult, is not even commenced. I see little prospect

prospect of a cart road being completed, judging of the time that has been occupied in getting so far, for some five years to come.*

Meanwhile, unless some other device is hit upon, all traffic must continue to go down the terrible "500 feet." If the lower part of the new ghaut is completed, Mr. Beaumont is thinking of having a cart depôt on it at the foot of the "500 feet," down to which he would send his coffee by means of a shoot over the precipices, or by a succession of lifts.

At the top of the Tambracherry Ghaut is Lackady, where Tippoo threw up a redoubt when he invaded Malabar. Here there is now a Government bungalow, built by Captain Kennedy; on an opposite hill stands his own house, and further up are two officers' bungalows and the mess-house. The lines of the Sappers and Miners are built along each side of the road, but they are merely of split bamboo, and have to be renewed at the end of each monsoon. The Lackady bungalows are overshadowed by an amphitheatre of mountains, those to the westward covered with rich forest vegetation, those to the north and east with rows of coffee plants. It is a pleasant place, with a fresh sea breeze often blowing, and, for Wynaad, must be comparatively healthy.

It would, I think, be very advisable to build pukka lines for the Sappers and Miners. A gang of wudders might run up good stone buildings during the monsoon, and the time wasted in annual hutting would be saved; while, when the work is done, the Government would be more than repaid by letting or selling the lines to Moplahs for a bazaar,—the nucleus of a thriving trading village at the top of the ghaut.

After ascending the ghaut, the line of communication, which ought to be a road, goes from Lackady to the village of Vythery; where there is a Moplah bazaar, a post office, and the Club of the Planters' Association of South Wynaad; and where Government offices are to be built. There are three small streams to cross, none of which are yet bridged, and the road, only two miles long, is not yet finished. The Public Works Department have been engaged upon it for upwards of 10 years! Captain Kennedy is now working on a new and improved trace.

The next section is from Vythery, by Chundale, to Culpetty. Immediately outside Vythery the road has to cross the Cunnnooth river, one of the most formidable in Wynaad during the monsoon. There is, of course, no bridge, but it is proposed to make one of 170 feet long, with three piers, 40 feet from each other, and a superstructure of angelly beams. From this point to Culpetty, the waste of money has been most lamentable. The old road is execrable, going straight over rocky hills, and across morasses where the bullocks fall and die. Yet it is the only one now available, and it is shocking to see the wretched beasts driven into a crush in the narrow passes, or slipping over on their backs. A new trace was approved by a former engineer, and commenced by a contractor, who completed it for some miles, and collected material for bridges. Captain Kennedy is now working on another trace, and very considerable progress has been made during the last two months, but no part is yet available for traffic. The road will have to cross the Culpetty river by a bridge 70 feet long, which is not yet commenced. The distance from Culpetty to Lackady is 15 miles.

Along the whole of this distance the road is lined with coffee estates, yet the only means of crossing the two rivers of Cunnnooth and Culpetty is by the stupid *jangdars*, which are soon washed away. Then those who dwell between the two rivers are helpless, and are divided from the outer world for days together. They are reduced to eating raggee cakes, get no post, and no supplies.

From Culpetty to the Mysore frontier, by Sultan's Battery, a distance of 30 miles, the line has scarcely been touched by the Public Works Department. For about a mile or so out of Culpetty the road has been nominally repaired, that is, the side drains have been dug out, and the dirt has been spread over the roadway. These so-called repairs are most remarkable. I have actually seen an overseer making

* In para. 9 of Public Works Despatch, dated 7 April 1865, No. 11, the Secretary of State wrote, in terms of high commendation, of the services of the Sappers and Miners on the Tambracherry Ghaut; but this gratifying recognition of their arduous work was never communicated to Captain Kennedy and his men by the Madras Government.

making the coolies dig swamp manure from amongst the bamboo clumps, and spread it over the road, as an uninitiated person would suppose, to serve as a top dressing for raising asparagus. When the monsoon comes the road is almost impassable until the rain has washed the top dressing away again.

About three years ago, the road from Culpetty to Sultan's Battery had been so long neglected, and had got into such a disgraceful state, that the deputy collector got leave to put it to rights with the means at his disposal, independently of the Public Works Department. His work was exceedingly creditable; he made causeways over the paddy flats and temporary wooden bridges; but the road has never been touched since, and has, of course, fallen into as bad a state as ever. Very little would keep it in tolerable repair, but that little is not done.

Sultan's Battery, or Gunputty-wuttum, occupies a very central position in Wynaad. The line of road from the Tambracherry Ghaut to the Mysore frontier will pass through it, as well as that from the Neilgherries, by Goodaloor to Manantoddy, along the length of the plateau. The names are derived from a square enclosure, surrounded by a ditch, where Tippoo mounted some guns, and took shots at a stone (*wuttum*) in a temple hard by, which was carved into the shape of the elephant headed Gunputty or Ganesa. The god has, in consequence, lost his trunk. Sultan's Battery is likely to be a very thriving place when the roads are made. There are already an excellent traveller's bungalow, an abkarree station, and a large bazaar, where enterprising Moplahs have handsome shop fronts. The place is surrounded by fine clumps of trees, native coffee gardens, and paddy cultivation.

The distance from Sultan's Battery to the Mysore frontier is 15 miles, and the first 11 are naturally so easy that they are even now passable for bandies during fine weather. There is a steep hill or two near Sultan's Battery, where the trace must be improved, and four rivers will require bridging. From a tumble-down swamy house, called Poongolycottah, through a weird forest, where tigers may be seen, in the hot afternoons, stalking monkeys round the bamboo clumps, to the Mysore frontier, a distance of four miles, the present track is execrable, and the most adventurous bandy could scarcely hope to struggle along it. After crossing the frontier, I immediately found a number of bandies laden with timber, and a large encampment of wood-wudders. They come out thus far with ease from Goondelpett, in Mysore, a distance of 25 miles, although nothing has yet been done to the road.

The other lines of communication in South Wynaad are the private ones made by planters, to which I shall allude in another section, and those leading to Manantoddy, in North Wynaad, the capital of the district. One of the latter leads from Sultan's Battery to Pannamurum, along a ridge, and might be kept in repair at a very trifling cost. Another, which is purely a district road, goes from Culpetty, across two ranges of rocky hills, to Pannamurum, where the Manantoddy, the largest river in Wynaad, must be crossed. A third goes from Vythery, by Teriote, to Manantoddy. This has been, as I think, most injudiciously, made an imperial line. Large sums of money have been wasted upon it, yet there are no bridges over the rivers beyond dangerous moveable planks, and it is not passable throughout for carts. It is purely a district line; there is already a tolerable bullock road along it for fair weather traffic, and, in my opinion, it would be unjustifiable to spend more money on it until the three main lines, so urgently needed, are finished.

The estates round Teriote, which are few in number, use the Coteaddy Ghaut, where there is a tolerable bullock road, to send their coffee to the coast. This route has the great advantage of having a navigable backwater close to the foot of the ghaut.

3. *Journey through North Wynaad.*

North Wynaad was formerly the most important part of the district. Here is Manantoddy, where a detachment of native troops were stationed, and when they were withdrawn it was here that the deputy collector established his cutcherry.

The great pioneer road from Malabar to Mysore also ran through North Wynaad, and this was the only means of communication for many years, and until the Perambody Ghaut road was made through Coorg, from the west coast to

to the interior. It passed up the Periar Ghaut, across North Wynaad, and into Mysore by the Bowally bridge : it was bridged throughout by serviceable old fashioned structures, and carts were often brought up the ghaut in spite of the precipitous gradient.

North Wynaad is separated from Coorg by the Bramah-gherry mountains, on the summit of which there is a plateau 6,000 feet above the sea. Parallel to them runs another well-wooded range of hills called the Dindimul Mountains.

Since 1840, coffee cultivation has rapidly increased in North Wynaad, and now there are estates all along the road from Manantoddy to the Periar Ghaut, upwards of 10 along the slopes of the Dindimul hills ; coffee cultivation extends from Manantoddy to within three miles of the Bowally bridge ; and in the north-east there are 31 estates in the Tirunelly valley and along the slopes of the Bramah-gherries. Altogether there are upwards of 53 coffee estates in North Wynaad.

The urgent need of the cultivators of these estates is, that the old pioneer road should be kept in ordinary working order, and that a trace with an easier gradient should be made up the Periar Ghaut. It might naturally be supposed that at least the road would be kept in repair with the ordinary maintenance allowance, but this is far from being the case. I am assured by those who can remember the road 20 years ago, that it was in better order then than it is now. There are numerous places which become impassable morasses in the monsoon, but which might be put right by a little timely repair. The planks forming temporary bridges are loose and dangerous, and even the roadway of one of the old bridges is so worn away that the bricks of the arch are laid bare. It is true that a dog-cart may be driven from Manantoddy for some miles towards the Periar Ghaut, but the three miles on the Manantoddy side of the Bowally bridge is in such a disgraceful state that it is almost impassable for ordinary bandy traffic. One work, however, has been completed, namely, the small bridge over the Dhoby's nullah, within a mile of Manantoddy. It has masonry abutments, and is on what is called the "Canara standard plan," that is, supported by struts and corbels beneath. This principle does not appear to me to be so good as the method of having all supports above, like the truss bridge at Tippoo-cardoo, in a country like Wynaad. When the floods come down with huge branches and uprooted trees, these snags will either dash against and injure the struts, or else the abutments must be of such an additional height as to clear the danger, thus greatly adding to the expense. The truss bridge, with all supports above, is quite clear of the freshes in the river that it spans. They were three years in making this little bridge over the Dhoby's nullah.

A new trace down the Periar Ghaut has been made by Mr. Nordmann, the supervisor in charge of works in North Wynaad. The lower part is merely earthwork, but from the top of the ghaut there are three sharp zigzags, requiring very heavy blasting and revetment work. Satisfactory progress was being made on this important ghaut, when during my stay at Manantoddy, an order came to stop all work, thus checking such progress as was being made, and inflicting a most serious injury on the interests of North Wynaad.

A great number of estates have been opened in North Wynaad on the eastern side, in the Tirunelly valley, and on the slopes of the Bramah-gherries. The soil, covered as it formerly was for the most part by clumps of bamboos, is too poor for the profitable cultivation of coffee, and the climate is too dry. This country, to the eastward of Manantoddy, is known as the "bamboo side." It usually yields one or two excellent crops, and then falls off, requiring manure, and every other advantage that human ingenuity can supply it with. The absence of all roads in their division renders this impossible, and the planters came to me in a body at Bramah-gherry, and explained their position. A road from the Bowally road to the Coorg frontier is an absolute necessity to them. It would be 15 miles long, and presents no engineering difficulties beyond bridges over three rivers. I think that this line, being the natural continuation of the road from the Neilgherries, along the centre of the Wynaad plateau, should be an imperial one. In the first place, there should be a military road between the Neilgherries and Coorg ; such a road, too, would facilitate operations

in an important Government forest; * it would open up a very important grain-producing district †, and the very existence of many coffee estates depends upon it. The planters assured me they were willing to make the road themselves by contract, if a Government officer would give them a trace. The first mile and a half of an excellent trace has already been made by Mr. Nordmann, but the work has been stopped, and, under present arrangements, there seems to be no hope of any progress. ‡

While at Manantoddy, I observed that much money was being frittered away in making traces, abandoning them, and making others in the direction of Teriote and Pannamurum. It is most deplorable that while the main lines of communication are impassable for cart traffic, funds should be squandered on futile traces for mere district roads.

I think it will be clear, from the above narrative of the state of the roads, that there has been very serious mismanagement in the administration of the Department of Public Works as regards Wynaad. The three divisions of the district each contain from 50 to 60 coffee estates; they are of about equal importance, and they each require, most urgently, a cart road from Mysore, to bring in labour and grain, and down a ghaut to export their produce. After 10 years, there is not one such cart road in Wynaad. It comes to this, that the department is incapable of making a simple road across the Wynaad plateau, and the causes of this utter failure, which must lie in the organisation of the department, seem to require careful consideration.

4. *Public Works Establishments in Wynaad.*

It is needless to revert to the shortcomings of former years, because those chiefly concerned are now dead, and their accounts have been wiped off. But the new executive system was commenced about two years ago, and its results, so far as Wynaad is concerned, may be estimated.

Formerly, Wynaad had a single engineer, with overseers under him, who was subordinate to the district engineer of Malabar. Under the present organisation, the superintending engineer of the 7th division is the chief Public Works executive officer in Canara, Malabar, including Wynaad, and Coimbatore. Under him, Wynaad is divided into three ranges, each under a range officer. During the time of my visit, Mr. O'Shaughnessy, an assistant engineer, had charge of South-east Wynaad, Captain Kennedy, of South, and Mr. Nordmann, a supervisor, of North Wynaad. The subordinate establishments in these ranges were in a most inefficient and unsatisfactory state.

The expenditure on public works in Wynaad is now two lacs, and the cost of establishments is at least 25 per cent. of the expenditure.

	Per Month.
	Rs.
The superintending engineer receives 9,600 rupees a year, of which there may be put down for Wynaad's share about - - - - -	150
Mr. O'Shaughnessy - - - - -	500
Captain Kennedy, including military pay, allowance, &c., about - - - - -	500
Mr. Nordmann - - - - -	150
The petty establishment average 300 rupees a month for each range - - - - -	900
Office establishments, about 220 rupees for each range, and 60 rupees for overseers' offices - - - - -	840
Four overseers (120 rupees each) - - - - -	480
	3,720
	12
Rs.	44,640 a year.

This

* The Coodracote forest. It is the only forest whence timber can be conveyed from Wynaad to the west coast market. The timber would go by the Periar Ghaut. Owing to the small demand in Mysore, the west coast market is the only one where remunerative prices will be obtainable for some time to come. The forest contains fine teak, blackwood, and mutti. The quantity of timber in cubic feet is estimated at about 200,000 of teak fit for felling, and about 50,000 of blackwood.

† In February 1866, rice was selling at 18 seers per rupee, and raggee at 28 in Coorg, while only 7 and 14 seers respectively were obtainable for a rupee at Manantoddy.

‡ See Enclosure, No. 3.

This is a heavy item in the expenditure, and it is a serious question whether the benefit that the public service should derive from it is realised. It seems to me to be essential to the progress and completion of the roads that they should be under the constant supervision of the superior executive officer, who should reside in Wynaad; that he should work in concert with the planters; that changes in his staff should be avoided; and that the subordinate establishments under the range officers should be efficient. The cost of establishment ought to be about 20, and not 25 per cent. of the expenditure.

I will now briefly state to what extent these essential conditions of efficiency are secured under the present system.

The superintending engineer has charge of so extensive a region that he cannot bestow more than a very small portion of his time on the Wynaad works. The changes in the staff have been incessant, and the directions given in para. 10 of the Secretary of State's Public Works Despatch, dated April 1865, have been totally disregarded. To take South Wynaad as an example. First, Captain Kennedy had charge of the ghaut only; Mr. Nordmann, of the road from thence to Sultan's Battery; and Mr. O'Shaughnessy, of that from the Battery to the Mysore frontier. Then the latter section was taken from Mr. O'Shaughnessy and given to Mr. Nordmann. Then the whole was given to Captain Kennedy. Then it was ordered to be taken from Captain Kennedy again, and once more to be divided between two other range officers. Then Mr. O'Shaughnessy was dismissed from the district altogether, and a new officer will be appointed, who will require a season to become acquainted with it. These constant changes render any real progress next to impossible. The subordinate staff is insufficient, and though the submission and sanction of plans and estimates are rigorously exacted before any work can be proceeded with, and all the complicated forms of account must be filled up and sent in every month, yet the range officers are not provided with draughtsmen, accountants, or even good overseers.

For these reasons, I have been unable to avoid the conclusion that no rapid or satisfactory, certainly no economical progress can be expected in the public works of Wynaad, until a complete change has been made in the system. The exceptional character of the work in Wynaad not only justifies, but renders necessary the appointment of a special executive engineer for the district, who should have no executive superior, but should correspond directly with the Secretary to Government, who should work in concert with the planters, and should have his eye constantly on the works in every part of the district. A supervisor and two overseers, with an efficient office establishment, would work under him in each range. On the completion of the roads, when nothing but maintenance operations will be necessary, the establishment might be very much reduced, and the appointment of the special executive engineer dispensed with, but in the meantime a saving would be effected on the present system, and the cost of establishment would be at once reduced to a little over 20 per cent. on the expenditure; thus,—

	Per Mensem.
	<i>Rs.</i>
One special executive engineer for Wynaad - - - -	750
Three supervisors, one for each range, at 250 rupees per mensem	750
Six overseers, two for each range, at 150 rupees per mensem -	900
Draughtsmen, accountants, and other office establishment -	900
	3,300
	12
<i>Rs.</i>	39,600

Nearly all the obstacles to satisfactory progress appeared to me to lie in the organisation of the present establishment. I therefore consider that some such change as I have proposed is one of the most urgent requirements of the district.

5. *Action of the Planters, and the Public Works Department, with regard to Contracts.*

The coffee planters of Wynaad are, as a body, vitally interested in the rapid and efficient prosecution of public works in their district, and at the same time they are in a position to furnish valuable assistance to Government officials. In no part of India, therefore, might contracts for the construction of roads be entered into with greater advantage.

The planters are an organised body, and in each division of the district they have formed an association, which represents their wants, and watches over their interests. Originally there was but one, called "the Planters' Association of Western India," which met at Manantoddy, and of which Mr. Gordon, who has charge of large estates at Vythery, was for some years chairman. Reports of the proceedings of this association have been published for the years 1859, 1860, 1861, 1862, and 1863.* In 1864 it was found that the three divisions of the district had increased very much in importance, while their interests were to some extent distinct. It was, therefore, thought desirable to form an association for each division, which was accordingly done. That of North Wynaad, meeting at the Manantoddy Club, is presided over by Mr. Richmond, with Mr. Rayne, the agent of the Madras Coffee Company, as secretary. The chairman and secretary of the South Wynaad Association, which meets at the Vythery Club, are Messrs. Rossell and Hinde, proprietors of fine estates on the Chumbra hill; while Mr. Minchin and Mr. Steedman hold the same offices for South-east Wynaad. It is proposed to form an association representing the planting interest of the whole of Western India, to meet at Ootacamund, of which those in Wynaad shall be branches.

This organisation is very advantageous to the planters, because it enables them to give weight to their representations by speaking collectively. It also supplies machinery which may hereafter be very serviceable in furthering that cordial co-operation which, it is to be hoped, will some day be established between the planters and the officers of the Public Works Department in the district. Many of the planters are proprietors, others represent the interests of companies, or of individual capitalists; and amongst them are to be found men who have experience in road making, who can obtain labour in much greater abundance, and far more economically, than any officer in the Public Works Department, and who could supply satisfactory guarantees for the fulfilment of any road contract they might make with the Government. The immense advantage to the public service that would be secured by making use of such agency is evident. The roads on the plateau would be completed at once by those who have the greatest interest in their being made well, and at a comparatively small cost, while a number of Government officers would be free for other service. The planters have already made several good district roads, among which I may mention a six-foot bullock road made by the Messrs. Wright, which connects the estates at Cheramboddy with the old Nelialum road to Sultan's Battery; and the excellent cart road, seven miles long, between the estates of the South Indian Coffee Company at Thanootha and those in the neighbourhood of Culpetty.

In spite of these considerations, the system of contracts has hitherto been uniformly discountenanced.

It is requisite, for the complete understanding of the Wynaad question, that the history of the abortive attempts that have been made from time to time to introduce this system, and to get the roads made through the agency of those who would be the chief users of them, should be known. I shall begin with a brief account of Mr. Ferguson's unsuccessful but most meritorious endeavour to make a road by contract.†

Mr. Ferguson is a planter of great experience, and considerable energy and intelligence, who now has charge of the fine Rimington estates, on the slopes of the Chumbra hill. In the beginning of 1863 he was requested by Major Syme, then the engineer in charge of Wynaad, to assist him in tracing a new line of cart road from Vythery to Culpetty. He commenced work in February, and completed

* See Enclosure, No. 4. Mr. Gordon's Views on Wynaad Roads.

† See Enclosure, No. 5.

completed the trace in April. Major Syme then asked him to take a contract for the construction of a cart road from Vythery, along the south side of the Culpetty hills, to Sultan's Battery, with a branch to Culpetty. Major Syme went over Mr. Ferguson's trace from Vythery to Culpetty several times, and was perfectly satisfied with it. The contract was signed in June 1863, for the construction of a road 18 feet wide, with drains two feet wide and one and a half deep, and sawn timber platform, bridges over the nullahs. Subsequently it was arranged that the bridging was not to extend to nullahs above 25 feet in width. The work was to have been measured up, and the accounts adjusted, twice a month. Mr. Ferguson worked all through the heavy monsoon of 1863, put up one permanent bridge, and prepared large quantities of timber for the more formidable bridges, for which he was to have had a separate contract. In October 1863, Mr. Smith succeeded Major Syme in Wynaad, and urged Mr. Ferguson to complete the road to Culpetty as rapidly as possible. A contract was entered into at the same time for bridging, at Rs. 1. 2. per cubic foot for timber, and 6 rupees for masonry, and for catch drains along the whole line of road at 2½ annas per cubic yard. By this time Mr. Ferguson had found that the original contract for road and bridges at 1,000 rupees per mile would be a great loss to him, and Mr. Smith agreed to allow him 2½ annas per cubic yard for all earthwork on the remaining half of the road, and to pay separately for the bridges. The work was proceeding satisfactorily when, on 3rd December 1863, a verbal order came to stop it all. Large gangs of men were at work at the time, and this sudden stoppage of course caused much loss and inconvenience. Afterwards, Mr. Ferguson was requested to go on again, and, during January and February 1864, he had 2,000 men employed; but in the latter month he received a final order to stop all work. He had spent 4,535 rupees on labourers' wages, and 2,600 rupees on that of mechanics, overseers, &c., and had completed four miles of road, besides partially opening the remainder. Progress had been comparatively slow, because the work had been done during the heavy rains, but it was advancing much more rapidly in the fine weather, when it was finally stopped by the superintending engineer. Had the contract been adhered to, there would now be a good cart road from Vythery to Sultan's Battery. Now, as I have already stated, no such road exists, while all the money spent by Mr. Ferguson (upwards of 700 £.) has been wasted. I went over his trace, which appeared to me to be a very good one; and though I think that the new trace made by Captain Kennedy is better, it is certainly not so much better as to justify the squandering of several hundred pounds, the leaving an important district without any road at all for an indefinite time, and the abandonment of miles of excellent work. Mr. Ferguson tells me that, had he received fair support from the Public Works Department, and been encouraged by liberal contracts, he would then have been very glad to have devoted his entire time to road making, but that he has now lost all confidence in the department, and has refused to undertake any further work connected with it.

So much for this transaction, which, I think, speaks for itself.

About two years ago a contract was made with Mr. Browning, a planter who owns a coffee estate near Goodaloor, to construct 18 miles of the road from Goodaloor to Sultan's Battery. He made an admirable trace, and completed the road according to his agreement in a most creditable way. He also made the new trace of the Goodaloor Ghaut. Mr. Browning is by no means one of the leading planters; he is working on a small scale, and the result of his contract showed that it was not essential that contractors should be men of great wealth, but that agreements might most advantageously be made for constructing portions of road with any settler of known probity and intelligence. It is of course essential that, in entering into a contract, the Government officials should make all necessary inquiries; and any consequences arising from this not having been done must be put down to neglect of duty on the part of the officer, and cannot be honestly quoted as an argument against contracts. I am induced to make this remark, because an agreement respecting a portion of the Teriote road, which was made by Mr. Nordmann with a Mr. Carter, turned out most unsatisfactorily, entirely in consequence of the neglect of the range officer to ascertain the character of the person to whom he was giving a contract. This transaction will, no doubt, be quoted by the opponents of a system of making roads by contract, as opposed to the system of having no roads through departmental agency; but, as I have

shown, it would be most unfair and misleading to adopt a line of argument based on the absence of ordinary caution on the part of the range officer.

There has been no want of opportunities of trying the contract system within the last two years, and several excellent offers have been made by influential planters. Mr. Wapshare, the manager of the Moyaar Coffee Company's estates, and Mr. Miller, of Devala, made an official proposal to construct a portion of the road in South-east Wynaad, and offered to pay down 1,000 l. as a guarantee for the fulfilment of their contract; but they received a reply that their offer was declined. Mr. Swan, a planter in the Ouchterlony Valley, made a similar offer, and received an identical reply.

Mr. Beaumont is one of the leading planters of South Wynaad. He is a gentleman of great energy and perseverance, and, as managing director of the South Indian Coffee Company, represents a very important interest. Mr. Minchin is universally respected by the whole planting community of South-east Wynaad; he has taken the lead, especially in the establishment of the Goodaloor Dispensary, and occupies the chair of their association. He owns large estates at Devala and Cherambody, and is a director of the South Indian Coffee Company. The Government accepted the proposal of these leading planters to contract for the selection of a trace, and the construction of a cart road from the Connooth stream near Vythery, to the Mysore frontier, *via* Sultan's Battery, in an order dated 21st October 1865. The contractors sent in a detailed estimate for the road from Sultan's Battery to the Mysore frontier, at the same rates as are paid by the Public Works Department in Wynaad, and stated they were ready to commence work on this portion of the line at once. Messrs. Beaumont and Minchin, in accordance with the wishes of the South Wynaad planters, selected the same trace south of the Culpetty Hill which had already been adopted by Major Syme in his conduct with Mr. Ferguson. The superintending engineer, in a letter dated 2nd November 1865,* objects to this trace, characterises Mr. Beaumont's conduct as deficient in candour and straightforwardness, and accuses him of interested motives in selecting this particular line. The superintending engineer also reported that he had directed Captain Kennedy to open up the road west of the Culpetty hill, in opposition to the proposed operations of the Government contractors. Mr. Beaumont protested against this antagonism, and he was informed, in an order dated 17th November 1865, that it was too late to alter the old route, which must go round the north side of the Culpetty hill. Although the old line was preferred by the contractors, in common with the whole planting community, they were yet willing to work on any trace insisted on by the Government, so long as some road or other was made; but, in a letter dated 29th November 1865, they reported that in consequence of "the illiberal construction put upon their proceedings," they retired from the undertaking they had proposed to carry out. The Government then ordered the superintending engineer to request them to reconsider their decision; but they finally replied that it was impossible to have anything to do with the Public Works Department in Wynaad under the existing system.

Thus was another opportunity of completing the road across the plateau of Central Wynaad thrown away. The contractors are men whose money, as coffee planters, is involved in the completion of these roads, and there cannot be any doubt as to the sincerity of their offer. The loss involved in the absence of roads is most serious to them. The Brinjarries demand 2½ rupees per bullock per trip to Calicut, for taking down coffee. A bullock carries 4 bushels (5 bushels to the cwt.). This is Rs. 2. 13. per cwt., or 5 l. 12 s. 6 d. per ton.† The freight from Calicut to England is from 3 l. to 4 l. If there was a cart road, a single bandy would carry 10 cwt. The two bullocks would cost 8 annas a day, and the bandy man 8 annas more; total, 1 rupee. The distance, say from Culpetty to Calicut, is 45 miles, and the trip will average 14 days, so that the cost will be 14 rupees, or about 2 l. 16 s. a ton. The absence of roads, therefore, exactly

* See Proceedings of Government, Public Works Department, 17th November 1865, 14th December 1865, and 16th February 1866.

† This is the cost to planters near the ghauts. It costs the Madras Coffee Company, whose estates are on the other side of Wynaad, 7 l. 10 s. a ton to convey their coffee to Tellicherry.

exactly doubles the expense of sending coffee to the coast. Their absence in the direction of the Mysore frontier, the source of supply for coolies and grain, is equally serious.

It is certainly most detrimental to the interests of the public service that every attempt of the planters to be permitted to make roads, on which their welfare depends, should be thwarted. If the roads were made by contract, under the auspices of such men as Messrs. Beaumont or Minchin, they would be completed at once, and at an immense saving of expense. While Captain Kennedy pays his labourers from Malabar at the rate of 8 annas a day, the planters get abundance of the same coast labour at 4 annas, and 1 anna 8 pie for rice. The Public Works officers have to give the wudders or road diggers 4 annas per cubic yard, while the planters get them at 3 annas. Yet the coolies, in spite of higher pay, prefer the planters to the Public Works Department as masters, and there can be no doubt that planters contracting to make roads would have the command of abundance of labour at far cheaper rates.

6. Civil Administration.

Before the planting interest in Wynaad became so important as it now is, the civil power was represented by a single native tahsildar, residing at Manantoddy. But about eight years ago it was found necessary to appoint a deputy collector to Wynaad, and in 1860 Mr. Herbert Richardson accepted the appointment. The present establishment in Wynaad is as follows:

	Per Annum.
	Rs.
Deputy Collector - - - - -	7,200
„ „ Establishment - - - - -	1,908
„ „ as Moonsiff - - - - -	408
Tahsildar - - - - -	2,400
„ Establishment - - - - -	5,868
One 1st class sub-magistrate at Vythery, with establishment -	2,076
„ „ at Goodaloor, with establishment	2,076
Two sub-magistrates as moonsiffs - - - - -	264
	264
	Rs. 22,464

The country is divided into 16 umshuns or parishes, to each of which an adigarri is appointed with a salary of 5 rupees a month. The pay is almost nominal, but the increase in consequence and position induces the leading natives of the umshuns to take the appointment of adigarri, the duties of which are to collect the revenue, and act generally under the deputy collector. The umshuns are as follows:—

North Wynaad.	South Wynaad.	South-east Wynaad.
1. Periar.	7. Koopatode.	13. Numbolycode.
2. Yeddavugah.	8. Pudady.	14. Cherangode.
3. Ellonaad.	9. Gunputty-wuttum.	15. Mumnaad.
4. Nullonaad.	10. Eddanursoor.	16. Mupenaad.
5. Tondonaad.	11. Vythery.	
6. Pornanoor.	12. Kurumbala.	

The work of the deputy collector has now become much more laborious than it is possible for one man to perform. Incessantly in the saddle for 15 days out of every month, Mr. Richardson has for five years done the work of three men as collector, as magistrate, as road maker, and as moonsiff. Few more pains-taking

taking and meritorious public servants are to be found in India, and his great powers of usefulness are increased by his well deserved popularity both amongst natives and European planters. The severity of the tax upon his powers of work is much increased by the annual attacks of fever, which the unhealthy climate of Wynaad entails.

The time has come for an increase in the official staff of this taluq, and Mr. Ballard, the Collector of Malabar, proposes that, instead of one deputy collector, a tabsildar, and two sub-magistrates, there should be a deputy collector and magistrate for each of the three divisions, with a sufficient staff, and a medical officer. The present establishment costs 22,464 rupees, and the proposed arrangement would come to 43,600 rupees, the difference being provided for by a registration fee on coolies. In the event of a new labour ordinance becoming law, a remodelling of the present official staff will be necessary.

One of the heaviest and most tiresome duties of the deputy collector is the superintendence of the collection of the land tax on coffee estates, and of the surveying operations which it entails. In February 1860 the planters agreed with Sir Charles Trevelyan to pay a tax of 2 rupees per acre on all land in bearing, on condition that the roads were vigorously proceeded with, and Sir Charles promised, on his part, that 30,000 rupees should annually be spent on roads on the plateau alone. The tax was imposed at once, and has been very regularly collected ever since, but the 30,000 rupees were not spent on the roads even in the three following years. By the new Waste Land Rules, 2 rupees an acre are charged at once, whether the land is in bearing or not. For the work of collecting this tax four surveyors are employed at 70 rupees pay and 26 batta per mensem each. Then there are draftsmen and demarcation inspectors, the whole establishment costing 939 rupees a month, or 11,268 rupees a year. The coffee tax has yielded as follows:—

	Acres.	Rupees.	
1860-61, European estates - -	4,881	9,762	
„ Native „ - -	2,375	4,990	
	7,256	14,752	yield of tax.
1864-65, European estates - -	9,865	19,731	
„ Native „ - -	4,748	9,497	
	14,613	29,228	yield of tax.

Thus the cost of collection is more than a third of the whole yield of the tax. By simply placing an export duty of such a sum per cwt. as would represent roughly 2 rupees per acre of coffee on all coffee exported from the Presidency, the same result would be attained at an infinitely smaller cost of collection. The Government would gain, while the tax would be more equal and less annoying to those upon whom it is levied. I have ascertained that the great majority of the planters would prefer this export duty to the present land tax, and I recommend it as a measure of evident expediency. It was the extreme heaviness, and not the principle of Sir Charles Trevelyan's proposed taxation, that made it so objectionable.

I cannot but feel that one of the most urgent duties of the Government in so exceptional a district as Wynaad, is that of seeing that the labouring classes are provided with medical assistance in case of sickness. It is a shame and disgrace to the Government of any country that such scenes as may often be witnessed in Wynaad should be possible. The sick and dying and dead often line the roads. Men in the last stages of fever are left to die by the roadsides, while vultures and jackals gnaw the bodies of the dead. Of course the employers of labour ought to subscribe freely to any measure calculated to alleviate these miseries, and, if they do not do so, they ought to be taxed for the purpose; but the Government should assist, and should prevent the occurrence of such horrors as are now by too common. It is these considerations which have led me to urge the Government to promote the spread of chinchona cultivation in Wynaad. ^{estates are} ~~the~~ ^{the} most pressing need is the establishment of an efficient dispensary ^{division} ~~estates are~~

South-east Wynaad is the only division that has hitherto done its duty

matter, and certainly the Government have met the proposal of the planters in a most liberal spirit. In March 1864 cholera and fever ravaged the neighbourhood of Goodaloor, and carried off many hundreds of people. It was this terrible visitation which seems to have suggested the establishment of a dispensary. The planters subscribed very liberally towards it, and the Government undertook to supply an apothecary and the medicines. The cost of the apothecary's salary is now divided between the Government and the planters. The present temporary building is well ventilated, and will hold about 20 patients, and the permanent dispensary is to be commenced as soon as the estimate is sanctioned. The establishment was opened on 1st May 1865, and, up to the end of the year, 116 in-patients had been received, of whom 94 were discharged cured, and 1,700 out-patients had been treated. These numbers show the inestimable blessing that the Goodaloor Dispensary has been to the coolies of South-east Wynaad and their families. I enclose an interesting report on the subject, which was drawn up for me by the apothecary, Mr. Wade.*

In South Wynaad the conduct of the planters, with regard to a dispensary, has not been satisfactory, and they have not yet followed the noble example of their brethren in the south-east. There is no medical man in the division, except the apothecary of the Sappers and Miners at Lackady, and, I believe, an apothecary in the employ of the South Indian Coffee Company. But there is no public supply of medicine, no gratuitous treatment, and no remedy for the crying evil which I have described. Men and women may die, just as the bullocks do, by the roadside, abandoned and uncared for.

In North Wynaad there is a medical man, Dr. Cream, at Manantoddy, who receives 150 rupees a month for attending the police and other Government employés, out of which sum he is expected to find his own medicines. But there is no dispensary for gratuitous treatment and distribution of medicines, such as exists at Goodaloor; and the planters have taken no steps for providing one. A pukka building, used for the same purpose when troops were stationed at Manantoddy, is available as a hospital.

The provisions of such a labour ordinance as that which was passed in Ceylon last October, will include the appointment of a medical man and the establishment of an efficient dispensary in all three divisions of Wynaad. There is no measure which is more needed, and which comes more legitimately within the province of the Government to promote, and none which so urgently demands immediate attention.

Labour Ordinance, and Cross Roads Bill.

(Before coffee planting commenced in Wynaad, the labouring class consisted of the Punniers, those curly headed slaves of the Chetties, who have, for the most part, preferred the old bondage under their hereditary masters to service on coffee estates. The planters, therefore, have to look abroad for their labour. Demand soon creates supply, and many thousands of coolies now annually come in from the villages of Mysore, and up the ghauts from Malabar. The wild Kurumbers also occasionally engage themselves, and on the Bramahgherry estates there are some families of very good labourers belonging to a slave caste from Coorg. But the great mass of the labour comes from Mysore and Malabar. Six years ago their pay was 3 annas a day, now the Malabar coolies get 4 annas, and 1 anna 8 pie for rice; and the Mysore coolies, 4 annas a day, and 4 annas a week besides, as a present to any man who works the whole six days. All the labour in North Wynaad is from the east. Felling is done by contract, at 20 rupees the acre, chiefly by Moplabs. The Malabar people live on rice; the Canarese of Mysore on raggee. At Culpetty, rice is now 11 rupees per 100 seers, and raggee 8 rupees 4 annas; while, five years ago, raggee was 3½ rupees the 100 seers.† Such has been the rapid rise in the price of grain.

The planters have to supply the coolies with suitable lines near their work, generally of split bamboos plastered with mud, and the health and comfort of the cooly and his family is, of course, an important consideration for the planter, as the supply of labour in a great measure depends on it. After the crop is picked, the coolies return to their own homes, to see after their crops and spend their money, of every _____ money,

as collect

432.

* See Enclosure No. 6.

† 1 seer = 2 lbs., or the weight of 80 rupees.

money, returning to Wynaad for the weeding and other work on the coffee plantations during the monsoon.

The usual method of obtaining labourers is to employ a native maistry, who engages to enlist a fixed number of coolies, and bring them to the estate from their own homes, with an agreement to work for a certain fixed sum, and the maistry receives a large sum of money in advance. There is now no efficient law to protect the planters from breaches of engagement on the part both of maistries and coolies, which frequently occur. Indeed, the present state of the law offers a strong inducement to swindling and dishonesty on the part of the labouring class, and Major Morgan, who is in charge of the Mudamullay and Seegor forests, reports that many maistries carry on a regular trade in taking advances for contracts which they have no intention of fulfilling. The reason is, that the only law bearing on this form of robbery is Act XIII., of 1859,* which provides that if a man neglecting to fulfil a contract, after receiving an advance, is convicted, he shall merely be imprisoned for three months, at the end of which time he comes out in the full enjoyment of the fruits of his dishonesty. It is just as if a man was sent to gaol for stealing a gold watch, and was presented with the watch as soon as his term of imprisonment expired. All persons guilty of fraudulent breaches of contract, whether they have received advances or not, should be obliged to fulfil their contracts after they have received such punishment as the magistrate may be empowered to inflict.

It is this unsatisfactory state of the law as it now stands which renders the enactment of a labour ordinance, clearly defining the rights and duties both of planters and coolies, a matter of urgent necessity. While such an ordinance is loudly called for by the planters, its importance is fully admitted by the Collector of Malabar, and other officials who are really conversant with the subject. The two Bengal Acts, regulating the transfer of labourers to Assam and Cachar, and the enforcement of contracts (III. of 1863, and VI. of 1865), have caused much discontent amongst the planters, and would be inapplicable to the requirements of Wynaad; but an Act embodying most of the provisions of the Ceylon ordinance would be both just and expedient.† The maistries and coolies should be obliged to fulfil their agreements, while the planters should be equally bound to pay them regularly, to provide them with suitable dwellings and with grain, to supply them with medical assistance in case of sickness, and to furnish means for them to return to their homes if they are disabled. The deputy collectors should be *ex officio* inspectors of labourers, and the medical officer of each division should report upon the health of the coolies, and the condition of their lines; but there should be no foolish and offensive titles, such as "Protector of Coolies." A slight knowledge of the history of the Spanish American colonies would have prevented any tendency to legislate with a view to setting up an official establishment intended to cause antagonism between the employer and the employed.

There should also be a provision in any labour ordinance that may be enacted, by which every labourer engaging to work on a coffee estate in Wynaad should be registered both in his own village and by the Wynaad official. Such a system would ensure the identification of the defaulters, while it would supply means of transmitting allotments to honest labourers. Even now the brinjarries sometimes request planters to act as their bankers. A small tax on this registration will, as has already been observed, furnish funds for defraying the expenses of the additional official establishment.

In addition to the labour ordinance for Wynaad, an Act is much needed by which planters may be enabled to make provision for the construction and maintenance of cross roads by a rate on all landholders in the districts through which such roads may pass. A Bill was prepared last August with this object, a copy of which is enclosed;‡ and it is to be hoped that there will be no unnecessary delay in enacting a law of the same tenor.

8. Concluding Remarks.

It is not only as a district in which English and native capital is largely invested, and many English capitalists and men of enterprise are deeply interested, that

* See Enclosure No. 7 (Act XIII. of 1859).

† See my Memorandum on Immigration to Ceylon. Enclosure to letter of 26th December 1865.

‡ See Enclosure No. 8.

that Wynaad claims attention from the Government. In addition to all this, it has, by the increased demand for grain and other supplies, and by the large employment of labour, very materially affected the prosperity of the labouring classes over a vast tract of country; yet year after year has been allowed to pass, and its most urgent requirements are still unprovided. Unless real action is taken at once, many planters will be ruined, and the discreditable sight will be presented of once cultivated land being converted into pestiferous jungle from which all fine timber will have for ever disappeared. I was deeply impressed with the necessity of adopting some such steps without delay, as I have referred to in detail under the different heads of this report, and which I will now briefly recapitulate.

The first great desideratum is the immediate completion of the three cart roads through the three divisions and down the three ghauts, and of a road from Manantoddy to the Coorg frontier. I have given reasons for strongly recommending the appointment of a special executive engineer for Wynaad, with strict orders to push on these works to completion with the utmost speed, and not to expend an anna on any other line whatever until they are completed. He should also have orders to secure the co-operation of the planters, and to get the work done by contracts with leading planters to as great an extent as possible. Unless active measures of this kind are at once adopted, a district which should have been one of the most flourishing in India will become a desert.

The requirement of next importance is an increase in official strength by the appointment of a deputy collector, and a medical man with a dispensary on the plan of that at Goodaloor, to each of the three divisions. The present tax of 2 rupees an acre should be abolished, and an export duty on coffee should be substituted. An enactment for the benefit alike of employers and employed, on the plan of the Ceylon Labour Ordinance, but also introducing a system of coolie registration, and a Cross Roads Act would complete all that is required in the way of legislation. These measures are essential not only to the prosperity, but to the very existence of the planting interest in Wynaad, and I have, therefore, considered it to be my duty to submit the impressions which I formed on the spot, and after very attentive consideration of the subject, in order that the Secretary of State in Council may be placed in full possession of the exact state of affairs in this great coffee-planting district.

Clements R. Markham.

February 1866.

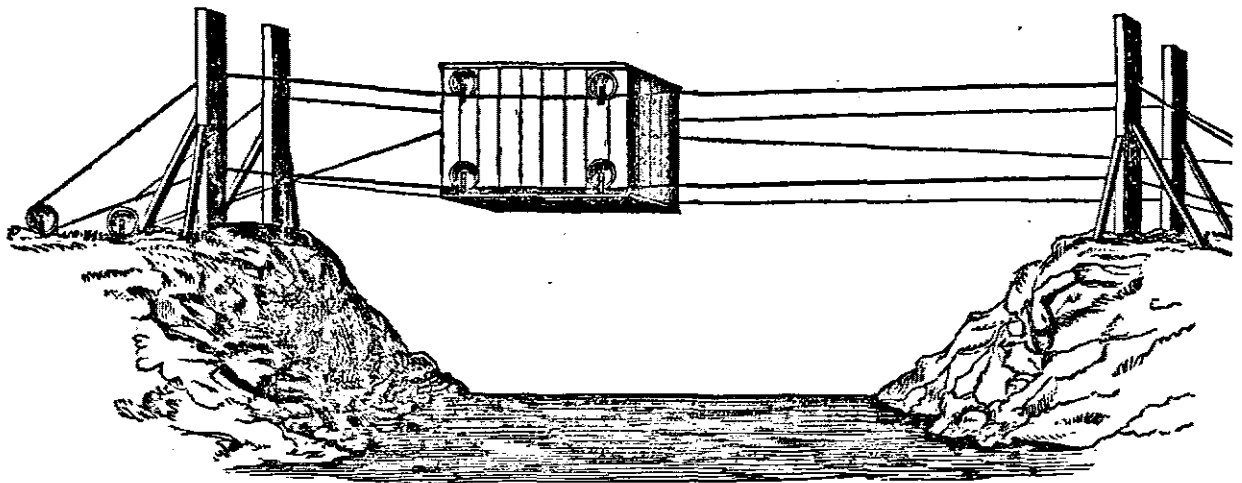
NOTE on the Jangdars, and on a new Method of crossing the Wynaad Rivers,
suggested by Mr. Beaumont.

The rivers of Wynaad are swollen to an enormous size during the monsoon, often rising 30 feet, with a breadth of 200 feet, dashing furiously along, and carrying down trees and masses of fallen boughs and roots. Communication is thus entirely cut off from one place to another, while a number of persons are drowned every year. The present method of crossing these rivers is as follows:—Three or four rattans are laid up into a rope, and stretched across, being secured to trees on either side. A bamboo raft of the rudest possible construction, called a jangdar, is secured to this rope by means of another rattan rope working on a grummet, which is swung from one bank to the other. The raft, which thus forms an obstruction, of course catches and stops all the snags and floating timber as they come down, until at last their accumulated force overcomes the resistance of the rattan cable, and the jangdar disappears. All communication is then cut off until the waters subside.

The faults of this rude contrivance are sufficiently apparent, and Sir William Denison proposed to obviate them by attaching the jangdar to a chain cable and anchor in the centre of the river, instead of a rope stretched over it. This would certainly be an improvement, and he gave orders that the plan should be tried in the river at Manantoddy. Instead of the jangdar, two canoes were provided with a platform over them, consisting of planks of angelly wood placed diagonally; but instead of using the anchor and cable, which is the real improvement, they intend to attach the raft to a chain across the river, thus retaining all the evils of the old jangdar plan.

It appeared to me, however, that the great mistake was in attempting to float a raft, in any way, on a swollen torrent bringing down uprooted trees; yet the prospect of finishing such expensive and large bridges as will be required for the more formidable rivers of Wynaad is still very remote, while it is deplorable that all communication should be annually cut off, for days together, by a mere rush of water. At first it occurred to me that a rattan bridge, renewable before every monsoon, might be thrown across without difficulty or expense; at least a single rattan cable, with a basket to travel along it conveying letters, supplies, or even passengers, would be a simple contrivance. I went into the jungle with a few coolies, and hauled out lengths of rattan from 80 to 100 feet long. The forests of the western ghauts are full of them.

But, on further reflection, I think it would be preferable, and in the end more economical, to adopt a more permanent contrivance for crossing the Wynaad rivers during the monsoon. The following plan was suggested to be by Mr. Beaumont. Four chains of galvanic wire, with a breaking strain of two or four tons, might be stretched across, and set up by windlasses on either bank, after passing over sheaves in solid upright timber supports. A light wrought-iron cage, 8 feet long by 4, might be made to travel on these cables by means of pulleys strengthened by a double bearing. Such a contrivance would carry passengers and goods with perfect ease.



Clements R. Markham.

February 1866.

Enclosures to Mr. *Markham's* Report on Wynaad.

No. 1.

CORRESPONDENCE on the subject of Chinchona Cultivation in Wynaad.

From *G. A. Ballard, Esq.*, Collector of Malabar, to Secretary, Board of Revenue.

Sir,

Calicut, 27 June 1864.

THE past season has been one of unusual sickness in Wynaad, and the great sufferings of the people have impressed me very strongly with the urgent necessity of taking all possible steps to alleviate the disastrous effects of future sickly seasons, which in all probability will occasionally recur. I believe the natives have no effective remedy for fever. It is most important to put one within their reach.

2. I do not know that this can be better done than by taking active steps to spread the Chinchona, not only in a few large plantations, but widely in the gardens and small holdings of the people.

3. The generosity of the native agriculturists can hardly be expected to go to the expense of purchasing Chinchona plants, especially at this early stage, whilst the cultivation is partly experimental; but they undoubtedly are sufficiently alive to the immense importance

tance of raising anything that will tend to ward off or alleviate fever to give attention to the culture of plants distributed to them.

4. I beg, therefore, that a supply of 500 plants in a suitable stage of growth may be sanctioned from the Government Chinchona gardens, and that a sum of 150 rupees may be allowed for the cost of baskets, coolie hire, &c. required for distribution.

Can be met from the sum of 1,000 rupees provided for "Other Items" under "I. Land Revenue, Miscellaneous," in the Budget of 1864-65.

5. Every care will be taken to distribute the young plants pretty evenly through the talooks, and as far as may be to select persons who will do them justice. Lists will be kept of the recipients, and all endeavours used by the officials to excite and keep up interest in the cultivation.

6. I advocate the gratuitous distribution now purely from a sanitary point of view. But I may add that, from the experiments already made in Wynaad, there seems no reason to doubt the success of Chinchona cultivation there, which may be looked upon as already established in one or two estates.

7. I believe, if what I have proposed is sanctioned, a great benefit will be conferred on Wynaad, and if, as I hope, Government are pleased to allow the plants, I beg early orders, so that they may be disseminated during the rains.

ORDER of the Board of Revenue.

1. Ordered to be submitted for the favourable consideration of Government.
2. The case is altogether exceptional.

ORDER of the Madras Government thereon, 27th July 1864 (No. 1,333).

1. In his letter submitted with the foregoing proceedings, the Collector of Malabar, referring to the occasional prevalence of fever in Wynaad, applies for a supply of 500 Chinchona plants for gratuitous distribution among native agriculturists in that talook, who, that officer observes, "can hardly be expected to go to the expense of purchasing the same."

2. The Government see no reason why Wynaad alone should be thus treated. It is not the only tract in which fever prevails, and is certainly richer than other feverish tracts. The price of Chinchonas, moreover, is extremely small, and when obtained by purchase there is some assurance that endeavours will be made for their being duly cared for. But were the plants distributed gratuitously, as now suggested, it is to be feared that, if not neglected, they would be destroyed by being stripped of their leaves and bark on occasions of attacks of fever. Mr. Ballard's proposal does not, therefore, seem expedient, and the Government must decline to accede to it.

From *Clements R. Markham, Esq.*, to the Secretary to Government, Revenue Department, Fort St. George; dated Bangalore, 7th February 1866.

1. WITH reference to para. 40 of my letter to your address, dated 16th January 1866, I beg in continuation to submit my conclusions respecting Chinchona cultivation in Wynaad, after a personal inspection of every part of that district.

2. Along the ridge of western ghauts overlooking Malabar, several grand masses of forest-covered mountain rise from the Wynaad plateau, and terminate in well-defined peaks at elevations of from 4,500 to 5,000 feet. The most remarkable of these mountain knots are the Velery-mulla, the Chumbra, the Koocha-mulla, and the Balasore ranges, while the Bramahgherry mountains form the boundary of Northern Wynaad. The sites best adapted for Chinchona cultivation are to be found along the more sheltered slopes of these ranges.

3. The present state of the undertaking, as regards Wynaad, is not so advanced as I had hoped; and this slow progress is due to the practice of charging money for the plants, a large per-centage of which die on the transit, instead of distributing widely and without stint. Good progress has, however, been made on a few estates, and several planters fully intend to give the cultivation a fair trial.

4. The estates where Chinchona plants are now growing are as follows:—There are a few in the Ouchterlony Valley, and on the plantations of the Moyaar Coffee Company. On the Naikenshola Estate, in Cherambody, Mr. Minchin has a nursery containing about 50 plants of *C. succirubra*, two or three feet high, as well as several trees planted out, one of which is six feet high and five inches in girth. On two estates, called the Ellem-

bellora and Panora Peaks, on the slopes of the Chumbra hills, several trees are growing most satisfactorily. The Ellembellora Peak Estate, belonging to Mr. Hinde, has an elevation of 3,500 feet, with a western aspect. Seven trees were planted out in February 1864, and they now look very healthy, with leaves untouched by the land wind. They are of the *C. succirubra* and *C. micrantha* species, and average a height of five to six feet, and a girth of five to seven inches. Mr. Hinde expects a coolie load of plants from the Neilgherries in a few days, and he intends to form a plantation on the slopes of the Chumbra mountain, above his estate, at an elevation of about 4,500 feet. The Panora Estate is at the northern end of the Chumbra range. Mr. Rossell, the owner, planted out several Chinchona trees in December 1863, at an elevation of 3,600 feet above the sea. Not a single drop of rain fell for three months after they were planted, and there are now 12 trees of *C. succirubra* and three of *C. micrantha* planted out, of which three of the former are cuttings struck on the estate. Their height is from five to seven feet, and girth six to seven inches. These two estates, as well as those of Rimington, on the other face of the Chumbra hills, are admirably adapted for Chinchona cultivation, and I look forward to very satisfactory results from the future operations of their owners. On the Anapara Estate, at the foot of the Chumbrás, Mr. Ferguson has a fine healthy tree. It is worthy of observation that the rainfall on these estates varies exactly as their aspects vary on the slopes of the Chumbra hills, with reference to the south-west monsoon. The following is a register of the rainfall kept on the two estates where Chinchona trees are growing:—

RAINFALL on the Slopes of the Chumbra Hills (Wynaad).

MONTH.	Panora Peak Estate.			Ellembellora Peak Estate.		
	1863.	1864.	1865.	1863.	1864.	1865.
	Inches.	Inches.	Inches.		Inches.	Inches.
January	1·14	0·00	0·00	—	—	0·00
February	0·02	0·00	0·00	—	—	1·33
March	5·43	0·00	0·72	—	—	0·45
April	7·49	7·16	5·08	—	4·49	7·41
May	5·53	5·30	7·98	—	8·44	9·37
June	56·66	39·28	22·54	—	40·49	26·30
July	35·84	54·68	79·60	—	69·39	97·98
August	36·42	12·67	21·59	—	16·47	25·78
September	7·00	7·77	5·42	—	10·02	5·41
October	10·43	2·32	4·88	—	5·90	7·47
November	1·14	1·60	4·77	—	0·78	4·62
December	1·19	0·45	0·75	—	0·26	0·76

At Baliapara, on the Koocha-mulla range, there are several plants; and Mr. Richardson has a row planted, in hard gravelly soil, in front of the cutcherry at Manantoddy. Finally, there are nine very fine healthy plants of *C. succirubra* on the estate of the Bramahgherry hills, belonging to the Madras Coffee Company.

5. An estate of 300 acres, on the well-wooded hills above the Tirunelly Pagoda, has been applied for by Mr. Lowry, a planter and an excellent gardener, exclusively for Chinchona cultivation. Mr. H. Gordon, who is opening largely on the Bramahgherries and in the Tirunelly Valley, has sent for 1,000 plants. Mr. Beaumont, the managing director of the South Indian Coffee Company, intends to form an experimental plantation at the foot of the Velery-mulla range, on the top and round the sides of a hill called Padapara. The plantation will cover about 20 acres, and will be sheltered partially from the south-west monsoon by the Velery-mullas, which tower above it. In short, there now seems to be a prospect of a considerable extension of Chinchona cultivation in Wynaad, and, while it will be remunerative to the planters, there will hereafter be supplies of bark for their labourers growing on the spot. I beg therefore to suggest that Mr. Richardson, the deputy collector, be supplied with all reports and proceedings on the subject of Chinchona cultivation, and especially with one of the copies of Mr. Howard's work (*Nueva Quinologia de Pavon*), so that there may be the means of reference for cultivators in Wynaad.

6. But, although the extension of this cultivation on the estates of European planters is much to be desired, it is far more important that the natives of the district should be induced to open small Chinchona gardens in every direction, and in great numbers. The people suffer fearfully from fever. The scourge has appeared exceptionally early this season, and I have myself witnessed its ravages, while I am assured that later in the year the scenes even on the public roads are loathsome and heart-rendering. Much of this fearful evil might easily be mitigated.

7. The Chetties, Nairs, and Moplahs, who occupy land in Wynaad, generally select elevated knolls for the sites of their dwellings, which are exceedingly picturesque. They are

are covered with jacks, mangoes, bastard sago palms, and plantains, and overlook the rich paddy cultivation in the flats below. In most of these sites Chinchona trees would grow well, and form another item in the garden produce of the people. The healing febrifuge would be at their doors, and the use of the bark would be extended to hundreds of slaves and coolies who now die and rot on the public roads for the want of it. The machinery for carrying out this beneficent measure is at hand. The deputy collector will gladly superintend its details, distribute plants, select the best persons as recipients, explain the importance of the measure, and endeavour to excite an interest in the cultivation. The experiment will cost little or nothing, while the good that may be derived from it is evident. An unspeakable blessing, such as only those who have witnessed the ravages of fever amongst the coolies can fully appreciate, will be conferred on the Wynaad district.

8. I venture, therefore, to recommend this measure most strongly to the favourable consideration of the Governor in Council. In the first instance, about 500 strong young Chinchona plants should be supplied to the deputy collector at Manantoddy, and a small sum should be sanctioned for the cost of coolie hire, tools, and the preparation of a nursery. He would then be in a position to propagate and distribute plants, and to take all such measures as, in his judgment, will be most conducive to the great object in view.

I have, &c.
(signed) *Clements R. Markham.*

No. 2.

MEMORANDUM on Road Works connected with Wynaad, for the Information of *C. R. Markham, Esq.*

1. STARTING from Ootakamund, a trace of a carriage road has been opened as a bridle path, and is now being widened *viâ* Pykara, to Neddiwattum, at the head of the Goodaloor ghaut. On this the only funds that have as yet been allotted is a sum of 700*l.* in the current year. In the draft budget list for 1866-67, 600*l.* have been asked for.

2. Between Neddiwattum on the Neilgherries and Goodaloor in the Wynaad a new carriage ghaut has been laid out, for which a sum of 1,300*l.* was allotted in 1864-65, and 576*l.* in the current year, in anticipation of sanction for regular plans and estimates subsequently sent in. The latter amount to 8,140*l.*, of which 2,000*l.* have been entered in the draft budget list.

3. The above works have been laid out, and are under the management of Major Farewell, executive engineer at Ootakamund, who will very gladly show Mr. Markham over them,

4. From Goodaloor eastwards 11 miles to the junction with the Mysore and Ooty road, at Tippakadoo, and westwards eight miles to Nadgany, at the head of the Karkoor ghaut, a carriage road is being opened on a trace laid out by the late Supervisor W. Campbell, Sub-Conductor of the Sappers and Miners, who died, from overwork and want of medical treatment, at Nadgany, in May 1864.* Work is now carried on, under sanctions of 5,840*l.* and 6,410*l.*, respectively, for the eastern and western sections; whereof 2,000*l.* was spent prior to the current year, in which and subsequent years an allotment of 2,000*l.* is annually made for further progress.

5. The new Karkoor ghaut was laid out by Mr. Sub-Engineer Bailey, Deputy Commissary of the Sappers and Miners, and the late Supervisor Campbell. It is now being opened on an estimate of 10,740*l.*† whereof 2,000*l.* was laid out prior to 1st May 1865, and an allotment of 1,000*l.* has been made for the current year, with permission to exceed it to any extent that the available labour and materials will admit of. Entry of 2,500*l.* for this work has been made in the Draft Budget List of 1866-67.

6. Mr. Assistant Engineer O'Shaughnessy, formerly of the Sappers and Miners, is in charge, and has drawn up the plans and estimates of the works noted in paras. 4 and 5, over which, if desired, he will be instructed to accompany Mr. Markham, as well as over those mentioned in the following para. 7, to which it is proposed to extend his supervision. The whole form one line of communication, which is expected to be open for dry weather traffic by the Christmas of 1866, in time for the bulk of the coffee crop of that year.

7. Road and bridge work is in progress from Karkoor ghaut to Areacode, the head of the navigation of the Beypore river, under the supervision of Mr. Bailey, and on traces, plans, and estimates made by him. The whole amount to 18,900*l.*, whereof 2,200*l.* is the outlay

* His widow has 9 rupees a month pension; 25 rupees as governess in a native school; four children.

† 6,000*l.* 10 feet instead of 18 feet, and masonry bridges.

outlay up to 1st May 1865, 2,150 *l.* the allotment of the current year, and 5,400 *l.* the aggregate of the entries in the Draft Budget of 1866-67.

8. Presuming Mr. Markham to take boat from Areakode to Calicut, he can thence proceed by a good carriage road to the foot of the new Tambercherry ghaut now being opened by Captain Kennedy, with the assistance of sappers, for six months of the year. 5,000 *l.* have been spent on this work in previous years, out of the estimate of 14,640 *l.* sanctioned for its completion, 5,300 *l.* is the allotment of the current year, and 5,600 *l.* the entry for 1866-67. The work at the head of the ghaut is difficult of execution beyond precedent, and will take several seasons more to complete.

9. Meanwhile the imperial line, from its head at Luckady, by Vythery, Kulputty, and Sultan's Battery, to the Mysore frontier, in the direction of Goondelpett, will be making progress. Its completion as a carriage road has only been estimated and undertaken as far as the Kulputty river as yet, at a cost aggregating 8,000 *l.*, whereof about 3,000 *l.* will represent the expenditure up to the end of the current official year, and 4,000 *l.* the amount of entries in next year's Budget List. Captain Kennedy's charge has just been extended to the Mysore frontier, and he will plan and estimate for completion of the road so far. An offer to contract for bridge and road work, made by two planters of Wynaad,* has been accepted to the extent of about 5,500 *l.* for bridges, and 1,900 *l.* for road work; but it remains to be seen whether the negotiation will end in anything.

10. Little show as yet having been made on the line noted in para 9, beyond the Kulputty river, it will be better for Mr. Markham to return from that point to Vythery, and take the Terriote road to Manantoddy. This is properly a district road, which has attained undue importance, and been made an imperial line, from local influences similar to those lately brought into play to supersede the old road, noted in para. 9, by one south of the Kulputty hill. Much money has been spent, and more has been wasted on it, but not till last year was its completion systematically planned and estimated for. But its trace is very defective, and revisions are required which will involve alterations of existing arrangements sanctioned to the extent of 6,600 *l.*, of which 1,300 *l.* were spent last year, 1,700 *l.* are allotted for the current year, and 2,000 *l.* entered in next year's Budget. Mr. Supervisor Nordmann, formerly of the Sappers and Miners, has only had charge of North Wynaad for 12 months, and, in spite of great obstacles, has done much to open the road for dry weather cart traffic.

11. The last main line of communication affecting Wynaad interests is that from the Mysore frontier at Bawally, through Manantoddy, by the Periah ghaut, to Cannanore and Tellicherry. It is of vital interest to North Wynaad, as the Karkoor ghaut line is to South-east Wynaad, and the Tambracherry ghaut line to South Wynaad, and within the writer's recollection it was the sole military and mercantile communication between Mysore and Malabar. It is an old pioneer work, and, bad as the trace and heavy as the ghaut gradients were, it was used by carts until superseded by the Perambaddy ghaut in Coorg, after the construction of which attention ceased to be paid for years even to the maintenance of its road surface. That is now in tolerable order above ghaut, and a number of minor bridges and drains have been sanctioned for its further improvement; below ghaut it is a first-class road. But it is on the ghaut itself that there is most to see, in the opening of a new trace for a cart road, the work of last season, and most creditable to Mr. Nordmann, by whom it has been laid out, under the immediate instructions of the superintending engineer. Should sufficient funds and labour be forthcoming, it is anticipated that the new ghaut may be opened for cart traffic to a width of 12 feet before the monsoon of 1866, with the most beneficial effects upon all North Wynaad.

12. Little attempt has been made in this paper to state how much has been done and how much remains to be done for the main communications of Wynaad. It is impossible to make such a statement intelligible to one who knows not the localities. Mr. Markham can only realise full information for himself and the Home authorities by actually traversing the lines indicated.

(signed) *G. W. Walker*, Lieutenant Colonel, R.E.
Superintending Engineer, 7th Division.

Superintending Engineer's Office, 7th Division,
Coonoor, 1 January 1866.

No. 3.

From some of the Proprietors and Planters of North-east Wynaad to
C. R. Markham, Esq.

Sir,

31 January 1866.

WE, the undersigned residents and planters of North-east Wynaad, having heard that you have arrived in this district with authority from Her Majesty's Government officially to

* Minchin, Beaumont.

to report on the prospects of increased colonization, the growth of coffee, and the wants of the district of the Wynaad, beg to bring under your notice the great disadvantages under which we labour, and invite you to inspect our locality personally, that you may judge of the unfortunate position in which we are placed for want of support from the Madras Government, to which we consider ourselves justly entitled, having invested our all in opening out this important district to the public.

The estates in this district alone, exclusive of native cultivation, are 31 in number, extending to about 7,000 acres, and employing on an average 4,000 coolies daily. The supplies for the sustenance of these coolies are drawn from Coorg and Mysore, the grain growing districts. Not one particle of grain is produced in Wynaad itself, and no roads, even of the humblest description, exist in this district, although the subject has been repeatedly brought under the notice of the authorities in the most urgent and respectful terms. We have ourselves also offered to aid with funds and labour if the Government will take our case into favourable consideration.

This year the grain in Mysore is reported to have failed altogether, which will necessarily cause a large influx of coolies into this part of the country, for whose subsistence large supplies of grain must be imported from Coorg, in addition to what will be required for ordinary consumption, which will also have to be brought from that district. To that important district there is no road, whilst from Mysore and Manantoddy the same obstacle exists, rendering it quite impossible, during the monsoon, to obtain any supplies without risking life and property.

Neither are we able to transport our produce to the coast without the greatest trouble and expense, amounting to more than the freight from thence to England.

The heavy tax of 4 s. per acre on the cultivation, which we are called on to pay, might lead us to expect that something would have been done on our behalf, but our disappointment was extreme when we found that all the strength of the Public Works Department was taken to South Wynaad, completely neglecting and abandoning this important district for one which we submit is not of equal consideration.

But we trust, and confidently hope, that if you will satisfy yourself personally regarding these our grievances, our case will meet with favourable consideration, affording, as it will, not only relief to us, but incalculable benefit to this district, by enabling fresh capital to be expended in opening out the country, which, as matters at present stand, is effectually checked.

In conclusion, we beg to mention that we shall be happy, by waiting on you or otherwise, to afford you any further information which you may desire on the subject.

We are, &c.

(signed)	<i>J. W. Wooldridge.</i>	<i>F. E. Richmond.</i>
	<i>Robt. Wotherspoon.</i>	<i>W. C. Dawson.</i>
	<i>P. H. Gordon.</i>	<i>H. L. Wooldridge.</i>
	<i>James C. Henderson.</i>	<i>J. Lowrie.</i>
	<i>W. Thos. Rayne.</i>	<i>J. Brown.</i>

Gentlemen,

Bangalore, 7 February 1866.

I HAVE the honour to acknowledge the receipt of your letter, dated the 31st ultimo, in which you describe the great disadvantages under which you labour, in consequence of the absence of a road in your division of the district of Wynaad. In subsequent conversations, I found that you were willing and anxious to complete the required road yourselves by contract, if the Government would enter into an agreement with you, and cause a trace to be made.

2. I have visited the districts of Wynaad, and have carefully examined their requirements, especially as regards communications, but it is desirable that you should not misunderstand my position. My official visit to India relates exclusively to questions connected with Chinchona cultivation, and I am not officially directed to report upon the coffee district of Wynaad. I intend, however, to forward a narrative, in which my impressions are recorded, for the information of the Secretary of State in Council, and I see no objection to my informing you briefly what those impressions have been with regard to your own division of the district.

3. Wynaad is now a district of very great importance, not only containing upwards of 200 coffee estates itself, but materially increasing the wealth and prosperity of the neighbouring regions, both on the side of the coast and of Mysore. It is naturally divided into three districts, each of which should be furnished with a good cart road from Malabar to Mysore, so that the produce of the estates might be sent to the coast, and grain and labour might come in from the eastward. There should also be an imperial road along the plateau from the Neilgherries to the frontier of Coorg. None of these important lines of communication are yet completed for cart traffic, most of them are in a most disgraceful condition, some are not even commenced.

4. I confine myself, in this letter, to the lines which specially interest yourselves, namely, those of North Wynaad, and I am strongly of opinion that there should be no delay in completing a good cart road up the Periar Ghaut, by Manantoddy to the Bowally bridge,

bridge, and another from the Bowally road to the frontier of Coorg. These lines are urgently required, not only for the district, but also as imperial communications.

5. Some progress has been made on the Periar Ghaut, an excellent trace has been made, and a good deal of blasting and revetment work has been completed. If steadily pushed forward, the Periar Ghaut should be open for cart traffic before the monsoon of 1867. Nothing should, in my opinion, be allowed to check the progress of this work, as the interests involved in its construction are of great importance. The old pioneer road from the head of the Periar Ghaut to the Bowally bridge might be kept in good order at very trifling cost. Yet in many places it is in bad order, the temporary bridges are unsafe, and the last three miles towards the Mysore frontier are execrable, and quite impassable for loaded bandy traffic.

6. But the road in which the planters of North-east Wynaad are specially interested, their estates being chiefly on the slopes of the Bramahgherry hills, and in the Tirunelly valley, is that from the Bowally-road to the Coorg frontier. I consider that this line of 15 miles ought to be an imperial one, as a military communication between the Neilgherries and Coorg, because it will be useful in facilitating operations in an important Government forest, because it will open up a very productive grain district, and because the existence of many valuable coffee estates depends upon it. Your estates are mainly on bamboo land, and they will require manuring, and every other advantage that human ingenuity can supply them with. If a road is not made they must all be ruined, and a region, which might have become rich and productive, will be converted into a pestiferous wilderness. The fine timber that has been felled will never appear again, but the coffee will be overgrown with useless weeds, breeding the deadliest forms of fever.

7. It is therefore of vital importance to your interests that a road should be made at once. There are no engineering difficulties, and the first mile and a half of an excellent trace is already furnished. If the Government is urged to complete this trace, I cannot doubt but that it will be pressed forward, and all then depends on your own combined action. Three bridges will be required, two of them rather serious and expensive works, and I am inclined to think that a cheaper contrivance, a plan and estimate of which I propose hereafter to send to you, if you should undertake the work, would answer the purpose during the monsoon. The banks might be sloped for cart traffic during fine weather.

8. I enclose an estimate which was made for the road from Sultan's Battery to the Mysore frontier, as some guide to you in drawing up an offer of a contract for submission to the Madras Government, and have the honour to be, gentlemen, with the warmest wishes for your success,

To the Proprietors and Planters
of North-east Wynaad.

Yours, &c.
(signed) *Clements R. Markham.*

No. 4.

From *J. Gordon, Esq.*, formerly Chairman of the Planters' Association, to
C. R. Markham, Esq.

Sir,

Ootacamund, 26 January 1866.

I much regret that I was prevented by the exigencies of business from waiting on you when you were here, as I desired to have some conversation with you about the Wynaad, to which, I was told, you were about to proceed to inspect the public works there. Before this reaches you that inspection will be over; but, nevertheless, I think it my duty, as one who took an active part for some years in bringing the wants of the Wynaad before the Government, to give you a brief history of the action of the Public Works Department in that district since I first knew it in 1859; and you will be able to judge, from what you have seen, even in this, the dry season, and with the great exertions in dressing up the old roads and opening new that has taken place within the last three months, what the state of the communications must be in the rains, and this after seven years of constant agitation of the subject by the planters (*vide* Proceedings, P. A. W. I. sent herewith), and promise after promise of attention by the Government, yes, even after money wasted in the Wynaad sufficient, as an officer high in the service admitted the other day, to have roaded it with macadamized roads, such as we asked for, from side to side. Why, then, do you find it without one cart road through it? There must have been causes remediable by the Madras Government within the last seven years, or even within the last three and a-half, since the deputation of planters had an interview with Sir W. Denison in Calicut, if the Government were sincerely in earnest and the public service not having given place to favouritism. We are all liable to have subordinates who neglect their duty, and our interests may suffer for a time, but if we maintain men in positions for which they have proved themselves grossly unfit, we accept the whole responsibility. This combined with, for years, an entire ignorance of what was the real state of the district, may be inferred from the accompanying papers as the case of the Madras Government. To this may be added, a too great inclination to accept the misrepresentations of local officers whose interest it might be to represent the planters as a set of dissatisfied grumblers without
real

real cause. You will have verified for yourself whether men whose success depended in great measure on having good passable cart communication to and from their estates, to bring in food and take out produce, were justified or not in complaining year after year that the money granted for the purpose was being wasted; but possibly you have passed through the Wynaad without being accompanied by any one to show you the public works from the planters' point of view, and I trust you will permit me to draw your attention to it again.

Somewhere about nine or ten years ago, a road was commenced from Manantoddy to Teriote, 16 miles, which in 1859 was traced on to Vithery, 14 miles further. You would pass over this line, and observe that there was little difficulty in cutting it, yet that road is still unfinished and not likely to be, reasoning by the past, for years to come. When it was first commenced it was a most useful road, as the supplies of grain brought to Manantoddy were generally sufficient for the consumption of all the estates in South as well as North Wynaad; but as cultivation extended, the north absorbed nearly all, and the south had to draw its supplies from Eastern Mysore (Goondalpet) and Lower Malabar. Now, had the Teriote road been finished in a reasonable time, say by 1862, and the work continued with energy upon the road from Vithery, *via* Sultan's Battery, to the Mysore frontier, we would have had for the money spent two cart roads through the district, connecting the principal outlet to Lower Malabar by the Tambracherry Ghaut with Mysore, *via* Manantoddy, to Bowally and Sultan's Battery to Goondalpet; and had the Tambracherry Ghaut been opened, not only in the time the planters expected, but according to the calculations of the officers in charge, carts could now have plied from Calicut to Bowally or Goondalpet, with, at the very most, a single break of 500 yards on the upper portion of the ghaut. But how is it? Last year during the monsoon, Manantoddy was cut off from all postal communication for, I believe, 16 days. The Teriote road, reported to Government as completed 18 feet wide in 1863, all but a few bridges, was impassable for even pedestrians for some time in the monsoon; and in all probability, as I said above, will not be ready for cart traffic for two years more. The road commenced from Vithery to Culputty to be continued onwards to Sultan's Battery, and reported in May 1863 (*vide* paper B.) as five miles nearly completed, and the whole to be finished by end of December, was, after it had been worked at till the following spring, abandoned, and the trace along the old road was being cut, another adopted instead, and should we again have another change of local officers, this may be abandoned and another commenced. As another specimen of the manner the work has been carried on, and the reports furnished to Government admit it, I will instance the road, after the Culputty and Teriote roads join, from Vithery to Lackady. On this piece of road gangs of people have been at work year after year since 1859, when I came to the country, up till now. You will find it reported in para. 20 of Government Order 241, of 1863 (*vide* Report Pro. P. W., 1863-64, page 50), that 3½ miles out from Lackady was completed to a width of 18 feet. Now, I was engaged to arbitrate for taking up the land for a portion of that road, and the breadth taken up was only 15 feet, and I made the road for the D. P. W. on a considerable portion of the extent, and it was only 12 feet. I also took the trouble to chain the whole distance made, which was 2½ miles. I merely quote this to show how recklessly reports were furnished, even by the superior officers, trusting to the information of the man in charge; but for an *exposé* of the manner work was performed and reports furnished to Government, I refer you to the Planters' Association Committee, and to reports and letters and speeches printed by order of the Association. What I blame the Madras Government for is, that in the face of all this they continued to put faith in the reports of their officers, and stopped criticism by refusing to supply the planters with further reports (*vide* paper F., letter No. 286, para. 3).

As I said before, great activity has taken place in the D. P. W. in Wynaad within the last three or four months, probably you know the cause why, at all events it is to be hoped it will continue even after you have left the country; should it not, I shall take steps to bring it to your notice, not on my individual authority, but supported by the local Associations, and as you must see by the accounts in their past proceedings nothing was exaggerated, it is to be hoped in the future more faith will be placed in them by those in authority than has been heretofore. So far from exaggeration have the reports of the past been, that it was my strongest objection to the proceedings of my fellow-planters in our Association, that their language was mild when it should have been strong; they "deprecat" when they should have "protested," they "called attention" to the shortcomings of public officers when, as a large influential and deeply interested body whose interests were suffering, they should have demanded their removal. Had they done so, our interests might not have suffered so long from inefficiency, or worse, and Government must have been a gainer, for work costs them double what it would have done three years ago.

My remarks in this letter are confined solely to South and North Wynaad, Vithery, and Manantoddy districts. South-east has been more fortunate in possessing for the last two years a most active local officer, and the result has been, not only a rapid opening of the roads there, but that the road from Goodaloor to Sultan's Battery partly cut as a cart road has been kept in good order. I must also beg of you to peruse the papers sent herewith, as giving a true exposition of the whole matter for the last seven years, viz., the Report of Proceedings, P. A. W. I. for years ending 1859, 1860, 1861, 1862, and 1863, also printed papers of the Association A., B., C., D., E., and F., with a pamphlet report of a meeting of South Wynaad planters at Lackady, and a speech of the retiring chairman of the Planters' Association, on 1st May 1864, describing the then state of the roads, which is endorsed by the Planters' Association ordering it to be published.

Had leisure permitted, I would have written at greater length and with more care, but there is no necessity with all these printed reports before you. Should you consider I have

trespassed too much on your time, I can only apologize by saying *my all* is embarked in Wynaad; I also have charge of very large interests there, all of which have been suffering for want of roads, and this year, when grain is scarce, we are threatened with absolute ruin on that account.

Kindly acknowledge receipt.

Yours, &c.
(signed) *J. Gordon.*

No. 5.

From *J. Ferguson, Esq.*, Remington Estate, Vithery, to *C. R. Markham, Esq.*

Dear Sir,

4 February 1866.

With reference to our conversation yesterday, the following is a brief account of my transaction with the Public Works Department here.

Early in 1863, Major Syme, Wynaad Range Officer, requested me to assist him in tracing a new line of (cart) road from Vithery to Culputty. I commenced the work in February, and in April, having no other occupation, I devoted my entire time to it, and completed the trace in that month.

Major Syme then asked me to take a contract to construct the entire road between Vithery and Sultan's Battery, about 25 miles, and also the branch to Culputty. I undertook the Culputty line first, as that was most urgently required, and, so soon as that was completed, I was to push on with the line to Sultan's Battery. Major Syme went over the trace from Vithery to Culputty several times with me, and was perfectly satisfied with it. I signed a contract for the work in June, I think, although I had commenced the work some time previously. The specification is for constructing a road 18 feet wide; drains two feet wide and $1\frac{1}{2}$ feet deep; and bridging *all* the nullahs along the line of road with sawn timber platform bridges. Subsequently I arranged with Major Syme that I was not to bridge any nullah above 25 feet in width. My work was to have been measured up and account adjusted twice a month. I worked at the road all through the heavy monsoon of 1863, put up one permanent bridge, and cut a large quantity of timber for large bridges, for which I was to get a separate contract after the rain.

In October, Mr. H. B. Smith took over charge of the district from Major Syme. Mr. Smith urged me to complete the Culputty line as rapidly as possible, so as to be able to get the line open to Sultan's Battery that season (1863-64). Mr. Smith gave me a contract for all the bridges, at Rs. 1.2 per cubic feet for timber work, and 6 rupees per cubic yard for masonry. I was also to construct "catch drains" along the entire line of road, at $2\frac{1}{2}$ annas per cubic yard. I found that the contract I had entered into with Major Syme to construct road and bridges at the rate of 1,000 rupees per mile, brought a considerable loss to me, so Mr. Smith then agreed to allow me $2\frac{1}{2}$ annas per cubic yard for earthwork on the remaining half of the road, and to pay me separately for *all* bridges, and not merely the large ones.

On 3rd December 1863, Mr. Smith verbally informed me that I must stop all work on the road, merely finishing up, ready for measurement, what I had in hand. He said such were Colonel Walker's orders. As I had then large gangs of men at work, this sudden cessation of work put me to much loss and inconvenience. I was subsequently requested to go on with the road, and, in January and February 1864, I had 2,000 people employed on the work, when I was told by Mr. Smith to do nothing more at it. My work was never once measured up. I had, in October 1864, to furnish the assistant engineer, Wynaad Range, with a statement of what money I had received, and the work was then to have been measured. I spent 4,535 rupees in labourers' wages, &c., on this work, and some 2,600 rupees in superintending, mechanics, &c. I made about four miles of road, and had portions of the remaining four miles between Culputty and Vithery partially open. Working, as I did, during heavy rains, the work was very heavy, and progressed comparatively slowly to what it would have done during the fine weather, when my contract was terminated in an unexpected manner. Had I received fair support from the Public Works Department, and been encouraged by liberal contracts, I should have been then very glad to have devoted my entire time to road making, but I have now lost all confidence in the department, and have refused to undertake any further work connected with it. Had the terms of my contract been adhered to by the Superintending Engineer, I have no hesitation in saying that there would long since have been a cart road between Lackadie, Culpetty, and Sultan's Battery.

I am, &c.
(signed) *J. J. Ferguson.*

No. 6.

No. 6.

Concise Report on the Civil Dispensary, Goodaloor, South-east Wynaad, up to 31st December 1865.

Established 1st May 1865.

In-Patients.

Remained	-	-	-	-	-	-	-
Admitted	-	-	-	-	-	-	116
Total	-	-	-	-	-	-	116
Discharged cured	-	-	-	-	-	-	94
Died	-	-	-	-	-	-	15
Remaining 31st December 1865	-	-	-	-	-	-	7

Number of out-patients treated from March to December 1865 - - 1,700

Goodaloor, a village numbering some 150 houses, and about 3,600 feet above the sea level, is situated at the foot of the Neddiwattam Ghaut, and is about 23 miles distant from Ootacamund in a south-west direction. Previous to 1860, it was a village of little or no importance, as it consisted only of about 10 huts; since then, and as coffee estates were opened in its immediate vicinity, it has been gradually rising in population, and would perhaps, at this date, have numbered more were it not for the terrible visitation of cholera in March 1844, which decimated its inhabitants, and intimidated others from making it their home, but it is now apparent that confidence has again been restored, inasmuch as fresh houses are cropping up daily. It was, I believe, the outbreak of cholera at that time which first suggested the idea of the establishment of a dispensary here, and which was very praiseworthy carried into effect by the European planters, unaided by Government in any pecuniary way as to its up-keep.

The temporary dispensary consists of three wards, well ventilated, and affords accommodation for about 20 patients. Two of these wards are allotted for male patients, while the other is reserved for females. It is centrally situated between the Goudaloor and Koror villages, on a rising plateau, quite distinct in itself, and is near enough for any emergency both by day and night.

Water is obtained for all purposes from streams which come down the hills round Goodaloor, and though in the dry weather they soon diminish in volume, yet it is not to be apprehended that there will be any scarcity of this essential.

The prevailing winds depend upon the monsoon. The winds from the north-east blow pretty steadily from October to March, when they generally become variable, and continue so till the setting in of the south-west rains, when the south-west wind prevails from June to September.

The south-west monsoon last year commenced in the early part of June, accompanied with thunder and lightning, lasting till the close of September. During the rainy season the place is almost daily enveloped in a fog or mist, which sometimes deposits a fine drizzle, and at others passes away as the day advances. It is during these months that fever in an epidemic form entirely ceases.

Of the 116 admissions into hospital of all classes, arranged as per margin, it will be seen that 47 cases were admitted under the head of fever and its sequelæ, but it must be remembered that these admissions are only the more severe cases which call for close attention, and which in no way represent the number treated as out-patients under this head, when fever rages as an epidemic, and of which hereafter.

Fever and its sequelæ	47
Diseases of the bowels	10
Diseases of the chest	10
Verueal	10
Other diseases	39
Total	116

Fever and its sequelæ	-	-	47
Diseases of the stomach and bowels	-	-	23
Diseases of the chest	-	-	5
Venereal	-	-	6
Other diseases	-	-	35
Total	-	-	116

Of the 23 diseases of the stomach and bowels, it is remarkable that most of the admissions occurred in the month of July, when the monsoon was at its height. Perhaps, undue exposure to wet, and the usual indigestible food of the coolies, were the primary causes. One case of choleraic diarrhœa occurred in this month, fairly attributable to the latter cause.

There was nothing remarkable in the other diseases here, and except a few cases of accidents which occurred while felling, and in one instance was caused by Captain Godfrey's waterwheel, all the others are to be met with and expected among a working population.

Of the 15 deaths registered, many of them were fairly attributable in the first instance to partial starvation, as they were paupers obtaining their food by begging or in some other precarious way, and who from their prostration, when no longer able to move about, laid down, thereby becoming a burden to their neighbours, and were carried up to the dispensary just to end their days, disease completing what starvation commenced, viz., death. Of the 1,700 treated as out-patients, the greater number were treated for fever, which in the early part of the year is the common disease of the place, and which is chiefly of the intermittent type, beginning mildly in February, becoming a regular epidemic after the early

rains or Mango showers in March and April, and ceasing gradually on the setting in of the south-west monsoon. It is during this time that Goodaloor becomes most unhealthy, and without a doubt it is, but I think, and am inclined to believe, that this fever season is common all over the Wynaad, and Goodaloor cannot be said to be worse than the other stations of the district, though it is represented to be. Cholera and small-pox did not prevail as an epidemic in this district last year. One case of choleraic diarrhoea has been noticed under the head of "Diseases of the stomach and bowels."

Before concluding this paper, I would beg to remark that sanitary measures are greatly needed in the village, and are carried out as far as practicable, but they are ill attended to as there are no menials about the place. There are no latrines, either private or public, so that night soil and filth accumulate, and are only removed by the inhabitants when the police is apprised of its whereabouts, and then too, with the greatest difficulty can the inhabitants be got to understand that it is injurious to health. The Municipal Act of 1865 would be a boon to this place.

(signed) *M. T. Wade,*

Assistant Apothecary, Goodaloor.

Goodaloor, 25 January 1866.

PROCEEDINGS of a Meeting of the Subscribers to the South-east Wynaad Dispensary, held at Goodaloor, on the 19th April 1865.

Present: Messrs. Minchin, Murray, Steedman, O'Shaughnessy, Higginbotham, Bennett, Browning, Sinclair, and Wade.

On the motion of Mr. Murray, seconded by Mr. Minchin, Mr. O'Shaughnessy took the Chair.

The Chairman stated the object of the meeting to be the appointment of a Committee of Management, and the formation of such rules as would be considered necessary for the working of the institution.

Mr. Minchin brought to the notice of the meeting the liberality of Government in attending so readily to the wishes of the residents, by appointing a Medical Officer to the district, in supplying medicines gratis, and in granting large sums to provide accommodation for the Medical Officer, and a temporary building for the sick. The Medical Officer is already comfortably housed, and a substantial hut has been erected, sufficiently large to accommodate about 20 patients. The institution is already working satisfactorily. Many are availing themselves of its benefits who would otherwise have to leave the district, and whose services would be lost to the country for at least some considerable period. A great amount of human suffering has been arrested, and all that remained for the residents to provide was sufficient funds for the erection of a permanent building, and the maintenance of the institution. A sum of 1,245 rupees has been already subscribed towards the amount necessary for the permanent dispensary.

Government are prepared to grant an equal amount, and they have already sanctioned 500 rupees towards it, in consideration of the accommodation to be provided for the constabulary; the amount at our disposal for the permanent building is about 3,000 rupees. Considering the decrease of labour and materials here, this amount will not be sufficient, and a further sum of at least 1,000 rupees must be collected amongst the residents or others who may feel disposed to aid this charity; this, with the equal grant from Government, will raise the amount available to 5,000 rupees, and for this sum the engineer expects to construct a good and commodious building.

An order of Government was then read, ruling that an increased allowance of 50 rupees per month to the medical officer in charge of the dispensary (recommended by the Inspector General, Medical Department) should be provided by the residents. It was put to the meeting, if the increased allowance was necessary; the meeting agreed unanimously that it was necessary. Mr. Minchin stated there could be no doubt about it, and, in order to meet this extra charge, he proposed that the subscribers be requested to increase their annual subscriptions, and that the members present use their influence in obtaining additional subscriptions, especially from the Europeans and native proprietors who have hitherto given no aid whatever towards the founding or support of the institution. This proposition was seconded by Mr. Higginbotham, and carried.

The under-mentioned subscribers then agreed to increase their annual subscriptions as follows:—

						Rs.	Rs.
Mr. Minchin, from	-	-	-	-	-	50	to 200
" Higginbotham, from	-	-	-	-	-	25	" 50
" Bennett	"	-	-	-	-	25	" 50
" Steedman	"	-	-	-	-	25	" 50
" Browning	"	-	-	-	-	25	" 50
" Sinclair	"	-	-	-	-	25	" 50
" O'Shaughnessy	"	-	-	-	-	25	" 50

A discussion then arose as to the propriety of refusing medical aid to the persons or tenants of resident non-subscribers, and the legality of charging such persons for accommodation in the dispensary, the amount so charged being credited to the funds of the institution.

Mr.

Mr. Minchin said it was much to be regretted that any of the residents should refuse aid to an institution of such immense advantage to the community, and he hoped that in a little time there would be no resident non-subscribers; and, as he understood that the subject under discussion had been referred to the Deputy Inspector General of Hospitals, he proposed that in the meantime all persons presenting themselves at the hospital in *formâ pauperis* be received without question. The proposition was seconded by Mr. Burnett, and carried.

A committee of management was then appointed of the following subscribers:—

President—J. W. Minchin, Esq.

Members.

Messrs. Steedman.
" O'Shaughnessy.
" Burnett.

Messrs. Browning.
" Sinclair.

Treasurer—A. H. Steedman, Esq.

Secretary—Mr. Wade, or the Medical Officer for the time being.

It was then resolved that the proceedings of the meeting be forwarded for information to the Collector of Malabar, who had taken the deepest interest in the establishment of the institution.

Thanks being given to the chairman, on the motion of Mr. Burnett, seconded by Mr. Browning, the meeting separated.

(signed) J. O'Shaughnessy, Chairman.

(A true copy.)

25 January 1866.

M. T. Wade,
Secretary to Committee of Management.

— No. 19. —

From the Madras Government to the Secretary of State for India.

Madras, 12 February 1867.

WE have the honour to forward for your information the accompanying Tabular Report on the number, condition, &c., of the Chinchona plants on the Neilgherries on the 31st December 1866.

Enclosure in No. 19.

REPORT on the Number, Distribution, and Condition of Chinchona Plants on the Neilgherries, on the 31st December 1866.

Species.	Botanical Names.	Commercial Names.	Number of Plants.	Value per Lb. of Dry Bark in the London Market.	REMARKS.
				s. d. s. d.	
1	C. succirubra - -	Red Bark - -	834,545	2 6 to 8 9	The total number of plants permanently planted out in the plantations remain the same as in last month, viz., 401,211.
2	C. Calisaya - - Frutex - - Vera - -	Yellow Bark - -	40,421	2 10 to 7 -	
3	C. officinalis: A. Uritusinga - B. Condamenia - S. Crispa - -				
		Original Loxa Bark -	87,509	2 10 to 7 -	The increase by propagation is 45,000, being 56,536 plants under the average of the last six months, making the total number 1,785,303.
		Select Crown Bark -	787,903	2 10 to 7 -	
		Fine Crown Bark -	4,380	2 10 to 6 -	
4	C. lancifolia - -	Pitayo Bark - -	304	1 8 to 2 10	
5	C. nitida - -	Genuine Grey Bark -	2,786	1 8 to 2 9	
6	C. species without name.	Fine Grey Bark -	8,500	1 8 to 2 10	
7	C. micrantha - -	Grey Bark - -	15,141	1 8 to 2 9	
8	C. Peruviana - -	Finest Grey Bark -	3,389	1 8 to 2 10	
9	C. Pahudiana - -	Unknown - -	425	Unknown.	
TOTAL Number of Plants - - -			1,785,303		

TABLE II.

MEMORANDUM of the Growth of Eleven Plants of *C. succirubra*, planted on the Second Denison Plantation, at Neddivuttum, on 30th August 1862.

Number of Plants.	Height in Inches when Planted on the 30 August 1862.	Height in Inches on the 30 November 1862.	Height in Inches on the 31 December 1862.	Growth during December 1862.	By whom Planted.	REMARKS.
1	23	144½	145½	1	Sir W. Denison.	TABLE II. exhibits the growth of 11 plants of <i>C. Succirubra</i> , planted out by Sir W. Denison, and other gentlemen at Neddivuttum on the 30th August 1862. The average growth of these plants during the month is ¾ths of an inch, or half of an inch above the growth of last month.
2	16½	129	130	1		
3	19	135	135½	½		
4	15	121½	123½	2		
5	27	148½	148½	—		
6	20	112½	114	1½	J. W. Breeks, Esq.	One of the two plants cut down on the 20th of March 1863 for the bark submitted to Mr. Howard for analysis, has made strong shoots of 91½ inches in height, giving the growth of 1½ inches during the month.
7	20	128½	129	½	Dr. Sanderson.	
8	18	135	135	—	J. D. Sim, Esq.	
9	20	138½	138½	—	Lieutenant McLeod.	
10	20	145	146	1	P. Grant, Esq.	
11	18	128	128½	½	Plant cut down for bark.	
12	—	90	91½	1½		

TABLE III.

SHOWING the Height of Twelve Plants of *C. officinalis* planted on the Dodabetta Plantation at Ootacamund, on the 30th September 1863.

Number of Plants.	Height in Inches when Planted on the 30 September 1863.	Height in Inches on the 30 November 1863.	Height in Inches on the 31 December 1863.	Growth in Inches during December 1863.	REMARKS.
1	19	124	124½	½	The 12 plants of <i>C. officinalis</i> (a shrubby species) on the Dodabetta Plantation, gives an average growth of ¾ths of an inch, or about one inch under the growth of last month.
2	14½	111	111½	½	
3	28	126	126½	½	
4	22	121½	121½	½	
5	21½	131½	132	½	
6	28	134½	135	½	Several plants of <i>C. Succirubra</i> , <i>Calisaya</i> , and <i>Condamenia</i> have furnished a good supply of fine seeds, which are now germinating freely.
7	22½	121½	121½	½	
8	21½	122	122½	½	
9	21½	129	129½	½	
10	19½	125½	125½	½	
11	24	128	128½	½	
12	24	130½	131	½	

TABLE IV.
REGISTER of Chinchona Plants Distributed.

NAMES.	STATIONS.	Number of Plants.	REMARKS.
Mr. F. N. Maltby -	Trevandrum -	16	The total number of plants issued to the public is 125,747, or the same as was shown last month.
Dr. Junghun -	Java -	56	
Mr. A. R. Lascelles -	Ootacamund -	12	
Mr. M. Anderson -	Jamaica -	2	The season has been very favourable; the rains having continued to the end of the month; our plants are conse- quently very healthy and robust for this season of the year.
Dr. Wiche -	Bombay -	10	
Dr. T. Anderson -	Calcutta -	554	
Dr. Jamieson -	Saharanpore -	107	
Professor Lees -	Calcutta -	547	
Rajah of Travancore -	Travancore -	521	
Major Morgan -	Ootacamund -	1,534	
Mr. E. T. Fitzgerald -	Calcutta -	558	
Mr. J. W. B. Money -	- ditto -	1,369	
Mr. W. Bourne -	- ditto -	532	
Captain Cox -	Wynaad -	6	
Mr. Hollock -	- ditto -	2	
Mr. T. Sheffield -	Ootacamund -	12	
Dr. F. Day -	Cochin -	100	
Mr. Brown -	Tellicherry -	12	
Mr. J. Hall -	Ootacamund -	156	
Mr. T. Knop -	- ditto -	18	
Captain Lees -	Bengal -	386	
Mr. W. H. Rayne -	Manantoddy -	424	
Rev. Sayers -	Ootacamund -	1,018	
Mr. A. Frend -	- ditto -	512	
Mr. Hollock -	- ditto -	1	
Mr. J. Pierie -	Seegoor -	12	
Colonel Scott -	Ootacamund -	1,236	
Mr. Berend -	Cachar -	275	
Rev. J. Hunter -	Coonoor -	12	
Mr. T. Mullaly -	- ditto -	212	
Mr. W. H. Stanes -	- ditto -	1,226	
Colonel R. Cooper -	Kotagherry -	12	
Mr. F. Cockburn -	- ditto -	12	
Colonel Woodfall -	Coonoor -	12	
Mr. C. Anderson -	- ditto -	24	
Colonel Angelo -	Ootacamund -	12	
Rev. E. Laseron -	- ditto -	12	
Captain R. N. Taylor -	Coorg -	96	
Major W. Agnew -	Assam -	139	
Mr. V. H. Levinge -	Madura -	12	
Chief Commissioner of -	Nagpore -	28	
Mr. Fletcher -	Ootacamund -	524	
Gool Muhomed -	- ditto -	20	
General McCleverty -	New Zealand -	23	
Mr. W. Robinson -	Kotagherry -	330	
Mr. Clarke -	Wynaad -	12	
Mr. H. R. Dawson -	Seegoor -	12	
Captain Mann -	Coorg -	48	
Mr. E. Roberts -	- ditto -	530	
Mr. H. Russell -	Wynaad -	52	
Reverend Wait -	Coonoor -	2	
Collector of Belgaum -	Belgaum -	28	
Collector of Honore -	Honore -	28	
Dr. Ross -	- ditto -	15	
His Excellency the Governor -	Bombay -	158	
Mr. H. Hinde -	Wynaad -	12	
Mr. E. B. Thomas -	Coonoor -	874	
Rajah of Poonganoor -	Poonganoor -	12	
Major Grant -	Wellington -	226	
Messrs. Thomson, Shaw & Co. -	Poonganoor -	28	
Mr. J. H. Trinson -	- ditto -	31	
Dr. Muller -	Melbourne -	28	
Mr. Tyrrell -	Mysore -	12	
Dr. Sayers -	Vellore -	12	
Major C. P. Taylor -	Ootacamund -	5,250	
Doctor Wilson -	- ditto -	6	
Mr. Schnarrie -	- ditto -	15,000	
Captain Fuller -	Coonoor -	417	
Dr. Drummond -	Ootacamund -	224	
Captain Jennings -	- ditto -	1,756	

TABLE IV.—Register of Chinchona Plants Distributed—*continued*.

NAMES.	STATIONS.	Number of Plants.	REMARKS.
Lieut. H. B. Montmorency - - -	Bangalore - - -	6	
Mr. McHutchin - - -	Ootacamund - - -	3	
Colonel Molesworth - - -	- ditto - - -	6	
Mr. C. Gray - - -	Coonoor - - -	12	
" H. B. Liddell - - -	Ootacamund - - -	12	
" Minchin - - -	Wynaad - - -	1,600	
His Excellency the Governor - - -	Vizagapatam - - -	35	
Mr. R. F. Phillips - - -	Kotagherry - - -	1,117	
Colonel Cooke - - -	- ditto - - -	24	
Mr. G. F. Glasson - - -	Wynaad - - -	1,000	
Dr. Macpherson - - -	Mercara - - -	400	
Mr. W. H. Kerr - - -	Coorg - - -	8,100	
" S. James - - -	Ootacamund - - -	1,000	
Colonel Whish - - -	Bengal - - -	82	
Mr. K. Mair - - -	Calcutta - - -	1,180	
" W. Shakespear - - -	- ditto - - -	61	
" E. E. Meakin - - -	- ditto - - -	168	
" C. Ackland - - -	- ditto - - -	150	
" K. McIver - - -	- ditto - - -	124	
" Havelock - - -	Ootacamund - - -	12	
" H. deFacien - - -	Kartairy - - -	6,821	
Major Sweet - - -	- ditto - - -	910	
Captain Campbell - - -	Bangalore - - -	6	
Royal Gardens - - -	Mauritius - - -	36	
Honourable W. R. Arbuthnot - - -	Wynaad - - -	93	
Mr. H. Maxwell - - -	Bombay - - -	50	
Mrs. C. Smith - - -	Wynaad - - -	316	
Captain Meekly - - -	Wellington - - -	200	
Mr. Walsh - - -	Salem - - -	150	
His Excellency the Governor General - - -	Java - - -	175	
Captain Richardson - - -	Kulhatty - - -	509	
Rajah of Poonganoor - - -	Poonganoor - - -	24	
His Excellency the Governor - - -	Madras - - -	24	
Mr. J. W. B. Money - - -	Ootacamund - - -	25,018	
Captain Mitcheson - - -	- ditto - - -	50	
Mr. R. H. Elliot - - -	Munjerabad - - -	276	
His Excellency the Governor General - - -	Goa - - -	252	
Colonel Phayre - - -	Rangoon - - -	152	
Mr. Ryal - - -	Kotagherry - - -	24	
" J. Gordon - - -	Coonoor - - -	6,325	
" J. Rohde - - -	Neddivuttum - - -	11,689	
" S. Pital - - -	Mauritius - - -	28	
" J. Horne - - -	- ditto - - -	36	
Mr. Edward Cremary - - -	Reunion - - -	36	
For the French Government - - -	Algiers - - -	51	
Mr. J. B. Norton - - -	Shevaroy - - -	45	
" Mackay - - -	Punjab - - -	50	
" W. Forsyth - - -	Central Provinces - - -	50	
Colonel Cadell - - -	Coorg - - -	169	
Mr. J. L. Browning - - -	Wynaad - - -	62	
" H. Leeds - - -	Burmah - - -	4	
Maloo Sait - - -	- ditto - - -	112	
Mr. A. D. Brown - - -	Dimbutty - - -	6	
" J. C. Misquith - - -	Ootacamund - - -	53	
" J. L. Transen - - -	Coonoor - - -	300	
Captain Fitzgerald - - -	Calcutta - - -	8	
Mr. Macpherson - - -	Ootacamund - - -	150	
Major Travers - - -	- ditto - - -	12	
Mr. S. Prager - - -	Vithry, Wynaad - - -	5,000	
Reverend Wenger - - -	Kaity, Ootacamund - - -	2	
Mr. G. W. Forbes - - -	Dhurmsala - - -	55	
Major C. Elliot - - -	Mysore - - -	5,044	
Collector of Salem - - -	Salem - - -	100	
" of Tinnevely - - -	Tinnevely - - -	500	
Colonel Denison - - -	Ootacamund - - -	550	
Conservator of Forests - - -	- ditto - - -	50	
Mr. J. Ouchterlony - - -	- ditto - - -	300	
" R. C. Elwin - - -	Neddivuttum - - -	12,510	
TOTAL Number of Plants - - -		1,25,747	

Ootacamund, 26 January 1867.

(signed) W. G. McIvor,
Supt. Govt. Chinchona Plantations.

ORDER of the Madras Government, 5 February 1867.

1. Ordered to be forwarded to the Secretary of State, to the Supreme Government, and to the other Governments in India; also to the Superintendent Chinchona Plantations in Java.

(signed) *W. Hudleston,*
Secretary to Government.

— No. 2). —

From the Secretary of State for India to the Government of Madras.

My Lord,

India Office, 16 April 1867.

Para. 1. I HAVE received and considered in Council your despatches in the Revenue Department, of the dates and numbers noted in the * margin,* on the subject of Chinchona cultivation.

* December 23 (No. 61), 1866.
January 22 (No. 4), 1867.
February 12 (No. 9), 1867.
February 12 (No. 11), 1867.

2. The annual Report for 1865-66 is particularly satisfactory, both as regards the progress that has been made in extending this cultivation, and the very important advance that has been effected in our knowledge of the correct method of treating the plants, so as to secure the largest per-centage of febrifuge virtue in the bark. The investigations of Mr. Broughton, acting in unison with the Superintendent, will, without doubt, lead to further valuable discoveries.

3. The recent analysis of Mr. Howard shows that the Crown barks grown in India are of very great value, and it is gratifying to find that they are not only propagated with great rapidity, but that they are remarkably hardy, and grow as well upon grass as upon forest lands. Plantations of this species may thus be formed without the necessity for felling and clearing the forest; and their growth on the grassy hill slopes will, as you observe, have the important effect of counterbalancing, to some extent, the extensive felling which has been going on in the hill districts of late years.

4. I regret the failure of the seeds collected in the Pitayo district of New Granada, and I fully concur with you in the importance of adding this hardy species to those now cultivated in India. The analysis of pieces of bark, which were received with the seeds, showed a larger yield of quinine than has been found in any other species growing wild in the South American forests. The best means of obtaining another supply of Pitayo barks seeds will receive my consideration.

5. I perceive with satisfaction that steps have been taken by your Government to introduce Chinchona cultivation as widely as possible in the districts where it is likely to be successful; and I look forward with interest to the receipt of reports showing the results of the experiments that have been commenced in the hills of Ganjam, at Popanassum, in Tinnevely, on the Nalla-Malla range in Kurnool, on the Shervaroy hills, in South Canara and in Wynaad. In the latter district, which is periodically desolated by fever, the extensive growth of Chinchona trees round the native houses would be a result of very great importance.

6. I do not find amongst the papers accompanying your despatch now under reply, that any steps have been taken to extend the cultivation of Chinchona trees on the Pulney hills; and I shall also be glad to receive, from time to time, through the Resident at Trivanderum, some account of the Chinchona plantation which has been formed at Peerméde, through the enlightened liberality of his Highness the Maharajah of Travancore.

7. Some confusion has been caused by varying the nomenclature of the three varieties of *C. officinalis*, now growing on the Neilgherries, as you will perceive by Mr. Howard's report of his last analysis. It should be pointed out to the superintendent that the nomenclature suggested in Mr. Markham's memorandum, dated 18th February 1863, ought to be adhered to for the present, in order to avoid confusion.

8. It appears from Mr. McIvor's Report that the experiment of employing convict labour on the Dodabetta and Neddiwattum plantations, has been attended with very satisfactory results. While easing, to some extent, the great demand on the free labour market, it has been of great advantage to the Government plantations; and it also seems to have had an excellent effect upon the convicts themselves.

I have, &c.
(signed) *Stafford H. Northcote.*

— No. 21. —

From the Government of Madras to the Secretary of State for India.

Madras, 12 February 1867.

1. We deem it right to bring to your notice the accompanying letter from Mr. McIvor, Superintendent of the Chinchona plantations, and our order thereon, as well as the previous order to which Mr. McIvor's letter refers.

2. We have, as you are aware, treated Mr. McIvor with uniform consideration and confidence, and have entrusted him with a larger measure of uncontrolled authority than is conceded to any other officer in his position. We have also, on repeated occasions, recorded our full appreciation of his services. It is with much concern, therefore, that we have felt ourselves compelled, on this occasion, to censure him for a style of address which is inconsistent with the respect and subordination due on the part of every public servant.

3. We deem it right to explain to your Lordship that the letters to which Mr. McIvor refers as having been addressed to our Chief Secretary by subordinates in the Chinchona establishment, and by him, contrary to rule, submitted to Government, were simply transferred by Mr. Arbuthnot to the Revenue Department of the Secretariat for disposal, in the ordinary course of business.

Enclosure 1, in No. 21.

From the Superintendent Government Chinchona Plantations to the Secretary to Government, Revenue Department, Fort Saint George, Ootacamund, 6th March 1866.

1. In compliance with the Order of Government, under date the 20th February 1866, I directed Mr. Charles Dawson to proceed and take charge of the Neddivuttum Chinchona Plantation; at the same time directing Lieutenant Nichol to hand over charge and to remove to the Pykara Plantation* until the 31st instant, intimating that after that date his services would be no longer required.

* *Vide* Copies A. and B.

2. Mr. Dawson, in compliance with these instructions, proceeded to Neddivuttum to take charge of the plantations on the 1st instant, Lieutenant Nichol refused to give over charge, and treated Mr. Dawson with the utmost contempt, forwarding to me letters Nos. 10, 11, 12, and 13, in which he declines to make over charge of the plantations. On the receipt of these letters, I again addressed Lieutenant Nichol, informing him that in consequence of his refusal to obey orders he was dismissed from the 1st instant,† and I directed Mr. Dawson to assume charge of the plantations, and at the same time I sent out my accountant to audit Lieutenant Nichol's advance accounts. At this time Lieutenant Nichol would appear to have been acting like a raving maniac, exerting himself to subvert all authority among the establishment. On the accountant presenting himself to audit the advance accounts, Lieutenant Nichol received him in a most boisterous and threatening manner, slamming the door in his face, and ordering him "off," and would not permit the accountant to have access to the books, or give any information; Lieutenant Nichol having now it appears removed the books and all papers from the plantations, and deposited them somewhere in Ootacamund, *vide* original letter No. 15.

† *Vide* Copy C. and G. O. Circular, No. 646, dated 9 June 1867, No. 1,899.

3. The assistant superintendents on each plantation receive certain sums as an advance, in order to purchase grain, advance to labourers, &c. These advances are not entered in our accounts, but remain as outstanding against the assistant superintendents, who are responsible for them until refunded, or proper vouchers produced for the expenditure. Lieutenant Nichol has been frequently called upon to produce these vouchers or to refund the

the money, but invariably excused himself for the time; and I have now reason to believe that a sum of about 500 rupees has been misapplied.

4. The malignity shown by Lieutenant Nichol, combined with the recklessness of his actions, render it dangerous for him to remain on the premises, especially as the buildings are thatched, and might be fired in a moment. I have, therefore, directed Mr. Dawson to apply for the aid of the magistrate to enable him to carry out the orders of Government.

5. Under these circumstances, I have the honour to solicit the favour of being instructed how to proceed in this matter.

From Lieutenant *G. Nichol* to the Chief Secretary to Government, Madras, Neddivuttum,
6th March 1866.

1. As the superintendent of the Government Gardens, Ootacamund, has informed me that he does not communicate with you direct, I take the liberty of laying the enclosed letter before you, together with my reply thereto, and I respectfully beg of you, in justice and humanity, to lay them before his Excellency the Governor in Council, with a view at least that I may be allowed a month, or even 15 days, to arrange for the removal of my family from Neddivuttum.

2. If Mr. McIvor has any just cause of complaint against me, or if I have committed myself in any way, he can obtain legal redress in the ordinary course, but I cannot believe that Government will allow him to traduce my character, and to behave so harshly and unjustly towards me as he has done.

3. It suits my circumstances to continue in my present temporary employment for a little time, and if Mr. McIvor cannot show sufficient cause why I should be removed from it, I beg to submit that it is unfair to thrust myself and family out of what we have come to consider a home, on such short notice and in such a violent manner, for no other reason than that I am aware of than to make room for a member of a family with which Mr. McIvor is connected in several trading and planting operations.

ORDER of the Government of Madras, 26th March 1866.

1. THE Governor in Council observes that Lieutenant Nichol has, by refusing to obey the orders of the head of his department, and retaining the accounts of the plantation, placed it out of the power of Government to entertain his complaint, or to retain him in his present position.

2. He must vacate the house at Neddivuttum, if he has not already quitted it, by the 31st instant, and forthwith give up the accounts, which are the property of Government. If he fails to comply with these requisitions, Mr. McIvor must apply to the magistracy for assistance.

3. As to the audit of Lieutenant Nichol's accounts, the Government consider it desirable that this should be performed by a special officer, as a very serious charge is brought against Lieutenant Nichol, who on his part denies that his accounts have ever been audited. Under such circumstances the appointment of an independent officer will prevent dispute, and the Government resolve to instruct the Collector of Coimbatore to depute his special assistant for the duty, or if he be not immediately available, to undertake it himself, the result being reported to Government.

4. The Governor in Council remarks that, although the power of appointing his own assistants has been left to Mr. McIvor, because he is most competent to judge of their qualifications for the peculiar work entrusted to him, this does not vest him with the power of summarily dismissing any assistant not expressly engaged on trial. Once permanently appointed, an assistant becomes entitled to the same privileges as other public servants. In the present instance, the Government have nothing on their records to show on what terms Lieutenant Nichol was engaged, and in what respects, prior to the present occurrences, he has failed to give satisfaction, and they did not suppose that their approval of Mr. Dawson's appointment to Neddivuttum would involve more than an exchange of appointments.

5. Looking at the position of his assistants, the Government consider it desirable that in future Mr. McIvor should nominate them on probation for a period not exceeding 12 months, during which they will of course draw full pay. If Mr. McIvor is satisfied that they possess the requisite qualifications for their important situations, he will then submit their names to Government for confirmation, and the sanction of Government will be necessary for their removal at any future period.

Enclosure 2; in No. 21.

From the Collector of Coimbatore to the Acting Secretary to Government, Revenue Department, Fort Saint George, Ootacamund, 12th June 1866.

1. REFERRING to the proceedings of Government, Revenue Department, and their Order

* Packet No. 1, containing an Account Book and Receipts numbered from 1 to 8.

Packet No. 2, containing a statement of accounts audited by Messrs. O'Shaughnessy and Dawson.

2nd. Lieutenant Nichol's accounts sent in on April 19.

3rd. A letter from Mr. McIvor objecting to certain charges in the above accounts, and forwarding a revised account.

Packet No. 3, containing Lieutenant Nichol's account as made out by him on May 25, with letter of the same date.

Packet No. 4, Memorandum of Lieutenant Nichol's accounts.

thereon, dated 26th March 1866, I beg to inform you that Mr. Hannington was called on to audit Lieutenant Nichol's accounts in connection with the Neddiwattam Chinchona plantation, of which he has been in charge for some time past, as Assistant Superintendent. Mr. Hannington's original letter with the marginally* noted enclosures, is forwarded for the information of Government. He has been unable to come to any satisfactory conclusion regarding the accounts, and I confess that my endeavours to do so have been equally unsuccessful.

2. The accounts to be audited extend from August 1864 to February 1866, a period of no less than 22 months.

3. Lieutenant Nichol produced two statements of accounts A. and B., embracing this period. Statement A. extending from August 1864 to December 1865, shows a balance against Lieutenant Nichol of Rs. 604. 3. 6.; Statement B. embracing the months of January, February, and March 1866, exhibits a sum of Rs. 512. 5. 0. in favour of Lieutenant Nichol. For the 22 months, Lieutenant Nichol and Mr. McIvor's accounts stand as follows:—

(Fractions of rupees are excluded.)

	Dr.	Cr.
Lieutenant Nichol	5,842	5,842
Mr. McIvor	6,183	3,689

Showing a balance of 2,494 rupees still unaccounted for by Lieutenant Nichol; of this balance, 886 rupees are due for tools supplied to Lieutenant Nichol. They are most probably on the estate, and therefore giving him credit for their value, there still remains a balance of 1,608 rupees according to Mr. McIvor's account, due by him. Most of the items contained in Statements A. and B., sent by Lieutenant Nichol, are disputed by Mr. McIvor, and as Lieutenant Nichol is unable to produce detailed vouchers for some items, and no vouchers at all for others (*vide* his letter in packet No. 3), it is difficult to arrive at a satisfactory conclusion regarding them. I believe that Messrs. O'Shaughnessy and Dawson, with Mr. McIvor's sanction, audited Lieutenant Nichol's accounts up to December 1865; but if any credit is to be placed in Mr. McIvor's remarks in his letter, dated the 3rd ultimo, No. 2, to Mr. Hannington, their audit must have been of a very perfunctory kind. In paragraph 3 of the said letter, when writing of one of the items, he says that he is called on to pass a charge of 643 rupees, whilst the value of the work performed amounts to Rs. 92. 8. 0. only. How this could have happened it is difficult to imagine, unless Messrs. O'Shaughnessy and Dawson simply looked to the vouchers placed before them without ascertaining whether the work alluded to had been done. Considering the lengthened period over which the accounts extend, from August 1864 to March 1866, the general want of vouchers for the expenditure incurred, the unsatisfactory nature of the vouchers produced, and the extraordinary manner in which the accounts seem to have been kept, if it can really be said that they have been kept, I confess that it seems useless to expect to be able to arrive at any satisfactory conclusion regarding the expenditure. I should therefore recommend that Mr. McIvor be directed to draw up a statement, after examination of work done on the Neddiwattam Plantation, and consultation with Mr. C. R. Dawson, now in charge of the said plantation, for submission to Government, on consideration of which the case may be finally disposed of.*

4. Lieutenant Nichol is an invalid officer, of limited means, and if held responsible for money not satisfactorily accounted for, he would be unable, I fear, to make it good, as no security, I believe, was taken from him on his assuming charge of the plantation.

From the Collector of Coimbatore to the Acting Secretary to Government, Revenue Department, Fort Saint George, Coimbatore, 30 June 1866.

With reference to my letter of the 22nd instant, No. 54, I beg to forward the marginally* noted letter, with enclosure, for the information of Government.

* From J. C. Hannington, Esq.,
Special Assistant Collector of Ootacamund, dated 29 June 1866.

-- From

From Lieutenant *G. Nichol*, Bombay Invalid Establishment, to the Secretary to Government, Revenue Department, Madras, Ootacamund, 4th April 1866.

1. I HAVE the honour to acknowledge the receipt of your communication of the 26th ultimo, Nos. 414, 415, 416, of the proceedings of the Madras Government (last evening) in compliance with which I have this day lodged in the Office of the Special Assistant Collector, all the books I had belonging to Government; but I wish to be allowed to retain such papers as will be necessary for me to support my position.

2. As I had previously to the receipt of your communication again addressed the Chief Secretary to Government, I now have the honour of enclosing you a copy of my letter.

From Lieutenant *G. Nichol*, Bombay Invalids, to the Acting Chief Secretary to Government, Madras, Chittoor, 16th July 1866.

I HAVE the honour to request you will be good enough to let me know the decision of Government on the report furnished by Mr. Hannington, with respect to my accounts with the Neddiwattam Estates, that I may be enabled to recover the sum due me previous to my departure for Europe on medical certificate.

ORDER of the Madras Government, 20 July 1866.

1. THE state of things reported in the above papers is very unsatisfactory, and Mr. McIvor is greatly to blame for allowing the accounts of any of his subordinates to be kept in so inefficient a manner, but under the circumstances stated by the Collector and Mr. Hannington, it appears to Government that the audit made by Messrs. O'Shaughnessy and Dawson of the accounts to the end of 1865 must be accepted, for the Government find nothing to support Mr. McIvor's assertion in his letter of 3rd May that "they admitted unvouched charges on a supposition that vouchers for a portion or the whole of the balance unaccounted for may be yet forthcoming."

2. So far as the Government see, Messrs. O'Shaughnessy and Dawson admitted only vouched charges, and merely stated their opinion that from the difficulty experienced in finding the vouchers which supported the admitted items, it seemed not improbable that vouchers for a portion, if not the whole of the unadmitted charges, might yet be forthcoming, a supposition which the facts of the case seem certainly to have warranted.

3. Accepting then this settlement of accounts to the end of 1865, and giving Lieutenant Nichol credit for his pay for February and March, which it would seem has not been disbursed, Mr. Hannington finds a balance in Lieutenant Nichol's favour of Rs. 320. 5. 6., at the close of the account, which sum the Government desire may be paid, in full and final adjustment. (Not March only as stated in Mr. Hannington's letter apparently by a clerical omission.)

4. They see nothing to be gained by calling on Mr. McIvor to prepare a statement of the value of work done on the plantation. It is far too late now to expect any satisfactory result from such a measure.

5. Mr. McIvor will be directed to submit a report to Government of the arrangements maintained by him for checking the expenditure of Government funds by his subordinates, showing the dates up to which the accounts of the several plantations have been passed, and what unaccounted balance is outstanding against each of his subordinates entrusted with the expenditure of funds.

(signed) *W. Hudleston*,
Acting Secretary to Government.

Enclosure 3, in No. 21.

From *J. C. Hannington*, Esq., Special Assistant Collector, Ootacamund, to *P. Grant*, Esq., Collector of Coimbatore.

Sir,

Ootacamund, 15 June 1866.

I REGRET much that such a delay has occurred in returning answer to your letter of 11th April 1866, No. 123, directing me to audit Lieutenant Nichol's account, but this delay was unavoidable, owing at first to the difficulty of obtaining any accounts whatever to audit; secondly, as you are aware, by an attempt to elucidate the accounts audited by Messrs. O'Shaughnessy and Dawson, and lastly (for a few days) by my being engaged in demarcation of lands on the Koondahs at the time Lieutenant Nichol sent in his final statement.

All endeavour to make examination of the accounts extending from August 1864 to January 1866, appears to be hopeless. In fact in Lieutenant Nichol's letter (enclosed), he states that he is unable to go into the details of the first item in this account, owing to some of the vouchers having been destroyed, others handed back to the parties who paid the monies due by them, &c.

These accounts were, however, apparently audited by Messrs. O'Shaughnessy and Dawson, who were, I believe, accepted by Mr. Melvor and Lieutenant Nichol, mutually, as examiners of the accounts, and a statement is made out by them, dated 9th January 1866, which is also signed and apparently so accepted by the acting pay clerk, T. Nárráin-sawmy.

Whether this statement is to be accepted, it is not for me to determine, but it is to be presumed that the gentlemen who made the examination of the accounts examined them with due care, and it is certainly as reliable a statement as from the present state of the accounts it is possible to procure.

I confess my utter inability to audit this statement, and I therefore perforce take it as the basis of my examination. From this account it would appear that the amount to be accounted for by Lieutenant Nichol, on the 9th January, is Rs. 604. 3. 6.; and referring to his account sent in, I find further advances made to him in February of 110 rupees and 120 rupees, making a total to be accounted for of Rs. 834. 3. 6., and I can find against this sum receipts in Lieutenant Nichol's favour for Rs. 904. 0. 9., to which, if we add his pay for the month of March, 250 rupees, makes a total of Rs. 1,154. 0. 9., leaving a balance in his favour of Rs. 320. 5. 6.

Although I can find no receipts or vouchers for items six, seven, and eight, amounting to Rs. 189. 15. 6., yet I believe these items will not be disputed by Mr. Melvor, as I fancy the articles are forthcoming.

If this be allowed, Lieutenant Nichol's account appears to me to be correct within two rupees, which were, I am informed, expended in the purchase of books for the estate.

Mr. Melvor disputes the correctness of item No. 1, but I found that the amount is credited (as entered in my statement) by the pay clerk, in a sort of account book.

The whole of the accounts (if they may be termed by that name) are in the most extraordinary state of confusion.

Lieutenant Nichol does not appear to have had the slightest knowledge of how accounts should be kept, and I consider that Mr. Melvor, as superintendent of the estate, cannot be held to be entirely blameless in having allowed the accounts to be thus kept by his assistant, without a personal examination for a period of nearly 18 months.

Whether Lieutenant Nichol is responsible to Mr. Melvor or to the Government, is a question which of course I shall not enter upon. Lest you should consider from the very unsatisfactory nature of this report, that I have not examined into the matter with care, I request you will be good enough to glance at the books, documents, and papers, which were handed over to me to examine, so that you may be personally satisfied of the difficulty of arriving at any conclusion on the matter.

With regard to the form in which I have drawn up the memorandum of account, I have made it as clear as possible, though whether in correct form or not, I am unable to say, as I have never been engaged in such a matter before.

I have, &c.
(signed) *J. C. Hannington*,
Special Assistant Collector.

Enclosure 4, in No. 21.

From the Superintendent Government Chinchona Plantations to the Secretary to Government, Revenue Department, Fort Saint George, Ootacamund, 29th September 1866.

1. I HAVE the honour, with reference to the order of Government in the Revenue Department, dated 20th July 1866, respectfully to state that this order, together with other proceedings of Government, has given rise to an impression among my subordinates that the Government is disinclined to maintain my authority.

2. This impression has arisen from undeserved lenity having been shown to persons under me who have been guilty of neglect of duty and grave insubordination, and from the Government having, in connection therewith, passed upon me unmerited censure. These proceedings of Government tend to render my subordinates not only useless as assistants to me, but make them an absolute impediment to the progress of the important national undertaking with which I am charged. Feeling confident that it is not the desire of Government to aim a fatal blow at the progress of a great undertaking fast ripening to success, I appeal with confidence for the support of my authority to the absolute and uncontrolled degree, for which I specially stipulated at the commencement of this undertaking.

3. Independent

3. Independent of the Government support necessarily conceded to each head of a department, and especially of a new department, I had special claims on the Government for

the support of my authority. In the beginning, when asked to undertake the conduct of this very arduous, and at one time very hazardous undertaking, I foresaw the great dangers to which such a delicate cultivation was exposed in case of neglect or disobedience of orders. At that time I had on two occasions been placed in the very painful position of being compelled either to oppose the orders of Government as to the treatment of the plants, or to carry them out to the destruction of this important experiment. I foresaw that success must depend on strict obedience to my orders, and also that failure, although brought about by causes beyond my control, would ruin my reputation. I therefore took the liberty to request, as per letters noted in the margin, that if the Government had not full confidence to entrust this undertaking to me with an establishment "selected by myself and entirely under my orders," they should relieve me from all connection with it; but that if I were entrusted with the undertaking, Government should guarantee me from all interference. The Government in reply under date 3rd July 1861, No. 1,328, resolved "to entrust this important experiment entirely to me, giving me full and entire control over all the operations, and holding me responsible for my conduct of them." This order being reiterated in several subsequent proceedings of Government, and confirmed by the Right Honourable the Secretary of State for India, as per extracts from despatches in the margin, I understood that my authority was to be absolute, that I was to select, appoint, and dismiss my subordinates, as I alone saw fit, and that I was guaranteed from all interference so long as I produced satisfactory results.

4. With these specific stipulations I accepted the responsibility, and set to work resolutely to overcome every physical difficulty. My endeavours, guided by long local experience, and by my horticultural knowledge, combined with unremitting personal attention and supervision of my subordinates' treatment of the plants, has now been rewarded by eminent success, so far that quinine bark is henceforth for ever secure as one of the products of India.

5. The first instance in which the Government passed unpunished neglect of duty and insubordination, was in the case of Mr. Lyall, a gardener engaged in Europe. I suspended him, and reported the fact to Government, who ordered his dismissal, but released him from the penalty attached, by special agreement, to his negligence and insubordination. Government probably only meant not to be hard upon the man, and never contemplated the evil effect on my authority. The Secretary of State in his letter to the Madras Government, No. 2 of the 16th January 1863, expressed his opinion that "the lenity with which Mr. Lyall had been treated was wholly undeserved." The consequence of this lenity was that Mr. Lyall, who was engaged in the neighbourhood, strongly represented to my subordinates that Government would take a favourable view of any neglect or insubordination towards me.

6. Notwithstanding this, my power of summary dismissal kept my subordinates in order from 1862 to 1865. During that time many were dismissed by me without any reference to, or interference by, Government. I was thus able to keep up a constant pressure to unremitting attention by my subordinates. I know that men do not like to be pressed to constant attention; but I had received these powers on condition of being successful; and this constant pressure is indispensable to success when, as in Chinchona cultivation, the neglect of a day may sacrifice the labour of years.

7. In August 1865, on visiting the Neddivuttum plantations, I found that Lieutenant Nichol, my subordinate in charge, appointed by me on the express terms that neglect or inattention would be visited by dismissal, had by carelessness in transplanting lost upwards of 12,000 Chinchona plants out of 16,000 he had planted out that month. I found on inquiry he had been drinking for some time, so as to incapacitate him for his duties. Previously he had also neglected important operations which led to the gaol works at Neddivuttum being removed by me from under his care. This continued charge of the plantations thus became incompatible with success, and I recommended his resigning. This he would not do. During September and October 1865, I found further neglect, that he had misapplied money, and that his presence was more and more detrimental to the success of the plantation, so that on the 28th of February 1866, I conveyed to him the usual monthly notice that his services would be dispensed with.

Recorded in G. O. 16th April 1861, No. 855.

From Mr. McIvor to Secretary to Government, Revenue Department, dated 30 March 1861.

Paragraph 19. I most respectfully beg to solicit that your honourable Government may be pleased to place this experiment entirely under my management, or release me from any connection with it.

Recorded in G. O. Revenue Department, 3rd July 1861, No. 1328.

From Mr. McIvor to Secretary to Government, Revenue Department, dated 9th May 1861, No. 59.

Paragraph 8. That no misunderstanding may occur on this subject in future, I most respectfully beg to explain that, by the Orders of Government above noted, I understand that the experiment on the Neilgherries is placed entirely under my control; that I am left to the free exercise of my own judgment in my endeavours to obtain the results desired by Government, and that the establishment is to be selected by my myself and placed entirely under my orders, otherwise I could not work it to advantage; also that I have the guarantee of Government from interference, so long as I produce results unequalled elsewhere.

From the Right Honourable the Secretary of State for India to his Excellency the Right Honourable the Governor General of India in Council, dated India Office, 10th June 1862.

Paragraph 4. I have, therefore, only to repeat the expression of my desire that no interference should take place on the part of Dr. Anderson, or any one else, with the prosecution of the experiments now proceeding in the Madras Presidency under the charge of Mr. McIvor.

From the Right Honourable the Secretary of State for India to his Excellency the Honourable the Governor in Council, Fort Saint George, dated India Office, London, 14th September 1861, No. 46.

Paragraph 2. Your resolution to entrust Mr. McIvor with "full and entire control over the operations," is in accordance with the opinion expressed in my Despatch of 2nd July last.

8. Lieutenant Nichol thereupon thought proper to state, in a letter to the Chief Secretary to Government, that he was dismissed "for no other reason, than that he was aware of, than to make room for a member of a family with which Mr. McIvor is connected in several trading and planting operations." The fact is, that I never had a trading transaction with a member of the family he referred to, and Lieutenant Nichol could not, therefore, be aware of anything of the kind.

9. But this is not the worst feature of the case; Lieutenant Nichol submits that letter direct to the Honourable A. J. Arbuthnot, Chief Secretary to Government, who, contrary to the rules of the service, receives that communication, which I, as the head of the department, had never seen. Lieutenant Nichol was the more inexcusable in this, because he was informed by me that the Chief Secretary was not my channel of communication with the Government, and that I would be happy to forward any remonstrance he wished to submit through the Revenue Secretary. Taking no notice of these instructions, and apparently calculating on a supposed hostile feeling towards myself on the part of Mr. Arbuthnot, in consequence of a misunderstanding which arose in 1864 between that gentleman and myself respecting the Pycara avenue, Lieutenant Nichol appealed direct to Mr. Arbuthnot, boasting to my other subordinates that by the influence of Mr. Arbuthnot he would "smash" me with the Government. Not only does Lieutenant Nichol thus knowingly appeal to the wrong authority, but Mr. Arbuthnot, without informing me, lays the complaint direct before Government, and Government passes an order on this irregular and *ex parte* complaint, thus irregularly submitted to them, and which I had never seen, and that without any inquiry of me, against whom the complaint was made. The Governor in Council by this order, under date the 26th March 1866, permits Lieutenant Nichol to occupy the house until the 31st March 1866, absolves him from accounting to me for public money he had from me, and directs him to give up the accounts, &c. The consequence is, that my subordinates have since acted as if satisfied that any irregular appeal against me would be received, and favourably considered by Government.

10. Immediately on receipt of the above order, Mr. Dawson, who by the previous attention and care in carrying out orders, had obtained Lieutenant Nichol's position, at once became most negligent and insubordinate. Soon after Mr. Smith, an East Indian, whom I had engaged as an overseer, when in a state of destitution, and subsequently appointed in charge of the Dodabetta plantation, replied to my fault-finding by directly threatening me with Mr. Arbuthnot, upon which I summarily dismissed him. He, in imitation of Lieutenant Nichol, at once appealed to Government, through the Chief Secretary, and I have been called upon to give my reasons for his dismissal. The Government Order of the 26th March 1866 thus proved an incitement to insubordination, and thus led to my orders being no longer strictly and actively followed.

11. But what is still more important, this Order, together with that of the 20th July 1866, now under reply, expressly alters the whole nature of my authority, and puts my relation with my subordinates on a totally different footing from what I expressly stipulated when I undertook the responsibility of success.

12. In paragraph 4 of the Order of the 26th March 1866, the Government concede to me the right of engaging my assistants, but states that I have not the power of summarily dismissing any one not expressly engaged on trial. There can be no system of discipline without the power of administering both rewards and punishments; and to concede to me the one and withhold the other can only lead to confusion and irregularity.

13. In paragraph 5, I am directed to nominate my "assistants on probation for a period not exceeding 12 months, and if I am satisfied that they possess the requisite qualifications for their important situations; I am then to submit their names to Government for confirmation." On account of the smallness of the salaries, we can get none but men who failed in other employment. It is with such men that, by unremitting supervision, by absolute power exercised in kindness, and by keeping up a steady pressure, I have achieved great results. By these personal exertions I have been able to dispense with all but the only qualification available, and consequently the only one I have hitherto required, viz., constant attention, and the strict, active, and literal carrying out of my orders in the manner shown by my own hands.

14. But if I am to be deprived of the means of securing this constant attention and obedience, by having the absolute power I originally stipulated for curtailed, then qualification will be required, which I do not know where to obtain. In that case, therefore, I must respectfully leave the nominations, as well as the dismissals, with the Government.

15. When I originally undertook the responsibility for the success of Chinchona cultivation in India, I stipulated for, and Government conceded to me, an absolute power over my establishment, which may be unusual in other departments.

16. The Orders of Government above noticed not only destroy this absolute power, but puts me on a worse footing than other heads of departments.

17. The success of Chinchona cultivation in India is now complete, and therefore Government may desire to get rid of the former anomaly, by putting my department on the same

same footing as others. If so, I can have no objection, as Government thereby declares the success achieved, to attain which the anomaly was created.

18. I would only remark, that although the success of Chinchona cultivation in India is now complete, many of the Government Chinchona plantations are as yet far from complete as remunerative undertakings. Under the new system I must at once decline all further responsibility for their successful remunerative completion. My responsibility before was as anomalous as the means at my disposal. My absolute undertaking for success must cease with my absolute powers.

19. I will still continue to give to the nominees of Government the most judicious orders. I will still show them with my own hands how the work ought to be done, and I will ex-postulate for neglect and disobedience of orders, and will report the same to Government; but for loss caused meanwhile by neglect and disobedience, I must be absolved from all blame. I consider it a duty respectfully to inform Government beforehand that the progress of the plantations will fall off, and that great losses of plants will be incurred under the new system. In Chinchona cultivation, the neglect of a day may destroy the labour of years, and my assistants have, since the order of 26th March 1866, been more neglectful than before. As an instance, I have all along given the strictest orders that in weeding, the earth and weeds shall not be heaped against the trees, as natives always try to do. Only last week, on visiting Dodabetta, and also Neddivuttum, I found my assistants had neglected to see to this. About 42,000 well-grown trees had been thus treated, and the bark on all was beginning to ferment; many fine trees were dead, another three days would have killed the whole of them. I at once personally supervised their being cleared, and now probably the loss will not be severe. Had my former power of summary dismissal, without appeal, continued, my assistants would probably have avoided neglect, which they knew involved such serious consequences.

20. At the same time, on the Neddivuttum plantations, my specific orders to clear the shading and weeds from around the newly planted-out plants had been entirely neglected, and the loss from this neglect is very serious, not being less than 20,000 to 25,000 plants. In this way, and in many others, labour may be destroyed by a day's neglect, which has occupied the department years in producing.

21. Having now submitted to Government the injustice done me in the sudden curtailing of my powers without first requiring any explanation, and the injury which has and must accrue to that Government plantations therefrom, I have the honour to ask for specific orders to myself and to my subordinates on that subject.

22. If my former absolute power is to be maintained, my subordinates must be informed that their appointment and dismissal is solely in my hands, and that my decision is to be without appeal, and that Government will neither receive complaints against me, nor call on me to answer them. If this, which would be my power in a private estate, be conceded, I have no objection to take on myself the same absolute responsibility for the successful remunerative completion of that Government plantations, as I before took for the success of Chinchona cultivation in India.

23. If, on the other hand, my department is to be put on the same footing as other departments, I beg that both my subordinates and I may be specifically informed of our respective duties, rights, and remedies. In that case, I must decline all further responsibility, except that of carrying out the duties which shall be assigned me by Government, and reporting any deficiency in my subordinates.

ORDER of the Madras Government, 15 January 1867.

1. THE Government have perused this letter with much surprise.

2. When the Chinchona experiment was first undertaken, it was right and necessary that Mr. McIvor should possess absolute power over his subordinates, who were few in number, and were probably drawn from a class with whom the fear of immediate and summary punishment was the most powerful incentive to care and exertion. In the interval of six years which has since elapsed, the establishment has been largely increased, and the permanent character which the undertaking has assumed, ought to render employment on it as assistants attractive to a superior class of men. These, however, must be fairly paid for their work, and duly protected from arbitrary authority, or they will not willingly enter the department.

3. The order of which Mr. McIvor complains, not only leaves the selection of assistants entirely to him, but gives him a year for their trial, during which period he can dispense with their services at his own will, if they misbehave, or even if they seem unlikely to give satisfaction. These powers are ample, and instead of being less, as he supposes, are greater than those accorded to the head of any department of the public service. Every public servant in other departments can appeal to the Governor in Council against dismissal, while Mr. McIvor can dismiss any employé—not being a confirmed assistant—without reference to higher authority. The power which Mr. McIvor desires is greater than that accorded to the Governor in Council, whose decisions are open to appeal to Her Majesty's Secretary of State.

4. The order in question does not debar Mr. McIvor from suspending an assistant for misconduct, until the orders of Government on his case are received, and he need be under no apprehension that he will not be supported in the just exercise of his authority.

5. The Government are surprised that Mr. McIvor should lend credence to the reports and suppositions of his subordinates. But he must distinctly understand that such communications as that now under notice, cannot be tolerated from any subordinate. He has been treated with uniform consideration and the utmost confidence, but the Government cannot allow their authority to be thus called in question, and the acts of their Chief Secretary impugned in so reprehensible and unfounded a manner.

(signed) *J. D. Sim,*
Secretary to Government.

— No. 22. —

From the Secretary of State for India to the Government of Madras.

My Lord,

India Office, 8 May 1867.

1. I HAVE had under consideration in Council your Despatch in the Revenue Department, dated 12th February 1867, bringing to my notice a letter from the Superintendent of Chinchona Plantations and the order which has been passed upon it by your Government.

2. I concur in the propriety of the censure which you have passed upon Mr. McIvor for the unbecoming and insubordinate style in which the letter in question is written.

3. The papers forwarded with your Despatch refer to the position of assistants employed by Mr. McIvor on the Chinchona plantations; and I perceive that you have now decided that the superintendent is to nominate them on probation for a period not exceeding 12 months, after which time they are to be confirmed on his recommendation, and the sanction of your Government will be necessary for their removal at any future period.

4. It should be understood that the power of selecting his subordinates, of dismissing them during the probationary year, and of suspension at any subsequent time, is entrusted to the superintendent; and that the reservation of the power of dismissal until confirmed by Government, is not intended to curtail the superintendent's authority, but merely to protect his subordinates from what might often be its arbitrary exercise.

5. Under this arrangement I trust that Mr. McIvor will, by strictly conforming to these instructions, continue to deserve the expressions of approval which his zeal, energy, and intelligence have frequently called forth, both from my predecessors and from your Excellency's Government.

I have, &c.
(signed) *Stafford H. Northcote.*

— No. 23. —

From the Government of Madras to the Secretary of State for India.

Madras, 25 March 1867.

Proceedings, dated
19th March 1867,
Nos. 302—304.

1. WITH reference to paragraph 2 of your Despatch, dated 16th January 1867, No. 3, we have the honour to forward further tabular reports, as far as they have been printed, of the therapeutic effects of the Chinchona alkaloids received from England for experimental trial, together with a preliminary report of the proceedings of the commissioners appointed to test the efficacy of these alkaloids. This report is very satisfactory and encouraging.

2. Adverting to paragraph 3 of your Despatch, dated 17th October 1866,
No.

No. 34, we forward also papers noted in the margin, explaining the circumstances under which we approved the selection of Ootacamund as the head quarters for Mr. Broughton, the Quinologist engaged to conduct the experiments in bark analysis, &c. You will observe that suitable provision has been made for the required laboratory, and that Mr. Broughton is to be provided with residence in the same building, charging him a moderate rent for it.

Proceedings, dated 14th January 1867, Nos. 228, 229.
 " " 12th February " " 134, 135.
 " " 23rd " " " 319, 320.

Enclosure 1 in No. 23.

From the President and Members of the Chinchona Commission to the Secretary to Government, Revenue Department, Fort St. George, Madras, 28th February 1867.

1. WITH reference to the Order of Government, dated 29th March 1866, we have the honour to report that the printing of the tabulated results of the experimental use of Chinchona alkaloids has occasioned some delay in the submission of a progress report. A considerable number of the tables, however have now been printed, so as to enable us to estimate, with tolerable precision, the therapeutical effects of the several alkaloids; and, as our President will have no other opportunity of recording his views as to the usefulness of these medicines, the Members of the Commission have decided to conclude now a preliminary report of their proceedings, leaving their more detailed observations to follow when the results of the experiments still in progress are more fully known.

2. In the tabular statements, already printed and laid before the Commission, minute particulars in regard to 1,145 cases of paroxysmal fevers treated either by Chinchonine, Chinchonidine, and Quinidine, have been registered. These fevers have occurred mostly at stations notably malarious, such as at Goodaloor in the Wynaad, Sumblepoor and Russelcondah in the Northern Circars, the Godavery jungles, Mysore, Cochin, and Labuan, and may, therefore, be regarded as fair average types of the forms of paroxysmal fever to be met with in the malarious districts of Southern India.

3. A larger number of cases have been treated up to date, but the Returns have not yet been received, or, if received, are not out of the printer's hands, so that the results must be considered in detail hereafter.

4. With regard to the 1,145 cases of fever referred to, it will suffice to note that they were treated by the alkaloids, as follows:—

By sulphate of Chinchonina	-	-	-	-	-	410
Ditto Chinchonidine	-	-	-	-	-	359
Ditto Quinidine	-	-	-	-	-	376

The doses and mode of administration varied a good deal. Some medical officers used large doses of from 15 to 20 grains; others, medium doses of from 8 to 10 grains, and some small doses of from 2 to 5 grains. As a general rule, the Members of the Commission are of opinion that the experiments were most successful when medium doses were employed, that is, the cases of fever in which 8 or 10 grains of alkaloid were administered in a single dose daily, appeared to recover more expeditiously than where larger or smaller quantities were employed. Large doses of Chinchonine, Chinchonidine, and Quinidine produce effects very similar to those of quinine. Disagreeable noises in the head, singing in the ears, deafness, and giddiness are the more noticeable of the symptoms produced by all of the Chinchona alkaloids. Vomiting, nausea, and purging also are occasionally noted to follow their use. On the other hand, small or moderate doses produce none of these peculiar effects, while they improve the appetite, strengthen the digestion, and, in many cases, appear to have a marked effect in reducing the size of congested spleens.

5. The alkaloids were exhibited successfully, that is, with the result of a rapid cessation febrile paroxysms in a very large proportion of the cases. Out of the 1,145 cases recorded, four deaths occurred, and all these took place at Goodaloor, in Wynaad. Dr. Keess observes of them, that the fever was complicated either with Pneumonia or Diarrhoea, and that a great proportion of his patients were half-starved, emaciated persons, completely prostrated by the malarious influences surrounding them.

In addition to the cases ending fatally, it is recorded that the alkaloids failed more or less to arrest febrile paroxysms in twenty-seven persons—a proportion a little in excess of two per cent. of the total cases treated.

6. In regard to these failures, it must be noted that they occurred chiefly in the practice of gentlemen who tried the alkaloids, not in recent attacks of fever, but in patients whose systems were chronically poisoned by malaria. Thus, Mr. Walters, of the 4th Regiment N.I., Secunderabad, records of many of his cases, that they had been from one to three or four months suffering from fever before he used the alkaloids, and that in some of them

quinine failed just as much as quinidine, Chinchonine, or Chinchonidine had done. Mr. Chipperfield explains the probable cause of failure in his Report (Appendix III). In recent attacks of uncomplicated paroxysmal fever, the new alkaloids appeared to most of the medical officers using them, and to the Members of the Commission, to be quite as efficacious in the curing of fevers, as quinine. On this subject, however, it is impossible to speak with precision, until the results of treatment with the chemically pure di-sulphate of quinine, as supplied by Messrs. Howards, have been tabulated in the form used for recording the treatment by the other alkaloids. Instructions have been issued to the gentlemen engaged in the experiment to do this, and the returns, when received, will afford most valuable data whereby to compare the relative therapeutical effects of the several alkaloids.

7. The evidence, so far as it has come before the Commission, does not go to show any particular superiority of one alkaloid over another.

The sulphate of quinidine is, perhaps, the one regarding which there is the least difference of opinion as to its merits. All three are undoubtedly anti-periodic, and capable of controlling paroxysmal fevers. The sulphate of Chinchonine in *large* doses perhaps causes more unpleasant symptoms than the others; but on this point further evidence is still wanting to enable the Commission to offer a positive opinion. As regards the general and practical question at issue, we agree with Dr. Keese in thinking that all three alkaloids are, equally with quinine, capable of controlling paroxysmal fevers. Dr. Keese's experience led him to conclude that a 10-grain dose of either salt, would check or postpone the febrile paroxysm in a considerable number of cases, while very few patients required more than a second 10-grain dose to subdue the disease for the time being.

Other observers have employed large quantities of the several drugs; but it is by no means clear to the Commission, that the quantities exhibited were, in all cases, necessary to check the fever. As regards this part of the inquiry, it is intended to institute a distinct series of experiments for the more accurate comparison of the value of the several alkaloids, when contrasted with quinine, or with each other.

8. The main conclusion which the Members of the Commission have derived from the data before them, is that the alkaloids hitherto but little valued in medicine, are scarcely, if at all, inferior as therapeutical agents to quinine.

What the exact differences may be in their physiological and therapeutical action, is a question the answering of which may fitly be deferred until more data have been collected in reference to the new alkaloids. The differences, however, will most likely be found to be of degree, rather than of kind, and practically, so far as the wants of India are concerned, it will be just as well that the locally grown barks yield a large proportion of one alkaloid as of another.

9. So impressed are we of the value of these hitherto despised alkaloids, that the Members of the Commission are unanimous in considering that, in the public service of this country, they may very advantageously be substituted in part for quinine. If three pounds of Chinchonine can be obtained at the price of one pound of quinine, we consider that a great public good would result from the purchase of the larger quantity, as it would enable the officers of the medical department to benefit a much larger number of the population than they can now afford to treat by prescribing quinine. Arrangements will be made by Dr. Mackenzie to include in the next medical indent on the home Government a requisition for suitable quantities of each alkaloid.

10. We beg to direct attention to the tables, &c., in the Appendix. It gives us much pleasure in testifying that the experiments conducted by Dr. Keese at Goodaloor have been most carefully recorded.

11. Mr. Cornish, Secretary to the Principal Inspector General, in addition to his other duties, voluntarily undertook those of Secretary to the Commission. For the mode in which these duties have been carried out, the Members of the Commission feel that their best acknowledgments are due to that gentleman.

APPENDIX I.

TABLE 1.—Showing the Results of Treatment of Paroxysmal Fevers by Chinchonine.

NAME OF MEDICAL OFFICER.	DISTRICT.	Type of Fever.			Results.		REMARKS.
		Quotidian.	Tertian.	Remittent.	Cured.	Failed.	
1 Dr. Keess and Mr. Wade.	Goodaloor (Wynnad)	170	19	1	188	2*	Large doses produced disagreeable effects; usual dose from 5 to 10 grains daily. Dr. Keess considers the remedy equal to quinine.
2 „ Foy - -	Sumbulpore - -	31	6	1	38	-	Chiefly 5-grain doses from two to three times daily.
3 „ Cleveland - -	Mysore - - -	38	4	2	43	1†	Dose grains v--xx three times a day. Chinchonism resulted when large doses were given.
4 „ Whitton - -	Cochin - - -	25	3	-	28	-	Single doses of 10 grains in a few. In most 5 grains before expected paroxysm. Remedy appeared to effect rapid reduction of spleen in several cases.
5 „ White, 1st Royals	Kamptee - - -	6	-	-	6	-	Small doses of 2 or 3 grains used. Had larger doses been given the cure would have been more rapid.
6 „ Dougall - -	Northern Circars -	14	2	-	16	-	Given in v, x, and xv grain doses.
7 „ Chipperfield -	Madras - - -	8	2	1	8	3*	In unsuccessful cases the remedy was not continued more than two days, small doses only given.
8 „ Heard - -	Shemogah, Mysore -	2	-	-	2	-	
9 „ Walters - -	Secunderabad - -	18	3	-	17	4	Nearly all Dr. Walters' cases had been a long time under other treatment before Chinchonine was resorted to. They were obstinate intermittents, and did not yield readily to treatment. Many of the cases had "burning of the hands and feet."
10 „ Fitzgerald -	Labuan - - -	14	5	-	19	-	Small doses used which rendered treatment protracted.
11 „ Houston - -	Upper Godavery -	35	-	-	35	-	Chinchonism resulted when repeated large doses were used. Dr. Houston notes that, in the majority of cases, the pulse rose soon after taking a dose of the medicine.
TOTAL - - -		361	44	6	400	10	
		410			410		

* Both died from exhaustion. † Complicated with pneumonia—the remedy was discontinued.

TABLE 2.—Showing the Results of Treatment of Paroxysmal Fevers by Chinchonidine.

NAME OF MEDICAL OFFICER.	DISTRICT.	Type of Fever.			Results.		REMARKS.
		Quotidian.	Tertian.	Remittent.	Cured.	Failed.	
1 Dr. Keess and Mr. Wade.	Goodaloor - -	137	16	1	154	-	These cases were nearly all cured by from one to two doses of 5 or 10 grains.
2 „ Foy - - -	Sumbulpore - -	36	5	-	39	2	In the cases of failure quinine was resorted to, but the result is not stated; generally used in 5-grain doses.
3 „ Cleveland - -	Mysore - - -	24	10	4	38	-	Doses varied from v to xx grains; small doses in a few cases with less immediate effect.
4 „ Whitton - -	Cochin - - -	28	4	-	31	1*	
5 „ White, 1st Royals	Kamptee - - -	-	-	-	-	-	
6 „ Dougall - -	Northern Circars -	12	3	-	15	-	Given in v, x, and xv grains doses, considered by Dr. Dougall quite equal to quinine.
7 „ Chipperfield -	Madras - - -	8	3	1	7	5	Three of the unsuccessful cases were only one day under treatment. See Dr. Chipperfield's remarks in Appendix III.
8 „ Heard - -	Shemogah, Mysore -	11	-	-	10	1	Grains 8 to 10 before paroxysm.
9 „ Walters - -	Secunderabad - -	7	1	-	5	3	As regards three cases the results are so vaguely given, that it cannot be said whether the remedy failed or not.
10 „ Fitzgerald -	Labuan - - -	18	4	-	22	-	Grains 3, 6, 8, before paroxysm.
11 „ Houston - -	Upper Godavery -	25	1	-	25	1†	
		306	47	6	346	13	Three doubtful.
TOTAL - - -		359			359		

* Fever became remittent. † Complicated with Neuralgia and Paralysis.

TABLE 3.—Showing the Results of Treatment of Paroxysmal Fevers of Quinidine.

NAME OF MEDICAL OFFICER.	DISTRICT.	Type of Fever.			Results.		REMARKS.
		Quotidian.	Tertian.	Remittent.	Cured.	Failed.	
1 Dr. Keess and Mr. Wade.	Goodaloor - -	140	11	2	151	2	Both died, one from exhaustion, one from dysentery.
2 „ Foy - - -	Sumbulpore - -	37	6	-	42	1	Chiefly 5-grain doses, three times a day.
3 „ Cleveland - -	Mysore - - -	28	5	-	33	-	Two cases result not known. From 2 to 20 grain doses, three times daily.
4 „ Whitton - - -	Cochin - - -	26	3	-	29	-	Chiefly 5-grain doses. In a few cases 10 grains.
5 „ White, 1st Royals	Kamptee - - -	9	-	-	9	-	Three and 5 grain doses, three times daily.
6 „ Dougall - - -	Northern Circars -	11	4	-	14	1*	Five, 12, and 15 grain doses.
7 „ Chipperfield - -	Mudras - - -	8	-	-	8	-	Five-grain doses, thrice daily.
8 „ Heard - - -	Shemogah, Mysore -	12	-	2	12	2†	Doses 2, 4, 5, and 6 grains.
9 „ Walters - - -	Secunderabad - -	15	1	-	14	2	Some of the cases were successfully treated hypodermically. The two failures cured by quinine.
10 „ Fitzgerald - -	Labuan - - -	9	1	-	10	-	Six-grain doses.
11 „ Houston - - -	Upper Godavery -	10	1	1	12	-	Grains v to x, twice a day.
12 „ Henderson - -	Bangalore - - -	15	-	-	12	3‡	
13 „ Oswald - - -	- ditto - - -	17	2	-	19	-	Grains v to x, chiefly in interval of fever.
		837	34	5	865	11	
Total - - -		876			876		

* In this case paroxysm only mitigated, not checked.

† These were cases of remittent fever, and remained under treatment though benefited.

‡ Remedy omitted on account of diarrhoea.

APPENDIX II.

REPORT on the Chinchona Alkaloids.

1. In obedience to instructions received from the head of the medical department, I proceeded to Goodaloor, South-east Wynaad, and started the alkaloids experiment on the 1st June 1866.

2. When I arrived at Goodaloor, fever was prevailing to a great extent, both there and in the adjoining coffee estates. Owing to the great rush of fever subjects to the dispensary, I decided on first observing the effects of large doses of the alkaloids.

3. As there were many persons suffering from fever in June, the administration of a single large dose enabled me to take up a larger number of cases than I would have been able to do had I begun with small and repeated doses.

4. I first tried chinchonidine, in doses varying from 10 to 15 grains, and in a few days I was pleased to find that it acted as quinine would have done in similar doses.

5. I next tried quinidine with similar results.

6. I left chinchonine to the last, as it was said to be an irritant of the gastro-intestinal mucous surface. I was, however, agreeably disappointed when I found that it did not cause nausea or vomiting in doses of 10 grains, and that it was as good an anti-periodic as the sister alkaloids.

7. Encouraged by the absence of symptoms indicating gastro-intestinal irritation, I used chinchonine in fever complicated with diarrhoea, and I am satisfied that it is not an irritant of the stomach or bowels, any more than quinine is, in certain cases:

8. Some

8. Some of my patients were out and in-patients of the Goodaloor dispensary. Others were visited in the bazaar, and in the adjoining coffee estates, from two to six miles distant from Goodaloor.

9. The great majority of my patients were half-starved emaciated persons, with flabby muscles, dry, dirty, and shrivelled skins, large spleens, bloodless eyes and tongue, and small atonic pulse. In many of them languor was so marked that they could with difficulty muster up energy enough to reply to questions; and so prostrated were some of them, that they were with difficulty induced to take the medicines offered to them.

10. I have not attempted to reduce to a small compass the results set forth in the tabular reports, as I hear that this work has been undertaken by the Chinchona Commission, but I beg leave to point out that a 10-grain dose of all three alkaloids seemed sufficient to check the return of fever in the majority of cases. Where it failed to check the return of fever, the succeeding paroxysm was generally observed to be less severe. When the paroxysms returned with unabated severity, 15 grains, and then 20 grains were tried. In a few severe cases I administered, at the onset, 15 or 20 grains.

11. During the four months that I was employed in the Wynaad, 467 cases were treated with the alkaloids. The majority of these were cases of the quotidian type. Bronchitis, congestion of the lungs, pneumonia, diarrhoea, dysentery, and anasarca were occasional complications. I may as well add, that these complications did not in the least interfere with the administration of the alkaloids. Where the local affection required special attention, the alkaloids were given with remedies suitable to the complication. I may here add, that all three alkaloids appeared to be as efficacious as quinine.

Madras, 25 February 1867.

(signed) J. Keess, M.D., Assistant Surgeon,
Late on Special Duty in the Wynaad.

APPENDIX III.

REPORT on the Therapeutic Effects of the Salts of the Chinchona Alkaloids.

1. IN furnishing the accompanying tabular reports of the therapeutic effects of the Chinchona alkaloids, as tested at the General Hospital, Madras, I have the honour to state, that in order to draw a more accurate comparison between the salts tested and the di-sulphate of quinine, I exhibited the former in the same way as I am in the habit of using the latter, viz., I gave the first dose upon the decline of the sweating stage, the second and third doses being given at two-hour intervals. The fourth dose was exhibited at the same hour as the first dose, and so on with the fifth, sixth, and any subsequent doses which appeared to be required.

2. I have been led to form a high estimate of the anti-periodic effects of the sulphate of quinidine. This salt was successful in the cure of the eight cases in which it was administered, and it appeared to me to be quite as valuable a remedy as the di-sulphate of quinine itself. In some respects it seemed superior to quinine, as in no instance did it produce any of the disagreeable effects termed chinchonism; in fact, two patients who were suffering from severe headache, stated that the medicine completely relieved this symptom. I did not observe any injurious effects upon the digestive organs, but rather a favourable action, as appetite was promoted and digestion apparently assisted. In seven cases, the quinidine was given in doses of five grains thrice daily. As these doses were effectual, I continued them. But, as a matter of experiment, in case eight, I gave, on the 11th of June, one dose of 15 grains on the decline of the sweating stage, and a second dose of eight grains two hours before the next expected paroxysm. The patient was free from fever for five days, when a relapse occurred. The same plan of administration was followed, and with success, for there was no further paroxysms of ague, although the patient remained under observation for incipient phthisis for a period of more than a month.

3. The sulphate of chinchonine I would place second on the list as an anti-periodic. It was unsuccessful in three out of 11 cases, but two of these were very unfavourable ones. One, a European coffee planter, was suffering from tœnia, and general abdominal engorgement, and the remedy could not be pushed in his case, as it produced chinchonism very rapidly. He had taken a large quantity of quinine before the chinchonine was commenced. He was subsequently treated with pernitrate of iron, kuosso, turpentine, and oil of male fern, but he did not pass the head or neck of the tœnia, only a few proglottides. I saw him on September 17th very much improved in health, getting strong and stout, and quite free from fever. The second case, a European (surgeon of the ship "Blackwall"), was a relapse.

relapse. Three weeks previously he had been cured of an intermittent by quinidine. (Case 7 in the table.) He was then suffering from chronic hepatitis, and had threatenings of hemiplegia. These symptoms quite disappeared before his first discharge from hospital on the 19th June. On his second admission, it was ascertained that he had been much exposed to the sun, going forwards and backwards among the shipping in the roads. The chinchonine* failed to arrest the paroxysms of ague, which was subsequently effected by quinine.

4. The third unsuccessful case was that of a Eurasian lad, whose stomach would not tolerate the remedy. He was subsequently cured by a combination of diaphoretics with quinine.

5. Gastric disturbance was produced by the chinchonine in most of the successful cases.

6. The sulphate of chinchonidine appears to me a much inferior anti-periodic to quinine. It was unsuccessful in five out of 12 cases in which it was employed. I allowed myself to be somewhat prejudiced against the salt when I commenced its use, as it almost always produced nausea.

7. In cases 1, 8, and 9, it was decidedly successful. Case 2 might be removed from the table; the man was saturated with malaria, and had previously been treated by quinine and by chinchonine.

8. Case 3 was a complicated one; the woman was the subject of hysteria, and each cold stage was accompanied by violent hysterical fits. Her spleen was much enlarged, and altogether it was a most unfavourable case for even quinine. Deobstruents were freely used, even whilst taking the chinchonidine. She is entered as having been successfully treated by the chinchonine (case No. 10 in the table). The fact is, there had been no paroxysm for two or three days, whilst taking the chinchonine, and as that salt was exhausted, she simply passed to the chinchonidine. She has since had relapses, and has been treated by quinine and deobstruents. She was discharged, at her own request, on the 31st August, but since then has had a relapse, and has again come under treatment.

9. Case 4 might be removed from the table; he had only one dose of chinchonidine which increased mental delusions as quinine had done before. He is still under treatment, occasionally getting a paroxysm of ague with very profuse sweating. He is improving under mineral acids, and his distressing mental delusions have disappeared.

10. In case 5, the remedy produced violent vomiting, and it was discontinued at the patient's request. The same remark may be made as to case 6, subsequently cured by quinine. Cases 7 and 12 were very mild cases, which would probably have been easily cured without any *Chinchona* preparation. In case 10, nine grains of chinchonidine appeared to prevent the recurrence of a paroxysm. The patient, a very anæmic female, was subsequently cured by ferruginous remedies.

Madras, 18 September 1866.

(signed) *W. N. Chipperfield*, Assistant Surgeon,
Acting Physician, General Hospital.

Enclosure 2, in No. 23.

From the Inspector General, Medical Department, to the Secretary to Government,
Revenue Department, Fort Saint George, 9 March 1867.

1. In continuation of this office letter, of 11th October 1866, I have the honour to forward, for submission to the Home Government, a copy of each of the tabulated reports received printed since that date, of the therapeutic effects of the *Chinchona* alkaloids received from England for experimental trial.

2. The report and tabulated statistics, received up to the end of February by the *Chinchona* Commission, have already been submitted to Government.

* Only *zss.* given.

List.

	Chincho- nine.	Chinchoni- dine.	Quinidine.	Chinchona Leaves and Bark.	Report.
Dr. Chipperfield General Hospital, Madras.	1	1	1	- -	1
Dr. Cleveland - Mysore - -	1	1	1	—	—
Dr. Dougall - Northern Circars -	2	2	2	—	—
Dr. Fitzgerald - Labuan - -	2	2	1	—	—
Dr. Foy - Sumbulpore - -	3	3	3	—	—
Dr. Heard - Shemogah - -	2	2	2	—	—
Dr. Henderson - Bangalore - -	- -	1	1	—	—
Dr. Houston - Doomignuidiem -	3	2	2	1	—
Dr. Keess - Goodaloor (Wynaad.)	3	3	3	1	1
Dr. Oswald - Mysore - -	- -	- -	2	1	—
Mr. Wade - Goodaloor (Wynaad.)	- -	1	2	—	—
Dr. Walters - Secunderabad -	3	3	2	3	—
Dr. White - Kamptee - -	1	- -	1	—	—
Dr. Whitton - Cochin - -	2	1	2	1	1
Dr. Miller - Thyetmyoo - -	- -	- -	1	—	—

Enclosure 3, in No. 23.

READ the following letter from the Superintendent Government Chinchona Plantations, to the Secretary to Government, Revenue Department, Fort Saint George, Ootacamund, 8 January 1867.

1. WITH reference to the order of Government of the 14th of December 1866, No. 3,382, paragraph 3, I have the honour to inform you that suitable accommodation can be provided for Mr. Broughton on the Chinchona Plantations at Neddivuttum, at a cost of about 2,500 rupees. The bungalow attached to the Assistant Superintendent's house would form a comfortable residence, while the two rooms for a laboratory, with the necessary supply of water, could be erected at a short distance from the bungalow. The principal supply of material on which Mr. Broughton would be engaged would thus be immediately at his command.

2. Should this plan meet the approval of Government, I will prepare the accommodation at once, and until this is finished Mr. Broughton's head-quarters might be at Ootacamund.

ORDER thereon, 14 January 1867.

1. ORDERED to be communicated to Mr. Broughton, who will proceed to Ootacamund as soon as he can, and favour Government with his opinion as to the best place for his head-quarters, after discussing the subject fully with Mr. McIvor and visiting Neddivuttum. While in Madras, Mr. Broughton should wait on the Principal Inspector General, Medical Department, Mr. Shaw, who will communicate to him the results of the recent experiments with Chinchonidine, &c.

2. Mr. Broughton will in due course furnish a statement of the establishment he will require, and will indent on the medical stores for such articles as he may need for his analysis. He will be furnished from time to time with copies of all correspondence connected with the Chinchona experiments.

(True extract.)

(signed)

J. D. Sim,
Secretary to Government.

John Broughton, Esq.
The Superintendent Government Chinchona Plantations.
The Principal Inspector General, Medical Department.

Enclosure 4, in No. 23.

From *J. Broughton*, Esq., to the Secretary to Government, Revenue Department,
Fort St. George, Ootacamund, 29th January 1867.

1. In fulfilment of the instructions contained in Order No. 228 of the Madras Government, I have, in company with Mr. McIvor, visited the various Chinchona plantations, and made myself acquainted with the advantages offered by their respective neighbourhood as sites for the erection of a chemical laboratory.

2. The result of this examination has led me to be decidedly of opinion that Ootacamund is by far the best place for extended chemical investigations. Neddivuttam, notwithstanding its important plantations of red bark trees, offers the following disadvantages:

First.—The lonely situation, and the necessity of procuring all supplies (except bark) from Ootacamund. This would frequently cause considerable inconvenience and delay in the progress of work.

Second.—The damp climate, which renders me unwilling to risk injury to delicate instruments constructed of metal. The higher mean temperature is also a disadvantage in such operations as require the manipulation of ether and other volatile liquids.

Ootacamund possesses the advantages of being near to the Dodabetta plantations, is central, and within reach of civilised assistance, and of a climate very favourable for scientific apparatus and work.

I trust, therefore, that my preference of Ootacamund, as the site for a laboratory, will be approved by Government.

3. I have furnished Mr. McIvor with a ground plan of the most convenient form of building. His estimate of the cost of the same, inclusive of the internal fittings, amounts to 2,100 rupees. A copy of this plan, with the specifications, I beg to enclose for the approval of Government. I have, also, in conjunction with Mr. McIvor, provisionally selected a very suitable site in an inconspicuous and, at present, uncultivated part of the Botanic Gardens, and adjoining their boundary.

4. The practical working of this establishment will eventually require the services of a Native writer and of a Native or European assistant, whom I could teach to prepare bark for analysis, make extracts, &c. Also, I would solicit permission to engage a peon for the performance of present rough work, at the same wages as those now employed in the Gardens, viz., 8 rupees a month.

5. I would also submit to the consideration of Government the desirability of attaching to the laboratory a few rooms for my own residence. There are many analytical processes which require to be performed continuously, and a considerable loss of time would ensue by allowing such to cease during the night. My presence on the spot would be economy of time and labour. It is unusual, and indeed somewhat unsafe, to allow a laboratory to be entirely deserted during a great part of the 24 hours. Should it be considered that such an arrangement is undesirable, being in some respects practically equivalent to an increase of pay, I would gladly obviate this objection by paying rent for such rooms.

ORDER of Madras Governmentt, 12th February 1867.

1. The Government approve the selection of Ootacamund as Mr. Broughton's headquarters and the site for the laboratory, for the reasons stated, as also the suggestion that quarters shall be provided for Mr. Broughton in the same building with the laboratory, he paying rent for the same.

2. A revised plan and estimate will be submitted for the building together with a rough sketch of the ground, to afford Government some idea of the position selected for it.

3. The Government authorise Mr. Broughton to engage at once a peon on 8 rupees monthly pay, and request him to renew his application for the further establishment when he wishes to entertain it.

4. His indent for chemicals will be forwarded to the Principal Inspector General, Medical Department, to be passed for supply in the usual manner.

(signed) *W. Hudleston*,
Secretary to Government.

Enclosure 5, in No. 23.

From *J. Broughton*, Esq., Quinologist, Chinchona Plantations, to the Secretary to Government, Revenue Department, Fort St. George, Ootacamund, 19th February 1867.

1. I HAVE the honour to acknowledge, with thanks, the receipt of a copy of Order of the Madras Government, dated 12th February 1867.

2. In fulfilment of the instructions therein contained, I herewith enclose a revised plan and estimate of cost of the laboratory building, with the additional rooms for my own residence; and also a map of the Botanic Gardens, roughly showing the proposed site for the same. The total of the estimate amounts to 6,500 rupees.

3. Concerning the erection of this building, I would beg respectfully to observe that, as the estimate is made by Mr. McIvor, it is extremely desirable that it should be put in train before his departure, which takes place on the 14th proximo. Furthermore, it is important, for the safety of the instruments shortly arriving from England, that the roof of the laboratory should be completed before the rains begin. On these grounds I trust I may be pardoned for the urgency with which I would request that I may be informed, by telegram, of the sanction of Government to this plan.

ORDER of the Madras Government, 28rd February 1867.

1. THE Government sanction the erection of the laboratory building and quinologists' residence on the proposed plan, at an estimated cost of 6,500 rupees.

2. The authority to commence the work will be communicated to Mr. Broughton by telegraph.

(True Extract.)

(signed) *W. Hudleston*,
Secretary to Government.

(True Copies.)

(signed) *J. Grose*,
Under Secretary to Government.

To John Broughton, Esq.,
the Superintendent Government Chinchona Plantations.
„ the Accountant General.

— No. 24. —

From the Secretary of State for India to the Government of Madras.

My Lord,

India Office, 24 May 1867.

1. I have received and considered in council your Despatch in the Revenue Department, dated 25th March 1867, forwarding the very satisfactory report of the commissioners appointed to test the efficacy of the Chinchona alkaloids other than quinine.

2. The result obtained from the treatment of 1,145 cases of paroxysmal fever is, that these alkaloids are scarcely, if at all, inferior to quinine, any differences being of degree rather than of kind. This result is so important, with reference to the value of those chinchona species now cultivated in the Government plantations which yield quinidine, chinchonidine, and chinchonine, that it should be made generally known. I have, therefore, directed copies of the report to be furnished to leading physicians and chemists in Great Britain and on the continent.

3. The arrangements for the erection of a residence and laboratory for Mr. Broughton in the Government Garden at Ootacamund appear to be the best that could have been adopted, and preferable to the formation of an establishment of the kind at Neddivuttum.

I have, &c.
(signed) *Stafford H. Northcote*.

From the Government of Madras to the Secretary of State for India.

Madras, 25 April 1867.

- 1. In continuation of our Despatch, dated 25th March 1867, we have the honour to forward herewith copy of the preliminary report of Mr. Broughton, the Government quinologist, on the results of his examination of the various products of the Government Chinchona plantations.
- 2. The report is very encouraging, and Mr. Broughton bears testimony to the value of the mossaing process introduced by Mr. McIvor.

Enclosure in No. 25.

From J. Broughton, Esq., Quinologist to Government, to the Secretary to Government, Revenue Department, Fort Saint George, Ootacamund, 2 April 1867.

- 1. I have the honour to enclose a preliminary report on the Chinchonæ of the Government plantations.
- 2. I would request permission to proceed on duty to Madras on the arrival of the Government vessel containing my laboratory stores, in order to superintend personally the transit of the same to this place. Any damage to the apparatus would seriously impede my future work.

From J. Broughton, Esq., Quinologist to Government, to the Secretary to Government, Revenue Department, Fort Saint George, dated Ootacamund, 1st April 1867.

Present want of chemical appliances.

C. succirubra.

Marked differences in habit of individual trees.

- 1. I have the honour, in the subsequent pages, of submitting such part of the results of my examination of the various products of the Government Chinchona plantations, that possess sufficient interest and definitiveness to be brought under the notice of Government.
- 2. This examination has been conducted under considerable difficulties, arising from the want of many of the chemical appliances which are requisite for the analysis of Chinchona barks. Notwithstanding the kind assistance I have received from Mr. McIvor and Mr. Batcock on all occasions when the establishment at the Botanic Gardens could supply my wants, much time has been consumed in improvising substitutes for lacking implements, and in making such arrangements as are incident to a new establishment.
- 3. The greater part of my attention has been devoted to an examination of C. Succirubra. Of all the species yet naturalized in India this exhibits the most vigorous growth. It is numerically the most important, since nearly 800,000 plants are now growing in the several plantations. It is, moreover, the bark of this kind that will first find its way into actual consumption. For these reasons the products of the red bark trees and the conditions of their occurrence merit an early and careful study.
- 4. A slight inspection of the more advanced portions of the plantations at Neddivuttum reveals considerable differences in the habit and appearances of the individual red bark trees. This has already been remarked by Mr. C. R. Markham, who suggested that these variations in the colouring and habit of the trees might probably be connected with differences in their yield of alkaloids. The accuracy of this conjecture is rendered evident by the results of the analyses of the trunk bark of four trees, which are calculated in percentages of dry bark, as given below :—

Statement of Analyses.

	I.	II.	III.	IV.
Total alkaloids (hydrated) - - - -	4.85	7.00	6.40	6.4
Alkaloid soluble in ether (quinine) - - -	3.25	4.25	4.75	1.7
Chinchonidine and Chinchonine - - - -	1.60	2.75	1.65	4.7
Sulphate of quinine obtained crystallised - -	3.00	4.00	4.55	1.7

In the above analyses, as well as those given subsequently, the sulphate of quinine has been obtained in as pure a state as possible.

5. Of No. I., it may be remarked that though the poorest specimen that has come under my notice, it gives at least an equal yield to the best Ecuador red barks. Nos. II., III., and IV. are considerably richer. Seven per cent. of alkaloids in the natural (unmossed) bark appeared to me so large an amount that I was led to repeat the analyses by a different method, which, however, closely corroborated the following results. No. II. owes its richness in alkaloids to the presence of an unusually large amount of Chinchonine, which crystallised from an alcoholic solution with the greatest readiness. No. IV. contained comparatively but a small amount of quinine, but in its stead a large amount of Chinchonidine, which easily yielded a sulphate not distinguishable by the eye from that of quinine. In this sample of bark the total quantity of crystalline sulphates obtained was no less than 5.2 per cent. of the weight of the dry bark. All the barks contain a certain amount of quinine apparently not susceptible of crystallization.

Remarks on analyses of red barks.

6. These analyses were made in all cases with the bark of the trunk, which (doubtless on account of superior age) is much richer than that of the branches yielding "quill bark." Some of the latter, which I examined, yielded but three per cent. of alkaloids, from which 1.4 per cent. of crystalline sulphates was obtained.

Bark of branches.

I am of opinion that the foregoing data, compared with those of Mr. Howard's earlier reports, afford grounds for believing that the amount of alkaloids in the barks is still on the increase.

Yield of alkaloids in bark still probably increasing.

7. It should be stated that the richness of the red barks in alkaloids, though doubtless entitling them to the first place among our Indian barks, is not in many respects a true measure of their intrinsic value for manufacturing purposes. This value depends also on the readiness with which the quinine, &c., can be obtained in a pure and crystalline form. In this respect the natural unmossed *Succirubra* bark is at some disadvantage, since its alkaloids are more difficult to obtain in a pure form than those yielded by some other kinds.

Considerations affecting value of red barks.

8. Mr. McIvor's valuable and interesting method of treatment of the barks by mossing has already been fully described by himself. Unfortunately I was unable to obtain a specimen of bark that had been under this treatment for more than six months. A sample of bark of a tree of four years and a half old, renewed under moss, yielded (in per-centages of dry bark):—

Mossed red bark.

Total alkaloids (hydrated) - - - - -	7.10 per cent.
Alkaloid soluble in ether (quinine) - - - - -	3.95 "
Chinchonine and chinchonidine - - - - -	3.15 "
Crystallised sulphate of quinine obtained - - - - -	3.45 "

Analyses of mossed renewed bark.

9. In this instance the comparative youth of the renewed bark does not permit me to quote so high a per-centage of alkaloids as that found some time since by Mr. Howard in bark that had been longer under treatment.* Nevertheless, the advantages of the mossing process applied to this bark makes itself at once evident to the worker by the readiness and purity with which the sulphates crystallise. The amount of the latter would be much larger had sulphate of chinchonidine been included.

10. An examination of the root bark of *C. succirubra* enabled me to corroborate the statement of Dr. De Vrij that it contains a large amount of alkaloids.

Root bark.

The dried bark yielded:—

Total alkaloids (hydrated) - - - - -	6.0 per cent.
Alkaloid soluble in ether (quinine) - - - - -	2.15 "
Chinchonidine and chinchonine - - - - -	3.85 "
Crystallised sulphate of quinine obtained - - - - -	2.00 "

From the above it appears that the greater part of the alkaloids in this root bark consists of chinchonidine and chinchonine. The former alkaloid occurs in considerable quantity. In no case, however, could the roots be a remunerative source of alkaloids, since their bark is thin, contains 74 per cent. of water, and is laborious to procure.

Remarks on analyses.

11. The occurrence of alkaloids in the leaves of the *Chinchonæ* has been the subject of numerous and conflicting statements. In order to inquire into this interesting and important point I worked with four pounds of the leaves of *C. succirubra*.† From these I succeeded in obtaining 3.1 grains of alkaloid, of which about one grain was soluble in ether, and gave a faint indication of quinine when tested with chlorine water and ammonia. From none of the alkaloid obtained from the leaves was I able to obtain a definite crystalline sulphate or oxulate.

Leaves of *C. succirubra*.

Though

* Government Return, 1866, p. 134.

† The method of proceeding adopted was as follows:—"The bruised leaves were boiled in a chattie with water, acidulated with sulphuric acid, and the bitter greenish decoction was separated by drainage and strong pressure through a cloth. It was then concentrated by evaporation, allowed to cool, and made strongly alkaline by the addition of milk of lime. A considerable precipitate was thus obtained, which was separated by filtration, and purified by careful washing: then dried at 200 F., and powdered. This powder was then repeatedly boiled with strong spirit, and the alcoholic extracts evaporated to dryness. The residue consisted mainly of a bitter yellow resin. It was boiled with acidulated water (by which but a small proportion dissolved) and filtered. The solution was then made alkaline with caustic soda and shaken up in a separator with chloroform. The chloroform was then separated, and being evaporated by a gentle heat in a capsule, left the purified alkaloid as residue.

Probable value of leaves.

Though I would refrain from advancing a decisive opinion until I have examined the leaves at another period of the year, it appears to me to be probable, from the above examination, that the leaves of *C. Succirubra* (even in the fresh green state) are worthless as a source of febrifuge alkaloids. They appear to owe their bitterness to the presence of quinovin, a substance which may probably possess some tonic qualities.

C. officinalis.

12. Next to the *C. Succirubra* the most important species we at present possess is the *C. Officinalis*, whose varieties yield the crown barks. The three varieties, *Bonplandiana*, *Uritusinga*, and *Crespilla*, greatly resemble one another, and appear to differ even less among themselves than some individuals of *C. Succirubra*, of which botanists recognise but one variety.

Var *Bonplandiana*.

Of these varieties, var *Bonplandiana* is the most important, since upwards of 750,000 are now growing on the plantations. This variety also comprises the most advanced trees, whose identity with their name could be considered certain. The trunk bark of a tree from Dodabetta plantation yielded in the dry bark the following per-centages:—

Analyses of crown bark.

Total alkaloids (hydrated)	-	-	-	-	3.6 per cent.
Alkaloid soluble in ether (quinine)	-	-	-	-	2.8 "
Chinchonine and chinchonidine	-	-	-	-	0.8 "
Sulphate of quinine obtain crystallised	-	-	-	-	2.6 "

The fresh bark contained 66 per cent. of water.

A second specimen of somewhat different habit yielded—

Total alkaloids (hydrated)	-	-	-	-	3.8 per cent.
Alkaloid soluble in ether (quinine)	-	-	-	-	3.0 "
Insoluble in ether (chinchonine)	-	-	-	-	0.8 "
Crystallised sulphate of quinine obtained	-	-	-	-	2.9 "

Value of crown bark.

Hence it appears that even at their present age the trees of *C. Officinalis* var *Bonplandiana* yield a bark of admirable quality, and nearly equal to the fine Calisaya bark of Bolivia. In the last-quoted analysis no alkaloids were found, except quinine and chinchonine, the latter occurring in but small quantity. I am of opinion that this bark possesses, for manufacturing purposes, certain advantages over the red bark, that in some measure tend to compensate for the smaller yield and slower growth of the tree producing it. The crown bark yields its alkaloids with greater ease, owing to the small amount of resin and colouring matter with which they are associated.

Mossed crown bark.

13. An analysis of similar bark that had been renewed six months under moss yielded:

Total alkaloids (hydrated)	-	-	-	-	6.8 per cent.
Alkaloid soluble in ether (quinine)	-	-	-	-	4.8 "
Chinchonine and chinchonidine	-	-	-	-	2.0 "
Sulphate of quinine obtained crystallised	-	-	-	-	4.1 "

Increased yield produced by mossing.

This analysis shows that the mossing process, though only applied for six months, has greatly increased the yield of alkaloids in this variety of bark.

Deleterious action of light on bark.

14. I would here beg permission to state, without advancing any new hypothesis, such known facts that appear in a great measure to explain the increased amount of alkaloids produced by mossing the bark.

The injurious action of light on the Chinchona bark and alkaloids was clearly pointed out many years ago by Pasteur,* a chemist, to whom our present knowledge of these alkaloids is largely indebted. It is on account of this destructive action of light that he recommended shielding the bark from sunlight while drying. Pure colourless solutions of the alkaloids are soon coloured brown and partially decomposed by exposure to sunshine. The same change takes place when dry or moist sulphate of quinine is insolated.

Experimental verification.

15. In order to verify these facts in the climate of the Neilgherries, I prepared from red bark, pure colourless solutions of each alkaloid, and sealed them up in vacuo in glass tubes, in order to eliminate possible oxidation. After three days' exposure to the sun's rays they all became coloured, while similar solutions preserved in the shade remained unaltered. The tube containing quinine was opened after a fortnight's exposure, and its contents examined. It was then found that a considerable quantity of a dark-coloured resinuous substance had been formed, and that much of the alkaloid had lost its power of crystallising. I would submit that these circumstances are very significant, when applied to the elucidation of the cause of some of the changes occurring in the living bark, and are most suggestive of future experiments in the cultivation of the latter.

Moss does not prevent oxidation.

16. It has been stated that the action of the moss is to protect the alkaloids from oxidation. This is contradicted by the circumstance that moss does not exclude either air or oxygen. It is also incompatible with the fact that the quinidine produced under moss in *Micrantha* bark is really a more oxidised substance than the chinchonine produced in the natural bark when fully exposed to the air.

17. It

* Comptes Rendus XXXVI., p. 26, and XXXVII., p. 162. Also Kopps' Jahresbericht, 1853, p. 419.

17. It appeared to me that an examination of bark that had been renewed by natural processes, without the application of moss, would possess considerable interest. It was suggested by a statement in Howard's "Nueva Quinologia of Pavon," and also given on the authority of Ruiz.* I was able to obtain a small quantity of such renewed bark from two *Succirubra* trees which had been injured and partially stripped of their bark by the falling of a log in October 1864. The renewed bark was thicker than that of the natural bark, measuring 0·19 to 0·22 in., instead of 0·16 in., and had replaced itself mainly from the edges of the wound; not from the surface, as is the case in mossed bark, but its analysis gave but 5 per cent. of alkaloids, of which about 3·25 appeared to consist of chinchonidine and chinchonine. Unless, therefore, the effect had been impaired by the lapse of time or the character of the injury, the quality of this renewed bark does not appear to corroborate the statement I have had the honour to cite above.

Natural renewed bark.

18. I would submit that the foregoing facts and considerations render it highly probable that the exposure of the living bark to direct sunlight has the effect of diminishing the yield in alkaloids, and hence the advantage of direct protection.

Rationale of mossing the bark.

I would beg leave to defer a comparative estimate of the respective values of the three varieties of *C. officinalis* till a subsequent report.

19. An analysis of the bark taken from a plant of *C. lancifolia*, two years old, yielded 0·8 per cent. of alkaloids, in which (though but a very small amount of bark was at my disposal) I was able to obtain distinct traces of a crystalline sulphate.

C. lancifolia.

20. An analysis of the trunk bark of *C. micrantha*, of four and a half years old, yielded the following numbers expressing per-centages in dry bark:—

C. micrantha.

Total alkaloids	-	-	-	-	-	-	-	-	7·1
Alkaloid soluble in ether	-	-	-	-	-	-	-	-	0·3
Chinchonine	-	-	-	-	-	-	-	-	6·8
Crystalline sulphates	-	-	-	-	-	-	-	-	None.

This large amount of chinchonine crystallised from solution in alcohol with the greatest readiness and purity, forming splendid crystals 0·18 inches long. Huanuco bark contains usually only about 2·0 per cent. of alkaloid. Should chinchonine come into use as a febrifuge (as appears not improbable from the experimental results of the Chinchona commission), this *micrantha* bark will furnish a most easy and abundant source. The tree rivals *C. Succirubra* in rapidity of growth, and the bark at present is 0·17 inches thick. It loses on drying 73 per cent. of water.

Value of *micrantha* bark.

21. Nearly all the above analyses were made with the fresh undried bark of the trees. Some preliminary experiments showed me that the bark in the "green" condition presented several advantages which facilitate its examination for alkaloids. The latter are extracted with far greater ease from the fresh than from the dried and powdered bark; and with much less expenditure of acid and labour, and consequently with diminished risk of error or alteration in composition. I am of opinion that this property of the fresh bark will eventually become of considerable importance. For purposes of quotation, it is of course indifferent whether the analyses are conducted with the fresh or the dried bark, provided the process of drying be conducted with proper care.

Advantages of working with fresh bark.

22. I have communicated these and other results of my observations to Mr. McIvor, and have discussed with him various applications to future cultivation. I have had to thank Mr. McIvor for much kind assistance, and also for some valuable information concerning the plantations and their products.

Results communicated to Mr. McIvor.

23. I trust I may be pardoned for expressing my gratification at finding, from personal examination, that the Government Chinchona plantations offer in their present stage such unmistakeable indications of success.

Present success of Chinchona plantations.

24. I have the honour to forward by banghy four specimens of alkaloids prepared from red bark, and illustrative of the foregoing report.

ORDER of the Madras Government, 12 April 1867.

1. THE Government have perused, with much interest, Mr. Broughton's very encouraging report, which will be forwarded to the Secretary of State, and communicated, with the recent report of the Chinchona Commission, to the Governments of India, and of the other Presidencies.

2. They note, with satisfaction, Mr. Broughton's testimony to the value of the mossing process

* *Nueva Quinologia*. G. Uritensing, p. 3.—"They cut off (Don Riofrio told me) the whole of the bark of the trunk of a small tree, leaving only a broad strip so as not to destroy the tree, which gradually replaces its loss; and the second time of cutting the bark is called *cascarillas rescatas*, and esteemed of superior quality."

process introduced by Mr. McIvor, and request that the results may be recorded in all reports of bark analysis when the tree has been thus treated.

3. Mr. Broughton will proceed to Madras, on duty, on the arrival of the ship containing his apparatus, for the purpose of taking charge of the cases and superintending their conveyance to Ootacamund.

(signed) *W. Hudleston,*
Secretary to Government.

— No. 26. —

From the Government of Madras to the Secretary of State for India.

Madras, 19 May 1867.

1. WE have the honour to advise you of the transmission, by the steamer conveying this mail, of a box containing four samples of Neilgherry Chinchona bark, to be submitted to Mr. Howard for analysis and report. A letter* from the acting superintendent on the subject of these samples is enclosed.

* Dated 9th May 1867, No. 66.
Proceedings of Government, 13th May 1867, Nos. 189, 190.

Enclosure in No. 26.

From the Acting Superintendent, Government Chinchona Plantations, to the Secretary to Government, Revenue Department, Fort St. George; Ootacamund, 9th May 1867.

1. I HAVE the honour to inform you that a box containing four samples of Neilgherry Chinchona barks* has this day been forwarded by banghy, for transmission to the Right Honourable the Secretary of State for India, to be submitted to Mr. Howard for analysis and report.

2. These samples are transmitted with a view of throwing more light on the efficiency of mossing, and also for the purpose of testing the quality of a variety of *C. officinalis*.

3. The bark was removed in the end of April 1867.

— No. 27. —

From the Government of Madras to the Secretary of State for India.

Madras, 23 May 1870.

1. WE have the honour to inform you that we have forwarded to your address by this mail three cases containing Chinchona bark, the produce of a number of trees felled on the Government Chinchona plantations at Neddivuttum, in order to try† the experiment of treating these trees as coppice wood, and to request that the bark may be transferred to Mr. Howard for analysis, as well as for an expression of his opinion as to its market value.

2. You will observe from the papers noted in the margin, which accompany this Despatch, that the trees felled were over four years' old, and were in the finest possible health, and the quantity of bark is probably sufficient to allow of its market value being tested by actual sale.

3. We beg that Mr. Howard may be requested to record separately the results of the analysis of the bark now transmitted, for comparison with the results of future cuttings of the shoots from the stools of the felled trees. The experiment will not be extended beyond the area already felled.

Proceedings of Government, dated 22 May 1867, Nos. 359, 360.

* *Memorandum.*—No. 1. Mossed crespilla bark, three-and-a-half years old.
No. 2. Strong-growing variety of *C. officinalis*, three-and-a-half years old.
No. 3. *C. Uritusinga* received from Mr. Howard, original bark.
No. 4. *C. Pahudiana* under moss, five years old.

† *Vide* paragraphs 9 and 10 of Sir William Denison's Minute, dated 30th October 1865, transmitted with Despatch, dated 25th December 1865, No. 75.

Enclosure in No. 27.

From the Acting Superintendent of Government Chinchona Plantations, to the Secretary to Government, Revenue Department, Fort St. George, Ootacamund, 1st May 1867, No. 62.

1. WITH reference to Government Order, dated 22nd December 1865, directing the experiment of treating Chinchona trees as coppice wood, I have the honour to advise you of the dispatch to day by the Indian Carrying Company of three cases of bark, obtained by felling a number of trees on the Government Chinchona Plantations at Neddivuttum.

2. The trees thus felled were over four years old, and were in the finest possible health.

3. I would beg to remark that in case of any detention, the cases should be put under shelter; if the bark gets damp from rain or other cause it will be seriously injured, if not entirely spoiled.

4. The Carrying Company's receipt is herewith annexed.

— No. 28. —

From the Secretary of State for India to the Government of Madras.

My Lord,

India Office, 23 August 1867.

PARA. 1. I have to acknowledge the receipt of your Despatches, of the numbers and dates noted in the margin, on the subject of Chinchona cultivation.

25 April.
19 May.
23 May.

2. The specimens of bark forwarded with your Despatch, dated March 12th, 1867, in the Revenue Department, are now exhibited in the Paris Exhibition. It is to be regretted that so few specimens were sent, and those only of one species. There should have been good specimens of the bark of all the species now cultivated on the Neilgherry Hills, together with flowers and capsules of such as have borne fruit.

3. Mr. Broughton's interesting preliminary Report, together with the Report of the Chinchona Commission, have been printed for the information of physicians and chemists in England and on the Continent. The Report of the Commissioners appointed in your presidency, as to the efficacy of Chinchona alkaloids other than quinine, is fully concurred in by the medical men who were appointed to make similar investigations in the Bombay Presidency. Their conclusions are highly important, and I shall be glad to receive the results of their further inquiries.

4. Mr. Howard has been requested to analyse and report upon the specimens of bark sent home with your Despatch in the Revenue Department, dated May 13th, 1867, but his report has not yet reached me.

5. The three chests containing each about 100 lbs. of Chinchona bark, the dispatch of which was reported in your letter, dated May 23rd, 1867, in the Revenue Department, arrived last month. They were put into the hands of a broker and sold by public sale on the 25th ultimo. The bark in the two cases (lots 109 and 110) sold at 2 s. per lb.; and that containing quill bark at 1 s. 9 d. per lb. This is considered by the broker, and by Mr. Howard, to be a very satisfactory result of the first offer of East Indian bark for public sale, in the London market. Mr. Howard has analysed samples of the bark which was put up for sale, and found the best to contain about 7 per cent. of alkaloids, after only four years of growth. He made the average of the whole consignment to yield 3 per cent., but the French estimate was that the three chests only averaged 1½ per cent.

I have, &c.
(signed) *Stafford H. Northcote.*

— No. 29. —

From the Government of Madras to the Secretary of State for India.

Madras, 11 July 1867.

1. We have the honour to forward herewith Mr. McIvor's Report on the Chinchona Plantations and Botanical Gardens on the Neilgherries for 1866-67,

2. You will observe that the total number of plants propagated during the year was 803,399, or nearly double the number for 1865-66. The number issued to the public was 42,065, making the total number so distributed 126,047. The number of plants permanently planted out during the year was 156,340, making the total number so planted out 557,551. Mr. McIvor expects to complete the plantations to the sanctioned extent, viz., 1,200 acres, by July 1868. The total extent now under cultivation is 895 acres.

3. The first plants which were permanently planted out in August and September 1862 are in the finest health, and are from 15 to 22 feet in height. They are now producing a large quantity of seed. The seed gathered last season was of excellent quality and germinated freely. We have approved Mr. McIvor's suggestion that a portion of the seed collected be distributed gratuitously to such planters as are likely to turn the supply to good account.

4. The necessity of making a further attempt to procure the seed of the Pitayo species, alluded to in para. 16 of Mr. McIvor's Report, has been already anticipated in para. 4 of your Despatch, dated 16th April 1867, No. 15.

5. We consider the results reported to be most satisfactory, and we have pleasure in again bringing to your notice Mr. McIvor's successful exertions in the promotion of this national undertaking.

Enclosure in No. 29.

From the Acting Superintendent, Government Chinchona Plantations, to the Secretary to Government, Revenue Department, Fort Saint George, Ootacamund, 27 April 1867.

I HAVE the honour to forward the Administration Report of this department for the official year 1866-67.

REPORT on the Government Chinchona Plantations and Botanical Gardens, Ootacamund, Neilgherries, for the Official Year 1866-67.

1. In submitting this report it affords me much satisfaction to be able to state that the season has been very favourable for planting operations, the rains extending to a later, and commencing at a much earlier period of the year than has been experienced since the introduction of the Chinchona plants to this country, consequently the plants have maintained a more than usual luxuriant state of growth throughout the whole of the year.

2. The works on our plantations have made more than average progress, and it is anticipated, by July 1868, the plantations will be completed to the sanctioned extent, viz., 1,200 acres of planted land. The average monthly increase by propagation throughout the year is 66,950 against 48,968, the result of last year. The maximum monthly increase by propagation has reached as high as 176,349 against 78,725, the highest monthly increase obtained during the season. The total number of plants on the 1st April 1867, was 1,926,044 against 1,156,070, the total number of plants on the 1st May last year. Thus the total number propagated during the year is 8,03,399 plants, or nearly double the number of plants propagated in 1865-66. The number of plants issued to the public is 42,065, making the total number 126,047 plants distributed up to the 1st April 1867. The number of plants permanently planted out to date is 557,551, or 156,340 planted during the present year. The first plants, which were permanently planted out in August and September 1862, have attained heights varying from 15 to 22 feet. These trees are in the finest health, have recently been covered with bloom, and are now producing many millions of excellent seeds. Six hundred of these have been cut down for their bark to be sent into the market in order to test its commercial value. The seeds gathered last season have germinated freely, and have been extensively distributed. Reports daily reach us of their excellence, and the great number of young seedlings raised from them.

3. The result of the last analysis of our bark exhibits a farther and steady yearly increase in the yield of alkaloids, and is of such a nature as to be highly encouraging and interesting. Our barks submitted for analysis in the early part of June 1863 gave 3.40 per cent. of alkaloids, those submitted in 1864 gave six per cent.; the highest result attained from the samples of

1865

1865 was 9.72 per cent. of alkaloid, while some of those samples yielded as high as six per cent. of crystallised sulphates. The bark submitted in October 1866 for analysis gave 9.79 per cent. of alkaloid, and of this 8.45 crystallised sulphates, showing an increase of nearly 2.50 per cent. of crystallised sulphates in one year's growth, or a yield in our young barks altogether unprecedented in the finest samples of mature American bark. Gratifying as this result is, we have not yet reached our maximum, but on the contrary, have every reason to hope that two or three years' additional growth will secure a yield of from 12 to 15 per cent. of crystallised sulphates. These are the results obtained by Mr. Howard in the public reports of his analysis, and may be taken as the standard of the value of the bark, as being conducted by an eminent chemist and practical manufacturer.

With these observations I proceed to particulars:—

Heads of Report.

	Paragraphs.
1. Propagation - - - - -	4 and 5
2. Condition and growth of plants - - - - -	6
3. Cultivation in the open ground - - - - -	7
4. Ditto - under the shade of living trees - - - - -	8
5. Ditto - results obtained by private planters in - - - - -	9
6. Ditto - accumulation of earth around the stems in- jures or destroys the plants - - - - -	10 and 11
7. Formation of alkaloids - - - - -	12 to 14
8. Chinchona, new varieties introduced, remarks on - - - - -	15 and 16
9. Establishment - - - - -	17
10. Convict labour - - - - -	18 and 19
11. Progress of operations - - - - -	20 to 24
12. Botanical gardens - - - - -	25 and 26
13. Tea plantation - - - - -	27
14. Concluding remarks - - - - -	28 and 29
15. Appendix A. accounts from the commencement to 31st March 1867.	
16. " B. meteorological observations at Neddivutun.	
17. " C. Ditto at Ootacamund.	

4 During the present year nearly the whole of our plants have been propagated from seeds, the *Succirubra* as well as other species having produced a quantity of ripe seed in the spring and autumn of 1866. From the 1st May 1866 to the 31st March 1867, 803,399 seedlings have been raised, the majority of these of the *Succirubra* and *Condamenia* being the two most valuable species at present in cultivation. This large number of seedlings necessitated the erection of a temporary house in order to give the plants accommodation during the dry months; further enlargement will not be necessary, as we have now cover for more than sufficient plants to complete our plantations; the demand for plants by private planters being limited partly on account of loss by bad seasons, and partly because some have been successful in raising the number of seedlings they require, *Chinchona* plants being more easily propagated by seeds than by cuttings.

5. Our crop of seeds of this season will be large, and would suggest, with the sanction of Government, that a portion of the seeds be distributed gratuitously to such planters as are likely to take care of them and turn them to account. As we have now the means, it is desirable that we should offer every facility for extending the cultivation of this valuable product, and this cannot be better done than by the distribution of seeds. The *Chinchona Lancifolia* is the only species here which has not produced seed, and consequently this plant has still to be increased by cuttings.

6. *Condition and Growth of Plants.*—The growth of the plants throughout the whole of our plantations still continues to be most satisfactory, the stems of our older plants increasing much in thickness, while the increase in the weight of bark has nearly doubled by the growth of 1866-67, thus showing the loss sustained by cutting down our trees at an early stage of growth, as the increase of the stems and bark is much greater in proportion after the plant has attained a considerable size. The *C. Succirubra* still maintains the most robust habit and luxuriant growth of any of the species yet introduced, and consequently gives promise of being the most profitable plant to cultivate at elevations varying from 4,000 to 8,000 feet. The *C. Officinalis* B. *Condamenia* almost equals the *C. Succirubra* in luxuriance of growth; it yields a thick bark, and a large product of alkaloid, and in most situations comes next in value to the *C. Succirubra*; while at high elevations (that is between 6,000 and 8,000 feet) it is the most profitable plant to cultivate. The growth of the *C. Calisaya* is unsatisfactory; only one or two varieties of the Bolivian *Calisaya*, raised from Mr. Money's seeds, promise to have a luxuriant habit of growth, and suited to this climate, with these exceptions, all our varieties of *C. Calisaya* or Bolivian barks are delicate, liable to disease and damp, and appearing to be, on the whole, a much more difficult plant to cultivate than the other species. The *C. Uritusinga* has the same habit and luxuriant growth as the *C. Officinalis* B. *Condamenia*, which in every respect it much resembles, in fact, varieties of one species run into the other, in such a manner as not to be distinguishable. This remark also applies to the *C. Crispa*. The bark of the *C. Pahudiana* has within the last year very much improved in appearance and in value. Although this is doubtless the least valuable of all the species in cultivation, it is still a bark which may

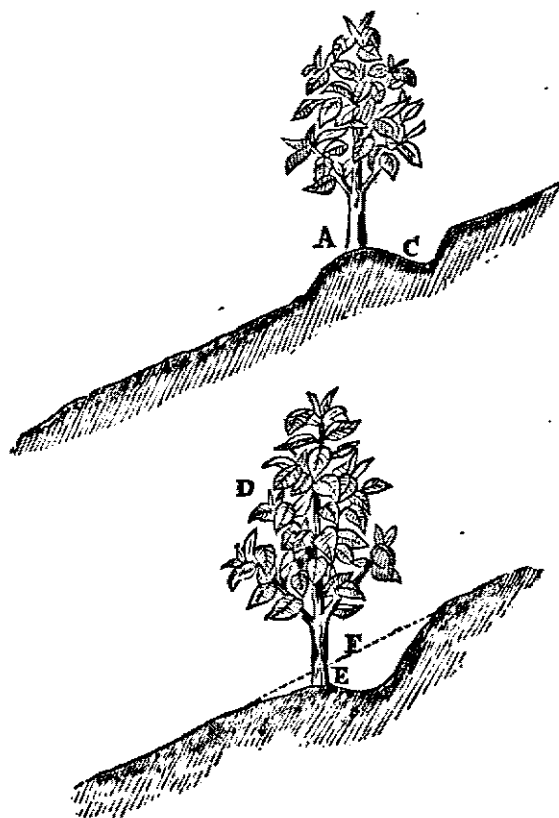
ultimately be turned to account. The *C. Lanceolata*, which we received from Java, has turned out to be only a variety of *C. Pahudiana*. The *Chinchona Lancifolia*, also from Java, promises to be a very valuable species; it is hardy and well suited to the climate, but being of slow growth, its cultivation will be less profitable than the varieties of *C. Officinalis*, which it appears to resemble in its requirements, and apparently grows as well upon grass as upon forest land.

7. *Cultivation on the open ground.*—This year a large extent of grass land has been planted, principally with the varieties of *C. Officinalis*, and these seem to succeed quite as well upon the grass as upon the forest land, especially when the land is trenched, and by this means we may convert a large portion of the numerous grassy hills, so common on the plateau of the Neilgherries, into forest. All the species of *Chinchona* are found to thrive best when fully exposed, a little shading by turf, wood, or fern, only being necessary to protect the plants when young. The system of staking so extensively used in the early part of our operations has been discontinued, except in such places as are exposed to the full force of the south-west monsoon.

8. *Cultivation under the shade of living trees.*—This system of cultivation has been entirely discontinued, as our experience proves that none of the species of *Chinchona* can be successfully grown under living shade. Even the *C. Calisaya* is injured when grown in this manner, while the stems of our plants of *C. Succirubra* and *C. Condamenia*, under dense shade, at four years' of age, are only a little thicker than a quill, and many of the plants have died altogether from drip and damp during the monsoon. The more the plants are exposed to light and air, the more robust is their growth, and greater the deposit of alkaloid.

9. *Cultivation: results obtained in, by private Planters.*—Numerous *Chinchona* planters at first entered the field, but several have recently had to dispose of their plantations, in consequence of their limited means not enabling them to carry the cultivation to a successful issue; others being unable to meet the heavy annual rent of two rupees per acre charged for forest lands on these hills, have been compelled to relinquish them. These results have been mainly brought about by the monetary crisis of last year. Some of the planters, however, have made rapid strides with their cultivation; among the most promising plantations are those of Mr. Money, Colonel Denison, Mr. Rohde, Major and Mr. Morgan, and Captain Jennings; these plantations are all in a very promising condition, and if carried on with the same perseverance will, in a few years, add to the exports of India a large supply of "Peruvian bark."

10. *Cultivation: accumulation of earth around the stems injures or destroys the plants.*—On examining private plantations, it was found that many fine plants were destroyed by earth being washed down, falling or being thrown around the stems of the plants in weeding. When the stems are covered for an inch or two above the collar with earth, a fungus attacks the bark, especially in wet weather. Fine plants of three or four years' growth are destroyed in a few days by this fungus, and the sudden death of plants, which a few days before were in the utmost health and luxuriance, so discourages planters unacquainted with the cause, as to lead them to suppose that something in the soil suddenly blasts the plant, and that sooner or later the whole may be destroyed in the same way.



11. To avoid the loss and disappointment likely to arise from the above cause, the plants should be placed on hillocks of earth cut out from the side of the hill, and slightly raised as at A., with a drain of a few inches in depth cut around on the hill side, as at C.; thus preventing the wash of earth around the stem of the plants. A plant in danger of being destroyed is shown at D., the loose earth having fallen down from the hill and covered the stem above the dotted line at the crown of the root at E. to the dotted line at F. Fermentation appears to set in on the covered bark, and is immediately followed by a fungus, which entirely destroys the texture of the bark and causes the death of the plant.

12. Formation

12. *Formation of Alkaloids.*—The result of the analysis by Mr. Howard* of the fifth remittance of our Neilgherry bark is most satisfactory and encouraging. The quantity of alkaloid already obtained is unequalled by the finest selected samples of matured South American bark. In our bark also the alkaloid is found in a state of greater purity and more easy of separation and crystallisation, while the yield of the superior alkaloid (quinine) is much higher in proportion to the other alkaloids. Thus our barks are at present unequalled in value, but great as are the results already secured, they are of such a nature as to indicate to

* REPORT of an Analysis of the Fifth Remittance of Bark from India, by J. E. Howard, Esq., F.L.S., dated 4th February 1867.

To the Under Secretary of State for India.

Sir,

I HAVE to report that the specimens of bark removed from trees in September and October 1866 reached me in good condition. The No. 1 specimen shows at once its superiority, and approaches nearly in appearances to the fine Red Bark grown in South America. No. 2 does not differ much at first sight, except in the absence of lichens, from No. 3. Amongst the barks of this parcel suited for sale at public auction, the broker at once selected the specimen of *C. Pahudiana*, as the most likely to give satisfaction, and as likely to realise at the present time from 1 s. 6 d. to 1 s. 8 d. per pound. Next to this, and at about the same value, comes No. 6, which is very much like the original specimen of this bark, as gathered by Mr. Cross, and now in my possession, together with a very well-preserved specimen of a flowering branch of this sort, the *Colorada del Rey* of Pavon, and now named *C. Officinalis*, var *Bonplandiana*. (See Mr. Markham's memorandum, at p. 5 of the Parliamentary Return (Chinchona) of 18th June 1866.) I make this correction on the strength of the corresponding appearance with the specimen brought by Mr. Cross, and beg to direct particular attention to the discrimination of the varieties of *C. Officinalis*, which, though classed together in some returns, and in others declared to be "not distinguishable," will be seen to be of totally different value for cultivation. Of this the *C. Officinalis*, var *Crispa*, is a remarkable illustration. I pointed out in 1852 the great inferiority of produce in alkaloids of this, the "fine Loja bark" of modern commerce, to the original Loja barks. This characteristic is not altered by the new place of growth, and this sort also preserves its peculiarly black appearance, and its very crisp fracture, from which peculiarities it was called *Cascarilla Crespilla Negro* by the Spanish dealers. It is, however, no longer noted in its new place of growth for the aroma (compared by Professor Guibourt to that of tobacco), nor has it the same pleasing appearance as when grown on the mountains of Loja. It would fetch probably 1 s. 4 d. to 1 s. 5 d. per pound in the market. The remaining parcels would not at first command a ready sale, as they differ so widely in appearance from any now in the market.

The quantity sent this time, especially of the earlier numbers, was more favourable for examination, affording the opportunity of correction by a second or third analysis of any point left obscure, an opportunity which I should desire for a future re-examination of No. 6, though I do not suppose that the result would be more favourable than it is this time.

No. 1. *C. Succirubra*.—Third crop of bark, renewed under moss:

Crystallised sulphates, per 100 parts	8.45
Alkaloids, soluble in Ether, viz., Chinchonidine and Quinine	1.14
Insoluble in Ether (Chinchonine)	0.20
	9.79

Memo.—The sulphates (of mixed Quinine and Chinchonidine) refine well, but do not stand the Ether test.

No. 2. *C. Succirubra*.—Original bark, six months under moss:

Crystallised sulphates	4.57
Alkaloids soluble in Ether, Chinchonidine and Quinine	3.78
Insoluble in Ether, Chinchonine	0.80
Chinchonine	0.11
	0.91
	9.26

Memo.—The sulphates as No. 1, but less easily refined.

No. 3. *C. Succirubra*.—Original bark, unmossed:

Crystallised sulphates	4.50
Alkaloids soluble in Ether	1.71
Insoluble in Ether, Chinchonine crest	0.40
Chinchonine	0.34
	0.74
	6.95

Memo.—The sulphates as under No. 2.

No. 4. *C. Officinalis*, var *B. Condaminia* (*Bonplandiana*?) Second crop of bark renewed under moss:

Crystallised sulphates	6.52
Alkaloids soluble in Ether, Quinine and Chinchonidine	1.35
Insoluble in Ether, Chinchonine	0.15
	8.02

Memo.—The sulphate refines well, and stands the Ether test.

No. 5. *C. Officinalis*, var *B. Condaminia* (*Bonplandiana*?) Original bark, nine months under moss:

Crystallised sulphates	6.66
Alkaloids soluble in Ether, Quinine and Chinchonidine	0.56
Insoluble in Ether, Chinchonine	0.15
	7.37

to a certainty that still greater results will be obtained by each successive year's growth. Hence in two or three years we may reasonably expect our barks to yield 12 or 15 per cent. of crystallised sulphates.

13. The

Memo.—As No. 4.

No. 6. <i>C. Officinalis</i> , var <i>B. Condaminia</i> (<i>Bonplandiana</i> ?) Original quill bark under moss :									
Crystallised sulphates	-	-	-	-	-	-	-	-	2.58
Alkaloids soluble in Ether, Quinine and Chinchonidine	-	-	-	-	-	-	-	-	2.10
Insoluble in Ether, Chinchonicine	-	-	-	-	-	-	-	-	0.05
									4.73

Memo.—As No. 5.

No. 7. <i>C. Pahudiana</i> .—Original bark, nine months under moss :									
Crystallised sulphates	-	-	-	-	-	-	-	-	0.581
Alkaloids soluble in Ether, Quinine chiefly	-	-	-	-	-	-	-	-	0.180
Insoluble in Ether, Chinchonicine, a trace	-	-	-	-	-	-	-	-	—
									0.761

Memo.—The Quinine refined (with some loss) and separated from a very little Chinchonidine (apparently) gave 0.580 per cent.

No. 8. <i>C. Officinalis</i> , var <i>Crispa</i> .—Original bark, unmossed :									
Crystallised sulphates	-	-	-	-	-	-	-	-	0.259
Alkaloids soluble in Ether, chiefly Quinine	-	-	-	-	-	-	-	-	0.370
Insoluble in Ether, Chinchonicine, a trace	-	-	-	-	-	-	-	-	—
									0.629

Memo.—The Quinine refined as above, still retaining a characteristic tinge of green, gave 0.590 per cent. Two specimens of this fine Loja in 1851 and 1854 gave me,—

1854—A particular fine and unmixed parcel :									
Quinidine and uncrystallised Quinine	-	-	-	-	-	-	-	-	0.40
Chinchonine	-	-	-	-	-	-	-	-	0.03
									0.43
1851—Another parcel, slightly mixed with “rusty brown” :									
Quinidine	-	-	-	-	-	-	-	-	0.57
Chinchonine	-	-	-	-	-	-	-	-	0.06
									0.63

(See Pereira's “Mat. Med.” Vol. II., p. 1,639, and “Pharmaceutical Journal,” August 1854.)

I trust that these trials will be useful in the guidance of the cultivation in India. It is evident that the plan adopted in No. 1 is the best. This was practised to some extent in the old times of collection of the Loja barks (as described by Ruiz in a manuscript in the British Museum, under the name of *Cascarillas Resacadas*), but unless the bark is covered with moss immediately, as discovered by Mr. McIvor, the sub-jacent woody portion suffers serious injury. On the other hand, if this is attended to, the operation may be repeated with advantage, increasing as it would seem for every time of renewal. Not only is the gross per-centage of alkaloids larger in the last decortication, but of this a more considerable per-centage consists of Quinine, and that less intimately combined with the yellow colouring matter, so as to be more easily purified. The structure reminds one of the granulated formation of flesh over a wound, and does not exhibit the customary liber fibres, or at least in a very much smaller proportion to the mass of the bark. This great richness in alkaloids does not seem to consist, therefore, with the views entertained by Wigand and others, that these liber fibres are the seat of the alkaloids. The improvement is less apparent in the present sample of the *C. Officinalis* (No. 4), but it is probable that some slight alteration might add a large portion of the at present uncrystallised 1.35 per cent. of alkaloid soluble in Ether to the previous amount of crystallised sulphates. In the meantime, the examination of No. 4 and No. 5 discloses a most gratifying success, in the excellence of what I conclude to be the predominant variety cultivated in India.* It is only in very few instances that the best Bolivian bark approaches the good quality which this Colorado del Rey has already attained in India.

* 753,272 plants out of 1,123,645 in May 1866. See “Report,” p. 253.

I have not yet had specimens for examination of the East Indian *C. Officinalis* var *Uritusinga*, but have reason to suppose this must also be a valuable species, whilst it must be evident that the variety *Crispa* should not be propagated, as it will not repay the expense of cultivation. The same remark, in my opinion, applies to the *C. Calisaya*, var *Frutex* (as the sort hitherto chiefly cultivated is very properly named by Mr. McIvor); also to the *C. Pahudiana*, which yields me much the same amount of alkaloid soluble in Ether that it has done to Dr. De Vry. It is a pity to plant this sort; but where, as in Java, it is so extensively grown, it were equally a pity, as I think, not to turn the bark to some useful purpose in the way of decoctions.

† “Return,” p. 203, &c.

I think the variety of *C. Officinalis*, which bore the name of *Cascarilla Amarilla del Rey*, and which would now be *C. Officinalis*, var *Bonplandiana lutea*, should also be introduced into the Indian cultivation. The bark of this sort fetches a high price in the market, as it is excellent for pharmaceutical preparations, and contains Quinine in a very pure state.

It seems to me that none of the small quill barks intended for sale to the druggists should be mossed, as the natural appearance of the bark would be more acceptable to the general dealer.

The effect of the application of moss for a few months to No. 2 does not show, as compared with the original unmossed bark of No. 3, so much real advantage as might have been expected. There is an increase in alkaloid, but this bears more upon the uncrystallisable portion of the quinine (as I ascertained by repeated experiment), and also upon the chinchonine, which was apparently doubled in the mossed bark at the expense of the chinchonicine. I cannot account for this fact, but perhaps Mr. McIvor may gain some light upon it. The chinchonine in these two samples was obtained in a beautifully crystalline form as alkaloid, and afterwards in its characteristic crystallisation as sulphate. Chinchonicine, the residuary product insoluble in Ether and of rather uncertain composition. On the whole, the present remittance of barks is unquestionably the most instructive, and the most encouraging that I have had the opportunity of examining from India,

13. The samples of bark forwarded for this analysis were not selected merely with a view of ascertaining the present maximum yield of alkaloid, but principally with a view of testing practically and by experiment the exact conditions required to increase the alkaloids, and the period necessary under different conditions for the inferior to pass into the superior alkaloids. The following conditions all more or less affect the yield of alkaloids, and the time necessary to transform one into the other. The density or sparseness in the covering of moss in barks thus treated, the condition of the soil, &c. Trees with abundant and luxuriant foliage always yield more alkaloid than trees with spare foliage. Trees with the foliage fully exposed to light and air, while their stems are under dense shade, are rich in alkaloids. These conditions affect the yield of alkaloids in nearly the same ratio in all the species, but individual plants of the same species are occasionally found which yield permanently more alkaloids than others; this seems to arise from a peculiarity in the individual, and may secure great results if taken advantage of.

14. It is of the utmost importance that we should thoroughly understand the true value of the above conditions, and the effects they produce to enable us to take advantage of them to the fullest extent. For this reason our samples of bark have been submitted from time to time for analysis, as it was most desirable that the effects on the product of alkaloids should be established by the independent and undoubted authority of Mr. Howard, and the more so in consequence of that gentleman being uninformed of the exact conditions under which the bark was produced. For the above reasons the result of our analysis do not enable us to pronounce with certainty the superiority of one species over another, and until each species has been placed under like conditions, we cannot form a decided opinion of their relative value. In paragraph 5, Mr. Howard observes that the variety *C. Crispa*, and also *C. Pahudiana*, should not be propagated, as they will not repay the expense of cultivation. This is so far correct with reference to *C. Pahudiana*, the bark of which has already been subjected to some of the most favourable conditions for the production of alkaloids, but not without advantage; and although this is no doubt the least profitable species in cultivation, still it is susceptible of improvement, and we may yet hope to cause the bark of this species to produce as much alkaloid and as valuable a bark in the market as the average barks of South America. With the *C. Crispa* the case is quite different. The bark of this plant submitted for analysis was taken from a plant not improved by art, and on which no care had been bestowed further than ordinary cultivation. The object of submitting this bark to analysis was to see to what extent the yield of alkaloids could be increased in the same plant when placed under different conditions, and this was done immediately on the removal of the bark, which formed the subject of the last analysis, and already the alkaloids have increased fourfold, therefore this species will prove valuable. As an example, I would mention that specimen No. 6 of Mr. Howard's Report of 1865 of *C. Condamenia* bark, gave 1.50 per cent. of alkaloids; of this 0.90 was crystallised sulphates, while renewed bark from the same tree gives in his present analysis 8.20 per cent. of alkaloids with 6.52 of crystallised sulphates. With reference to paragraph 8 of Mr. Howard's Report noted above, I would observe that the application of moss, in the first instance, increases the inferior alkaloids, as observed in No. 2 of the present sample, and especially in No. 3 of the samples submitted for analysis in 1865. The transformation is a matter of time, as renewed bark from the same plant as yielded in No. 3 of 1865, of which 2.72 per cent. only was crystallised sulphate out of a total of 9.72 of alkaloid, gives, in the present analysis, 9.79 of alkaloid, of which 8.45 is crystallised sulphates. This is an improvement almost inconceivable, and a longer period or denser covering would have added the greater portion of the 1.14 uncrystallisable quinine to the crystallised sulphates. In our experiments we have found all changes of alkaloid in the bark, by whatever condition effected, to be more or less gradual.

15. *Chinchona, new varieties introduced, remarks on.*—Of the Bolivian Chinchonas raised from Mr. Money's seeds we have at least five distinct varieties, four of which are entirely new. Two of these varieties give promise of succeeding in this climate, but the others are unpromising, and die off rapidly from any sudden change from drought to damp, or from damp to drought, and which, as our climate is liable to sudden variations, renders the cultivation of these varieties precarious and troublesome, although the difficulties in this respect are not insurmountable were it certain that all or any of the varieties would, by an additional product of alkaloids, repay the extra cost and trouble attendant on their cultivation. This is by no means certain, as our *C. Condamenia*, in its present stage of growth, has produced a quantity of alkaloid which, in quantity and purity, has not been exceeded by the finest and mature Bolivian barks of commerce.

16. In my previous reports attention was drawn to the circumstance of the failure of the seeds of the Pitayo barks, with a suggestion that a fresh collection of the seeds should be made and transmitted to India, in order to add this very valuable species to our collection of quinine yielding chinchonas. Without the very valuable Pitayo barks our collection is still incomplete. I would, therefore, respectfully submit, for the favourable consideration of Government, the desirableness of making a further attempt to secure this species.

17. *Establishments.*—It affords me much satisfaction to be able to report the hearty co-operation and zeal with which my assistants have carried out the various duties entrusted to their care. Mr. Batcock, deputy superintendent, has shown much diligence, attention, and skill, in carrying out the works connected with the Propagating Department and Botanical Gardens, and in disbursing pay to the various establishments and auditing of accounts.

Mr. Charles Dawson, the assistant superintendent at Neddivuttum, has been most attentive to his duties, and is gaining a better knowledge of the treatment and management of the plants. Mr. Meakin, assistant superintendent at Malakoondah, has pressed forward the work in this plantation to the best of his ability, and under serious difficulty in consequence of imperfect communication. Mr. Sherman, the overseer in charge of the Hooker estate, has carefully carried out his instructions, and been most successful in his planting operations. Mr. McDonald, the overseer in charge of the Wood estate, Pykara, has been attentive and careful. In the Office Establishment, Narrainsawmy Naidoo and Mr. McNair continue to give every satisfaction in the performance of their duties as office manager and pay clerk.

18. *Convict labour.*—The convicts continue to work cheerfully and contentedly, and perform more work than can be obtained from free labourers. On the Dodabetta plantation they are employed under the supervision of Mr. Gibson, a West Indian planter, who has shown much skill in the arrangement and direction of their labour. Here the health of the convicts has been excellent, their conduct good, no escapes or attempts at escape, but few instances of malingering, and no mortality. On the Neddivuttum plantation the labour of the convicts has been very satisfactory; here, however, there have been two deaths, three escapes have been effected, and only one of the convicts re-captured. The men, as a whole, are healthy and contented, the deaths having arisen from diseases contracted in the plains, and the escapes effected by men of the wandering tribes who are impatient of restraint, and their habit of life renders them almost certain to evade re-capture. The system of reward at the rate of six pice for a quarter of a day's work is still paid to the convicts; this stimulates exertion, and induces them to perform a much greater work than could otherwise be procured from them. Here the convicts are employed under Mr. Bunkall,

19. This year free labour has been plentiful, many of the labouring population of the Mysore country having been induced by the scarcity of provisions to leave their homes and visit the hills in search of employment.

20. *Progress of Operations.*—In the Propagating Department a new temporary house has been erected feet in length by feet wide, and as the necessity for extensive propagating operations has now ceased, no further accommodation will be required in this branch. The total number of plants produced from the beginning of the undertaking to the 31st March 1867 is 1,926,044, exclusive of plants distributed to the public, the number of plants propagated during the 11 months being 803,399. On the 31st March 1867 the number and distribution of our plants stood as follows:—

Plants permanently planted out on the plantations	-	-	-	-	557,651
Plants in open-air nurseries	-	-	-	-	299,464
Rooted plants and seedlings in propagating houses	-	-	-	-	1,069,029
Estimated number of unrooted cuttings and untransplanted seedlings	-	-	-	-	100,000
Total	-	-	-	-	2,026,044

21. On the Neddivuttum plantations 87 additional acres have been planted, making the total number of acres under cultivation on these plantations 444; the planting of this season has taken place principally on the Kilgraston and second Denison plantations; and on the Hooker plantation 26 acres have been planted. Here the land has been inclosed, and 42,000 pits prepared for the reception of plants next season, while on the Kilgraston estate 83,000 pits have been prepared for planting. At the gaol a new range of police lines, covered with corrugated iron, has been completed, permanent cook-rooms erected, and a bungalow for the accommodation of the gaoler and apothecary and their families; the verandah rooms vacated by the gaoler and apothecary will be prepared for a gaol hospital.

22. On the wood plantation at Pykara 21 acres of land have been planted during this season, which gives a total of 113 acres under cultivation on this plantation. A fence has been completed around the plantation to exclude wild animals, especially the elk, as they crop the young plants, and have done serious damage, especially in the avenue.

23. On the Dodabetta plantation the work has made very satisfactory progress; here 88 acres have been brought into cultivation this year, making the total extent of land under cultivation on these plantations 312 acres. Adjacent to the gaol a dwelling house for the gaoler and overseer of convicts has been completed.

24. On the Malakoondah plantations 35,000 pits have been made, nurseries finished, and stocked with a like number of plants. Here the gaol buildings and police lines have been completed, but until a road has been made to this plantation, it is considered undesirable to locate prisoners there, as a danger exists of the supplies being cut off during the monsoon, in consequence of the roads being unbridged and rendered otherwise almost impassable.

25. *Botanical Gardens.*—The plan in Appendix D. shows a sketch and description of the gardens. The improvements effected in them will be observed by comparing this with the old plan E. It is proposed, during the present year, to begin to lay out the upper portion noted "Proposed new Botanical Garden." I would respectfully suggest that, with the approval of Government, this portion be laid out strictly as a botanical garden, "according

ing to Lindley's natural system," each group or natural order to be presented, so far as practicable; and this can be done to a greater extent here than in perhaps any other part of the world, where plants of temperate climates grow freely alike with sub-tropical, and even tropical, plants. Thus great facilities are offered for the formation of a valuable botanical garden; our collection of plants are already extensive, and opportunities for obtaining more yearly increasing. The advantages of this arrangement would interest, as well as instruct, and prove of great practical value in this country, by showing the variations of climate which plants are susceptible of bearing without injury. The portion marked "Economical Garden" to be reserved for the growth of useful and economic plants only, where could be seen at a glance the plants yielding the various products of commerce. With this arrangement a catalogue would be of great importance and convey much useful information, which is not the case at present, the plants being arranged for beauty and effect, rather than utility and economy. Several interesting plants have been added to our collection during the present year; to Dr. Cleghorn we are indebted for seeds of various Himalayan stone fruits and ornamental trees and shrubs; to Dr. Hooker for the Shiraz tobacco, the true jalap (*Convolvulus Jalapa*), the false jalap (*Convolvulus Chicorhiza*), the Dragon's Blood (*Dracæna Draco*), and other ornamental and economic plants kindly brought out by Mr. Broughton; to Major Hutton for seeds of handsome new varieties of *Veronicus*; and to Captain Beddome for some rare and interesting ferns.

26. The following Table exhibits the distribution of garden plants and seeds for the official year 1866-67 :—

	Fruit Trees and Shrubs.	Timber Trees.	Shrubs and Flowers.	Collection of Seeds.	Amount.
					Rs. a. p.
May - - - - 1866	- -	100	189	34	184 12 -
June - - - - "	78	4,000	111	31	250 6 -
July - - - - "	34	925	368	19	186 12 -
August - - - - "	36	-	193	37	234 4 -
September - - - - "	12	6	49	21	91 8 -
October - - - - "	6	-	74	24	86 - -
November - - - - "	50	-	35	6	44 10 -
December - - - - "	20	100	22	4	34 2 -
January - - - - 1867	- -	-	41	5	37 - -
February - - - - "	- -	-	4	10	22 10 -
March - - - - "	- -	25	64	8	35 8 -
Total Distribution - - -	216	5,156	1,150	199	1,207 8 -

27. *Tea Plantation.*—The experimental tea plantation has not been extended, and the number of plants remain as formerly, namely 13,500. There is a great and marked difference in the individual plants of tea, as regards both yield and quality, some plants producing from four to five times as much tea as others, it is thus obvious that for profitable cultivation, only the most productive plants should be propagated; and as individual qualities can only be perpetuated by cuttings or grafting, the plants must be propagated by one or other of the above modes; cuttings are the least expensive, and quite as effectual.

28. *Concluding Remarks.*—It will be observed, by the above details, that during the present year our operations have made more than usual progress; the buildings, roads, inclosing and draining the extent of our plantations (with the exception of Malakoondah), are nearly completed, 222 additional acres of land have been planted, making the total number of 895 acres under cultivation.

29. In conclusion, I beg to tender my acknowledgments to the Madras Government for the liberality in which my suggestions have been met, and for the interest they have shown in promoting the interests of the public in this national undertaking; to Mr. J. E. Howard, and Mr. Clements R. Markham of the India House, my best thanks are due for most important and valuable information.

(signed) W. G. McIvor,
Superintendent,
Government Chinchona Plantations.

Ootacamund, 25 April 1867.

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Appendix (A.)

SANCTIONED ESTIMATED COST of each CHINCHONA PLANTATION

PARTICULARS.	Operations preparatory to Receipt of Plants.	Superintendent and Office Establishment.					Nursery Department.					Dodabetta		
	1860-61.	1861-62. 1862-63.	1863-64.	1864-65.	1865-66.	1866-67.	1861-62. 1862-63.	1863-64.	1864-65.	1865-66.	1866-67.	1861-62. 1862-63.	1863-64.	1864-65.
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
Grant for the propaga- tion of sites - - -	2,000	-	-	-	-	-	-	-	-	-	-	-	-	-
Establishments, includ- ing salaries, &c. - -	-	9,550	5,880	8,180	8,768	7,773	7,629	4,609	3,948	4,048	3,711	7,680	5,700	7,248
Buildings - - -	-	-	-	-	-	-	1,200 2,000	-	800	-	-	560	-	600
Tool and store rooms -	-	-	-	-	-	-	-	-	-	-	-	250	-	250
Coolies' quarters - -	-	-	-	-	-	-	-	-	-	-	-	700	-	-
Felling - - -	-	-	-	-	-	-	-	-	-	-	-	1,900	-	550
Clearing - - -	-	-	-	-	-	-	-	-	-	-	-	1,780	-	550
Pitting - - -	-	-	-	-	-	-	-	-	-	-	-	1,900	-	550
Carriage of plants - -	-	-	-	-	-	-	-	-	-	-	-	150	-	150
Planting and shading -	-	-	-	-	-	-	-	-	-	-	-	700	-	200
Trenching - - -	-	-	-	-	-	-	-	-	-	-	-	1,800	-	500
Inclosing - - -	-	-	-	-	-	-	756	-	-	-	-	5,850	-	550
Road making - - -	-	-	-	-	-	-	-	-	-	-	-	2,025	-	-
Tools - - -	-	-	-	-	-	-	-	-	-	-	400	1,200	-	800
Contingencies - - -	-	-	-	-	-	95	196	-	300	500	600	1,599	-	500
Clothing - - -	-	-	-	-	-	-	-	-	-	-	100	-	-	-
TOTAL - - - Rs.	2,000	9,550	5,880	8,180	8,768	7,868	11,781	4,609	5,048	4,548	4,811	28,094	5,700	12,448

ACTUAL EXPENDITURE on each CHINCHONA PLANTATION

PARTICULARS.	Operations preparatory to Receipt of Plants.	Superintendent and Office Establishment.					Propagation and Nursery Department.					Dodabetta		
	1860-61.	1861-62. 1862-63.	1863-64.	1864-65.	1865-66.	1866-67.	1861-62-63.	1863-64.	1864-65.	1865-66.	1866-67.	1861-62. 1863.	1863-64.	1864-65.
	Rs. a. p.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs. a. p.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
Establishments, includ- ing salaries, &c. - -	114 2 3	9,690	6,437	7,971	8,142	7,715	5,953 11 6	3,440	3,478	4,539	6,536	3,755	2,605	7,083
Buildings - - -	-	-	-	-	-	-	6,225 - -	3,000	1,500	-	1,504	885	-	7,250
Tool and store rooms -	-	-	-	-	-	-	-	-	-	-	-	-	230	-
Coolies' quarters - -	-	-	-	-	-	-	-	-	-	-	-	250	500	-
Felling - - -	302 5 3	-	-	-	-	-	-	-	-	-	-	1,198	500	650
Clearing - - -	-	-	-	-	-	-	-	-	-	-	-	1,150	400	650
Pitting - - -	-	-	-	-	-	-	-	-	-	-	-	1,598	1,010	500
Carriage of plants - -	-	-	-	-	-	-	-	-	-	-	-	445	140	250
Planting and shading -	-	-	-	-	-	-	-	-	-	-	-	805	560	700
Trenching - - -	-	-	-	-	-	-	-	-	-	-	-	-	1,200	600
Inclosing - - -	-	-	-	-	-	-	-	-	-	-	-	2,800	-	357
Road making - - -	300 - -	-	-	-	-	-	-	-	-	-	-	1,300	2,070	1,000
Tools - - -	271 - -	-	-	-	-	-	-	-	-	170	-	698	600	499
Contingencies - - -	67 - -	-	-	50	200	-	-	-	450	700	383	584	500	800
Excavating - - -	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL - - - Rs.	1,054 7 6	9,690	6,437	8,021	8,342	7,715	11,678 11 6	6,440	5,428	5,409	8,423	15,448	10,315	20,339

Ootacamund, }
April 1867. }

Appendix (A.)

from Commencement of Operations to 31st March 1867.

Plantations.		Neddivuttum Plantations.					Pycara Plantations.				Malcoondah Plantations.				Total.
1865-66.	1866-67.	1862-63.	1863-64.	1864-65.	1865-66.	1866-67.	1862-63. 1863-64.	1864-65.	1865-66.	1866-67.	1863-64.	1864-65.	1865-66.	1866-67.	
Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2,000
8,790	10,738	13,476	15,348	12,360	16,260	12,856	4,033	6,564	7,014	2,860	-	5,600	3,120	4,225	2,07,966
7,000	2,500	2,080	-	750	8,500	3,300	{ 1,530 } { 2,000 }	-	-	-	-	750	2,500	1,075	37,145
-	200	250	-	400	-	-	250	350	375	-	125	150	-	400	3,000
200	-	2,000	-	300	400	300	1,000	200	-	100	500	250	-	200	6,150
-	400	4,500	-	900	1,500	800	1,500	900	750	800	6,150	900	-	900	22,450
-	300	4,500	-	900	1,500	650	1,500	900	750	500	-	900	-	800	15,530
-	800	5,000	-	900	2,000	400	-	900	1,000	700	-	900	-	800	15,850
400	1,000	900	-	400	900	1,000	-	350	450	200	-	50	-	300	6,250
350	700	1,100	-	350	900	900	1,300	250	450	500	-	-	-	100	7,800
600	308	4,000	-	1,100	900	-	8,000	1,250	700	-	-	1,250	-	542	20,950
-	500	3,900	-	-	1,350	600	750	-	550	200	375	300	650	500	16,831
800	-	1,520	-	550	1,000	-	1,350	200	600	450	675	1,500	500	433	11,603
525	1,000	1,282	-	900	1,000	1,200	1,282	500	-	600	641	700	500	600	13,130
1,000	700	3,834	-	600	1,200	1,300	2,046	350	500	500	846	250	300	500	17,716
-	150	-	-	-	-	200	-	-	-	50	-	-	-	50	550
19,665	19,294	48,342	15,348	20,410	37,410	23,506	26,541	12,714	13,139	7,460	9,312	13,500	7,570	11,425	4,04,921

from Commencement of Operations to 31st March 1867.

Plantations.		Neddivuttum Plantations.					Pycara Plantations.				Malcoondah Plantations.				Total.
1865-66.	1866-67.	1861-62-63.	1863-64.	1864-65.	1865-66.	1866-67.	1862-63.	1864-65.	1865-66.	1866-67.	1863-64.	1865-66.	1866-67.		
Rs.	Rs.	Rs. a. p.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs. a. p.	
5,235	6,406	9,195 0 0	5,874	12,507	12,052	15,350	1,608	1,880	2,086	1,935	971	1,671	3,050	1,56,587 13 9	
4,500	3,023	1,560 0 0	1,000	8,550	4,000	3,294	1,683	-	-	-	850	890	448	50,142 0 0	
200	-	350 0 0	500	450	169	-	275	250	320	-	300	-	-	3,044 0 0	
308	-	1,750 0 0	1,000	500	400	-	1,650	250	-	-	250	-	-	6,858 0 0	
1,300	257	3,280 7 3	2,200	800	-	983	3,500	750	1,500	-	3,251	-	-	20,471 12 6	
1,300	78	1,500 0 0	2,200	500	700	700	3,125	750	1,500	322	1,625	825	415	17,740 0 0	
2,000	384	2,538 7 3	2,000	700	1,500	913	1,000	600	1,355	-	738	750	240	17,826 7 3	
700	250	1,440 1 9	750	302	959	300	65	350	600	200	-	-	150	6,961 1 9	
2,000	621	1,540 1 8	898	500	1,000	939	65	300	400	150	-	-	250	10,728 1 8	
800	900	1,972 0 0	1,780	1,135	560	1,104	-	1,000	700	300	-	200	200	12,291 0 0	
1,200	350	1,550 0 0	900	-	760	280	679	-	750	200	300	750	-	10,876 0 0	
1,000	625	2,100 0 0	2,000	327	-	1,030	1,500	504	400	662	1,377	800	22	17,017 0 0	
886	450	1,100 0 0	868	650	900	239	1,500	1,000	250	200	1,000	-	350	11,431 0 0	
1,510	616	1,255 0 0	850	1,200	1,800	617	400	250	350	160	225	250	135	13,352 0 0	
-	450	-	-	-	-	1,195	-	-	-	-	-	-	-	1,645 0 0	
22,738	14,309	31,041 1 11	22,820	28,181	24,740	26,944	17,050	7,884	10,811	4,129	10,887	6,136	5,260	3,56,971 4 11	

(signed) W. G. McIvor,
Superintendent, Government Chinchona Plantations.

(B.)

METEOROLOGICAL OBSERVATIONS made on the Government Chinchona Plantations at *Neddivuttum*, from 1st May 1866 to 31st March 1867.

MONTHS.	Hygrometer.		Maximum in Shade.	Minimum in Shade.	Solar Radiation.	Terrestrial Radiation.	Rain in Inches.	Days with Rain.	Days without Rain.
	Dry Bulb.	Wet Bulb.							
May - -	69.85	61.28	66.71	59.93	-	68.17	3.40	9	22
June - -	60.09	58.71	60.50	57.67	-	59.38	32.01	21	9
July - -	57.78	57.10	60.31	55.24	-	58.88	20.62	28	3
August -	58.52	57.72	59.27	54.83	-	58.25	22.18	25	6
September -	59.40	57.23	60.09	53.90	-	56.59	10.85	20	10
October -	59.18	58.55	60.81	54.09	-	-	10.50	17	14
November -	58.64	55.05	-	-	-	-	0.65	4	26
December -	58.16	56.37	61.30	51.17	-	-	2.73	4	27
January -	56.34	52.08	58.03	45.80	-	-	0.00	0	31
February -	63.19	57.05	65.21	56.64	-	-	0.02	1	27
March -	62.47	57.38	64.81	55.35	-	-	1.22	3	28
Total -	-	-	-	-	-	-	104.18	132	203
Mean -	60.33	57.14	61.70	54.44	-	60.25	-	-	-

(C.)

METEOROLOGICAL OBSERVATIONS made at the Botanical Gardens, *Ootacamund*, from 1st May 1866 to 31st March 1867.

MONTHS.	Hygrometer.		Maximum in Shade.	Minimum in Shade.	Solar Radiation.	Terrestrial Radiation.	Rain in Inches.	Days with Rain.	Days without Rain.
	Dry Bulb.	Wet Bulb.							
May - -	64.95	58.35	74.03	54.39	109.57	81.73	4.70	19	12
June - -	58.78	55.80	65.10	52.93	94.13	71.20	6.14	15	15
July - -	56.07	54.53	63.86	50.68	93.46	69.79	3.05	19	12
August -	56.90	55.61	66.48	50.64	100.15	71.43	2.66	20	11
September -	58.72	55.75	67.86	50.53	101.52	75.55	1.79	25	5
October -	58.02	55.78	67.61	51.68	104.42	70.55	10.38	20	11
November -	56.45	52.01	68.27	47.10	109.63	65.40	2.29	8	22
December -	57.16	53.44	68.26	46.48	108.39	63.00	5.11	9	22
January -	60.06	48.93	71.30	44.76	119.93	-	0.00	-	31
February -	62.15	61.43	73.67	45.89	127.74	-	0.39	1	27
March -	63.71	53.05	74.30	49.55	129.33	-	1.14	6	25
Total -	-	-	-	-	-	-	37.65	142	193
Mean -	59.36	54.07	69.16	49.51	108.93	71.08	-	-	-

Ootacamund, }
25 April 1867. }

(signed) G. Batcock, Deputy Superintendent,
Government Chinchona Plantations.

The new plan of the gardens, which accompanies this Report, will show the improvements effected since 1857. On the lawn, No. 6 in the old plan, a labyrinth has been laid down, the hedges formed of the rose *Gloire de Rosamere*. On the lawn, Nos. 11 and 5 in the old plan, a number of flower beds have been made and planted with florist's flowers, and the ornamental piece of water, No. 11, has been extended into a serpentine lake across the lawn. On the portion No. 21 of the old plan, an Italian parterre has been laid out and planted; a large octagonal bower is built in the centre, to be used as a band-stand, and also as an ornamental erection on the terrace; six circular basins have been built, intended as fountain basins, the jets, however, have not yet been fixed, but will be this year. Vases have been placed on the most prominent parts of the walls, each filled with suitable plants. This parterre necessarily involved a great amount of labour, on account of the deep excavations required; but its formation has produced a great improvement in the gardens, as the part now occupied by the lake was formerly a swamp in which nothing would thrive. On lawns 22 and 28 a number of beds have been formed and edged with daisies

daisies and forget-me-not; the jets are supplied by bamboos from a reservoir in the nursery grounds. On lawn 29 a large excavation has been made for the new fern house, which has been built, and the exterior covered with epiphytal orchids and ferns, the space round the house being laid out in box-edged beds and borders, filled with a miscellaneous selection of florist's flowers; in the wet parts ornamental basins have been made. Above this are shown, in the new plan, the Chinchona nursery and propagating houses, and to the north the site for the proposed Botanical Gardens; this site possesses a considerable diversity of soil and aspect, and now that a main road has been completed, access to every part of it is comparatively easy.

ORDER of the Madras Government, 20 June 1867.

1. His Excellency the Governor in Council considers that the results reported relating to the Chinchona plantations are most satisfactory, and will have pleasure in bringing to the notice of Her Majesty's Secretary of State Mr. McIvor's successful exertions in the promotion of this national undertaking.

2. The Government approve Mr. McIvor's suggestion, that a portion of the seed collected be distributed gratuitously to such planters as are likely to turn the supply to good account. A record of the distribution made will be kept, and appended to the periodical list of plants distributed.

3. The experiment of felling the trees for the supply of bark will be restricted to the area already fixed.

4. It is observed that the Home Government have expressed their intention to cause further steps to be taken for the collection of the seed of the Pitayo varieties.

5. The Government approve of Mr. McIvor's proposal to lay out the upper portion of the Government gardens at Ootacamund as a botanical garden, on Lindley's natural system.

6. They desire that, without any material extension of the tea plantation, Mr. McIvor will carry out his suggestion for propagating the more valuable individual tea plants by cuttings, as they manifest their qualities, so as to be in a position to supply a superior class of young plants in moderate quantities to any of the planters in the Presidency who may desire to secure them.

(signed) *J. W. Hudleston,*
Secretary to Government.

— No. 30. —

From the Secretary of State for India to the Government of Madras.

To His Excellency the Right Honourable the Governor in Council,
Fort St. George.

My Lord,

India Office, 8 November 1867.

Para. 1. I HAVE received and considered in Council your Despatches in the Revenue Department, of the dates noted in the margin, on the subject of Chinchona cultivation; and with reference to your Despatch, dated 13th May 1867, forwarding specimens of the bark of *C. officinalis*, I herewith transmit 40 copies of Mr. Howard's report of his analysis, the results of which are very satisfactory.

11 July 1867.
12 August 1867.
27 August 1867.
Dated 28 August 1867.

2. I have perused the annual report of Mr. McIvor, and the report of Mr. Broughton on the results of an analytical examination of the barks grown on the Government plantations, with much interest. Mr. Broughton appears to have entered upon his duties with much zeal, and to appreciate the importance of the numerous points connected with Chinchona cultivation, which require careful investigation. I trust that valuable results will be derived from his analyses.

I have, &c.
(signed) *Stafford H. Northcote.*

Enclosure in No. 30.

REPORT of an Analysis of the Sixth Remittance of Bark from India.

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

Sir,

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

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

Crystallised sulphates, per 100 parts - - - - -	2.46
Alkaloids soluble in ether, chiefly uncrystallised quinine† - - -	0.44
Insoluble in ether (chinchonicine and chinchonine)‡ - - -	0.86
	3.76

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

Crystallised sulphates - - - - -	2.92
Soluble in ether (chinchonidine and quinine) - - - - -	0.41
Insoluble in ether (chinchonicine and chinchonine) - - - - -	1.20
	4.53

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

Total weight of precipitated alkaloids - - - - -	2.43
Oxalate quinine - - - - -	1.40
Uncrystallised quinine - - - - -	0.17
Chinchonicine - - - - -	0.70
Resin and loss - - - - -	0.16
	2.42

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

Crystallized sulphates - - - - -	1.60
Soluble in ether (quinine and aricine?) - - - - -	0.61
Insoluble in ether (chinchonine), a trace.	
	2.21

Memorandum.—None of the above crystallised sulphates would perfectly stand the test, all containing a little chinchonidine. The same remark applies to a portion (the second crystallisation) of oxalate quinine.

I adopted for No. 3 the plan of securing the total weight of alkaloid in the first instance, as I was uncertain of any further result, having only 300 grains of bark to work upon, and that of poor quality. This plan is, however, deceptive, the alkaloids not being purified. The loss is also more than is apparent, since the amount of the oxalic acid must be added for minute accuracy.

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

The mossed *crespilla* bark is surprisingly improved by the treatment to which it has been subjected. I think that, in the former trial, some portion of the alkaloid must have been unconsciously lost in connection with the abundant colouring matter which distinguishes this sort; but with all this improvement, it scarcely equals No. 2, the strong-growing variety, or *C. officinalis*, var. *Bonplandiana*, in its natural state. This latter gave me, as last sent, more than 6.50 per cent. of crystallised sulphate, and is consequently by so much (about three times) more worth cultivating. The No. 3, *Uritusinga* bark, is remarkable

* It now resembles more the *Loja noueux* of Jussieu.

† The remainder probably chinchonidine. I neglected to substitute the word chinchonidine for the word quinine in treating of the var. *crispa* in my last report. The analyses in which it appears were quoted *verbatim* from Pereira, and were made 14 or 15 years ago, when accuracy as to this discrimination was not valued as it now is. I have no reason, from recent analysis, to believe that quinine is contained in the Loja barks.

‡ The amount of crystallised chinchonine is small in all the Loja barks.

remarkable for the small amount of colouring matter which it contains, and the consequent ease with which the alkaloids can be purified. It will probably yield a large amount of produce under good cultivation. No. 4, *C. Paludiana*, is improved by mossaing, but I have no confidence in it as a source of quinine, and believe it will prove to be most valuable as furnishing a new sort of "rusty bark," or "rusty crown bark," as it would probably be called in commerce, and, as I mentioned in my last, would command a good price in this way, if imported in long and slender quills.

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

— No. 31. —

From the Government of Madras to the Secretary of State for India.

Madras, 12 August 1867.

1. IN continuation of our Despatch, dated 25th April 1867, No. 28, we have the honour to forward herewith copy of the further report of Mr. Broughton, the Government quinologist, on the results of an analytical examination of the barks from the Government Chinchona Plantations, together with the sample of pure sulphate of quinine obtained from the bark of *C. officinalis*, var. *crispa*.

2. The samples of alkaloids prepared from the red barks were forwarded with our letter of the 25th April, above alluded to.

Enclosure in No. 31.

From J. Broughton, Esq., Quinologist to Government, to the Secretary to Government, Revenue Department, Fort Saint George, Ootacamund, 13 July 1867.

1. I BEG permission to complete, in the subsequent pages, the account of the results obtained in an analytical examination of the Chinchona of the Government plantations, the earlier part of which I had the honour of communicating in my Report dated 1st April 1867. This examination was absolutely required, in order to obtain as far as possible a knowledge of the existing conditions under which future work will have to be conducted.

2. It is for this reason also that I have paid special attention to the products of the Chinchona barks while in their fresh green state, before being subjected to those processes of drying and transit, which, I have reason to think, considerably modify their chemical nature. By having the plants themselves so near at hand I possess a great advantage, which will not fail to lead to valuable results. Bark in its fresh state.

3. In the Report above referred to, I had the honour of quoting some analyses of one of the varieties of Crown barks, namely, that of *C. Officinalis*, var. *Bonplandiana*. We possess, however, two other varieties of Chinchona *Officinalis*, respectively named vars. *Condaminea* and *Crispa*, and it appeared desirable to make a comparative examination of the bark of each under similar conditions of age, locality, elevation, &c. Crown Barks.

4. Analyses of two samples of the trunk bark of var. *Bonplandiana*, of three years eight months old, from Dodabet plantation, and grown on grass land, yielded the following results, calculated in per-centages of dry bark :— C. Officinalis, var. Bonplandiana.

Statement of Analyses.

	I.	II.
Total alkaloids - - - - -	3·84	3·91
Quinine - - - - -	1·64	1·83
Chinchonidine and Chinchonine - - - - -	2·20	2·08
Sulphate of Quinine obtained crystallised - -	1·5	1·61
Sulphate of Chinchonidine obtained crystallised -	1·74	1·80

The thickness of the finer specimens of this bark was about 0·12 in. It contained an average of 73 per cent. of water.

Var. Condaminea.

5. An analysis of the bark of *C. Officinalis* var. *Condaminea* yielded the following numbers:—

Statement of Analysis.

Total alkaloids - - - - -	4·08 per cent.
Quinine - - - - -	2·05
Chinchonidine and Chinchonine - - - - -	2·03
Crystallised Sulphate of Quinine obtained - -	1·54
Ditto - ditto - of Chinchonidine obtained -	1·70

The amount of water in this bark was 73 per cent. For this fine variety of Crown Bark this country is indebted to Mr. Howard.

Var. Crispa.

6. Analyses of the bark of *C. Officinalis*, var. *Crispa*, grown on grass land of the same age as the preceding varieties, yielded in per-centages of dry bark:—

Statement of Analyses.

	I.	II.
Total alkaloids - - - - -	3·72	3·81
Chinchonidine and Chinchonine - - - - -	1·42	1·54
Quinine - - - - -	2·30	2·27
Sulphate Chinchonidine obtained crystallised -	0·80	0·87
Sulphate Quinine obtained crystallised - -	1·95	1·75

Other determinations of the gross amount of alkaloids in this variety of bark yielded respectively 3·31 per cent., 3·70 per cent., and 4·1 per cent. The mean of results being, therefore, 3·73 per cent.

Discrepancy with Mr. Howard's analysis.

7. From a Report on this bark by Mr. Howard, dated February 1867, I observe that he arrives at very different conclusions respecting its value.* I have, however, spent much time in carefully verifying the grounds of my opinion, and have no hesitation in affirming that this variety of Crown bark is not essentially inferior in its yield of alkaloids to the other two. I believe the great discrepancy between Mr. Howard's analysis and my own, can be explained either by an unfavourable specimen of bark reaching him, or more probably by the quality being deteriorated by the mode of drying. It will also be observed that this bark contains Chinchonidine and not Quinidine. This result I have carefully corroborated by obtaining all the characteristic reactions of Chinchonidine. In examining its solution by polarised light, I obtained a strong rotation of the plane of polarisation to the left and not to the right, as in the case of Quinidine. The reactions of Quinidine I failed to obtain. I have the honour to forward a specimen of pure sulphate of Quinine obtained from this bark.

8. From

* "No. 8. *C. officinalis*, var. *crispa*.—Original bark unmossed :

Crystallised sulphates - - - - -	0·259
Alkaloids soluble in ether - - - - -	0·370
Insoluble in ether, chinchonicine, a trace.	

0·629"—P. 2 of Report.

"It must be evident that the var. *crispa* should not be propagated, as it will not repay the expense of cultivation."—*Ibid*, p. 2.

8. From the above data I am compelled to conclude that there is scarcely any difference of yield in the three varieties of *C. Officinalis* as grown on the Government plantations. I would place little stress on the variations in the amount of Chinchonidine, as indicating a constant peculiarity in either kind. It is very remarkable that the specimens of the bark of var *Bonplandiana*, which were one year older than those whose analysis is above given, and which were grown under partial shade, yielded little of this alkaloid, a circumstance which I had the honour of mentioning in a former Report.* Dr. de Vrij found that the *Calisaya* barks of Java were somewhat similarly affected, and contained more quinine when grown under partial shade. I think there are ground for believing that when the branches of our trees are sufficiently expanded to screen their bark from direct sunlight, the amount of Chinchonidine in these barks will be found to diminish. The substitution to a greater or less extent of quinine by Chinchonidine is a very general characteristic of all our best barks, though the range of replacement is wider in the red.

Similarity of Crown barks in yield.

Chinchonidine in Indian barks.

9. For the manufacture of pure crystalline salts of the alkaloids, the varieties of *C. officinalis* yield the most suitable barks in our possession. Their alkaloids crystallise as sulphates with singular ease, and are readily purified. The very considerable yield of such young trees (three years eight months) is worthy of special remark.†

Value of Crown barks.

10. The similarity in the amount of alkaloids yielded by the Crown barks is in harmony with the similarity of their botanical structure. The three varieties resemble each other so greatly that, except in the case of individual plants, which possess in a special degree the attributed marks of their variety, it is very difficult to distinguish them with certainty. They are all mingled on the plantations. Had it not been for the kind and valuable assistance I have received from Mr. Batcock, who has taken much pains to select me specimens of undoubted origin, it would have been scarcely possible for me to have made the comparative examination I have had the honour to cite.

Similarity of botanical structure.

11. I have also made a careful investigation of the leaves of *C. officinalis*. I worked with 3 lbs. of the fresh leaves; but though a considerable precipitate was at first obtained, I was finally unable to detect even a trace of alkaloid. I conclude, therefore, that the leaves of this species are destitute of value.

Leaves.

12. A similar examination was made with the ripening fruit. In this case I succeeded in obtaining indications of alkaloid; but the amount was so minute that, although I worked with a large quantity of the fruit, I was unable to determine its nature with certainty, nor did the most delicate tests for quinine indicate that substance. The fruit certainly contains less than 0.00002 per cent. of its weight of dubious alkaloid, and is practically worthless for official preparations.

Fruit.

13. I have already had the honour of communicating the results of an analysis of the bark of *C. Micrantha*.‡

14. An analysis of the trunk bark of *C. Nitida*, four and a-half years old, from Neddivuttum, gave the following per-centages of alkaloid calculated for dry bark:—

C. Nitida.

Total alkaloids	-	-	-	-	-	-	-	6.00 per cent.
Alkaloid soluble in ether	-	-	-	-	-	-	-	0.32
Chinchonine	-	-	-	-	-	-	-	5.54
Quinidine	-	-	-	-	-	-	-	0.14
Crystallised sulphate obtained	-	-	-	-	-	-	-	0.10

The bark was 0.17 inch thick, and contained 69 per cent. of water. A microscopic examination showed a great abundance of resin cells with but few cortical fibres. The Chinchonine obtained crystallised with readiness. This bark and its products showed much similarity with those of *C. Micrantha*, though the alkaloids obtained were somewhat less in quantity. Six per cent. is, however, a large yield, and is treble that of the American *C. Nitida* bark.

15. The trunk bark of *C. Peruviana* gave, on analysis, the following numbers calculated for 100 parts of dry bark:—

C. Peruviana.

Total alkaloids	-	-	-	-	-	-	-	6.25
Soluble in ether	-	-	-	-	-	-	-	0.41
Chinchonidine	-	-	-	-	-	-	-	2.00
Chinchonine	-	-	-	-	-	-	-	3.84
Crystallised sulphate Chinchonidine obtained	-	-	-	-	-	-	-	1.80

The

* Proceedings of Madras Government, Revenue Department, No. 206, 12th April 1867.

† Since the above was written, I have obtained as much as 5 per cent. of alkaloids from trees of the same age, growing under very favourable conditions of soil, aspect, &c.

‡ Total alkaloids - - - - 7.1 per cent.
Soluble in ether - - - - 0.3
Chinchonine - - - - 6.8
Crystalline sulphates - - - - None.—Report dated 1st April 1867.

The bark was 0·16 inch thick, and contained 72·9 per cent. of water. It differs from the other grey barks by containing two per cent. of Chinchonidine, differing in some respects from ordinary Chinchonidine, though its optical properties are apparently the same.*

Value of grey barks.

16. From the foregoing analyses it appears that although the grey barks do not contain quinine, they are among the richest we possess in their yield of alkaloids. I would submit that the results obtained by the Chinchona Commission, respecting the efficacy of the alkaloids produced by these plants, hardly justify the disregard with which the grey barks have hitherto been treated. I would suggest that the cultivation of the beautiful-leaved *C. Peruviana* might be extended, with considerable advantage in many cases. A few plants interspersed among future plantations of *C. Succirubra* would do much to relieve the monotonous uniformity of appearance produced by the latter.

"Unknown name" Bark.

17. An examination of the species of Chinchona that is designated "Unknown name," yielded the following results. In the dry bark:—

Total alkaloids	-	-	-	-	-	-	-	1·2 per cent.
Alkaloid soluble in ether	-	-	-	-	-	-	-	0·39
Chinchonine	-	-	-	-	-	-	-	0·81
Crystalline sulphates	-	-	-	-	-	-	-	None.†

The bark contained 73·4 per cent. of water. The alkaloids obtained are deficient in quantity, and are purified with extreme difficulty from the bitter resin with which they are associated. The amount of chinchonine that I was able to obtain in a crystalline state was small.

C. Pahudiana.

18. The cultivation of *C. Pahudiana* has long been abandoned. I made, however, for my own satisfaction, an examination of the bark. From it I was only able to obtain 0·3 per cent. of alkaloid. The bark of this species is thin, and a microscopic examination showed that the fibres of the liber are more abundant and of larger size than those occurring in the more valuable kinds. Its structure presents few of the indications which are said to characterise the valuable kinds of Chinchona.

C. Calisaya.

19. Among the unpromising-looking bushes, which are our eldest representatives of the *C. Calisaya*, there are but three whose bark is available for analysis. As this kind has already been examined by Mr. Howard, and its cultivation discontinued, I thought it better to reserve the examination of these few trees till special circumstances may render it necessary.

Subjects in course of investigation.

20. Experiments are in progress for the determination of the best season for cropping the bark on the large scale, but some time must elapse before these are complete. Comparative trials of the various methods of drying the bark for exportation must be postponed, till the atmosphere is less saturated with watery vapour than it is at this season.

21. In addition to the results I have had the honour to communicate in the foregoing paragraphs, I have been fortunate enough to obtain some of interest connected with the influence of soil, and others relating to the physiology of the alkaloids and their occurrence. But until the application of these results has been verified by repeated experiments, I will, with the permission of Government, refrain from communicating them.

22. I shall have the honour of communicating further information, on the effects of mowing the barks of the various kinds, as soon as the trees I have thus treated have been allowed sufficient time to yield bark available for analysis.

Official preparation of *C. barks*.

23. The question respecting a ready means of utilising the barks in the form of some simple preparation for therapeutical purposes in this country is receiving my best attention.

ORDER of the Madras Government, 26 July 1867.

1. Ordered that the above report be forwarded to the Secretary of State, together with the sample of pure sulphate of quinine obtained from the bark of *C. officinalis*, var. *crispa*.

2. It is observed that the samples of alkaloids prepared from the red bark, and received with Mr. Broughton's first report, were similarly forwarded.

3. The present report will also be communicated to the Governments of India and of the other Presidencies, and copies of both reports, together with that of the Chinchona Commission,

* I believe, with Mr. Howard (Nueva Quinologia), that this alkaloid is identical with that described by Wittstein. I am at present unable to refer to Wittstein's Memoir, which is necessary for complete confirmation.

† Since chinchonine crystallises more readily in the free state, I invariably exclude it from the sulphates.

Commission, will be forwarded to the Governments of Ceylon, the Straits' Settlements, Batavia, and the French Settlements in India.

4. The Government desire that attention be given by the superintendent of the Chinchona plantations to the more extended cultivation of the grey bark varieties, and that Mr. Broughton's suggestion for the intermingling of the *C. Peruviana* in future plantations of *C. Succirubra* be carried out.

5. It seems undesirable to extend the cultivation of the variety designated "Unknown name," the bark of which appears to be comparatively valueless. The Government will look with interest for Mr. Broughton's further reports.

(signed) *W. Hudleston*,
Secretary to Government.

— No. 32. —

From the Government of Madras to the Secretary of State for India.

Madras, 27 August 1867.

WITH reference to paragraph 4 of your Despatch, dated 16th January 1867, No. 3, we have the honour to forward for your information the accompanying tabular report on the progress and condition of the Chinchona plantations on the Neilgherries, for the half-year ending 31st July 1867.

Procs. of Govt., 27
August 1867, Nos.
514, 515.

Enclosure in No. 32.

From the Acting Superintendent of Government Chinchona Plantations, to the Secretary to Government, Revenue Department, Fort Saint George, Ootacamund, 21 August 1867.

I HAVE the honour to forward herewith the half-yearly report on the growth and condition of Chinchona plants on the Government plantations, as directed in G. O., dated 28th February 1867.

REPORT on the Number, Distribution, and Condition of Chinchona Plants on the Neilgherries, for the Half-Year, ending 31 July 1867

Species.	Botanical Names.	Commercial Names.	Number of Plants.	Value per lb. of Dry Bark in the London Market.	REMARKS.	
1	C. succirubra - -	Red Bark - -	962,925	s. d. s. d. 2 6 to 8 9	The number of plants permanently planted out in the plantations is 339,701, making the total 740,912.	
2	C. Calisaya - -	Yellow Bark - -	40,421	2 10 to 7 -		
I.	C. Frutex - -					
II.	C. Vera - -					
3	C. Officinalis.	—	—	—		
I.	Var. Condamenia-	Original Loxa Bark	861,183	2 10 to 7 -	The increase by propagation is 179,280 plants, the monthly average being 29,880, making the total 1,988,972.	
II.	Var. Bonplandiana	Select Crown Bark -	87,509	2 10 to 7 -		
III.	Var. Crispa - -	Fine Crown Bark -	4,380	2 10 to 8 -		
4	C. Lancifolia - -	Pitayo Bark - -	304	1 8 to 2 10		
5	C. Nitida - -	Genuine Grey Bark -	2,786	1 8 to 2 9	The plants of all the species of Chinchona still continue to grow luxuriantly; the oldest plants of C. Succirubra have this year again produced a large quantity of good seeds, and are now blooming freely. C. Micrantha has also produced seeds in equal abundance and of good quality. The varieties of C. Officinalis have a considerable quantity of seed on the plants, but it requires a long time to ripen; what have been gathered have germinated freely.	
6	C. Species without name.	Fine Grey Bark -	8,500	1 8 to 2 10		
7	C. Micrantha - -	Grey Bark - -	15,141	1 8 to 2 9		
8	C. Peruviana - -	Finest Grey Bark -	3,389	1 8 to 2 10		
9	C. Pahudiana - -	Unknown - -	425	Unknown.		
TOTAL Number of Plants - - -			1,988,972			

TABLE showing the Growth of the Different Species of Plants planted out in the Plantations, for the Half-Year, ending 31 July 1867.

Number of Plants.	Species.	Where Planted.	When Planted.	Maximum Growth.	Average Growth.	Height of the Tallest Tree.	Girth near the Ground.
12	Chinchona succirubra	Neddivutum.	30 August 1862.	in. 30½	in. 12½	ft. 16½	in. 20
12	Micrantha	Neddivutum.	1862 - -	16	8½	17½	9½
12	Officinalis	Dodabetta	30 Sept. 1863	7½	6½	11½	8

TABLE showing the Propagation, Distribution, &c., of Plants and Seeds, during the Half-Year, ending 31 July 1867.

DATE.	Total Number of Plants Propagated.	Total Number permanently Planted Out.	Total Number of Plants Distributed to Private Individuals.	Total Quantity of Seeds Distributed.
1867:				oz.
February -	25,000	- -	100	—½
March - -	12,410	- -	200	1½
April - -	35,880	156,340	—	—
May - -	30,360	- -	141	5
June - -	27,270	183,361	- -	6½
July - -	48,360		2,170	—
	179,280	339,701	2,611	14
Previously -	1,810,303	401,211	125,747	20
Grand Total -	1,989,583	740,912	128,358	34

The south-west monsoon of this year has been characterised by higher winds than usual, and has blown the leaves entirely off many of the plants in the most exposed situations. They are however recovering, and, from the abundance of young and healthy foliage they now have, do not appear to have suffered seriously.

The rain-fall has also been heavy and sudden and of short duration; it has not been productive of any injury to the plants.

The number of plants issued to the public is 2,611, making the total distributed 128,358. In addition to these, 34 ounces (in number about 2,040,000) of seeds have also been gratuitously distributed, and which have generally been successfully reared.

(signed) G. Batcock,
Acting Superintendent Chinchona Plantations.

— No. 33. —

From the Government of *Madras* to the Secretary of State for *India*.

Madras, 18 February 1868.

1. We have the honour to forward, for your information, the accompanying interesting report by Mr. Broughton, the Government quinologist, on the utilisation of the Chinchona barks of the Government plantations on the Neilgherry Hills, together with our proceedings thereon, dated 13th December 1867.

2. You will observe from our Proceedings just quoted that we have, at Mr. Broughton's request, permitted him to proceed into the districts adjoining the hills, in order to investigate their capabilities for furnishing the requisite materials for the manufacture of febrifuge preparations, and that we have recommended to his attention some inquiry into the native remedies for fever, and into the medicinal properties of the barks of indigenous trees and other vegetable products of the country.

3. We also forward, for your information, the accompanying letter from the Inspector General, Indian Medical Department, giving cover to a report by Assistant Apothecary Wade, in medical charge at Goodaloor (Wynaad) on the "liquid preparation" of Chinchona sent to him for trial by Mr. Broughton. The results obtained, it will be seen, are very encouraging.

Enclosure 1, in No. 33.

From *J. Broughton*, Esq., Quinologist to Government, to the Secretary to Government, Revenue Department, Fort St. George, Ootacamund, 28th November 1867.

1. I HAVE the honour of forwarding a Report on the utilisation of the Chinchona barks of the Government plantations.

2. In connection with this subject, I am desirous of ascertaining the capability of this part of India of furnishing materials for the manufacture of the febrifuge preparations mentioned in my report. It appears highly desirable that the natural products occurring in the districts surrounding these hills should be utilised as far as possible in this manufacture, and that, for this purpose, their comparative technical value *and cost* should be investigated.

3. The most important of these materials are, lime, soda, pearlash, magnesia, animal charcoal, acid, alcohol, and their possible substitutes. Among the latter class may probably be found some of the more abundant vegetable products of the western coast.

4. I therefore request that Government will be pleased to allow me to visit, on duty, localities in Coimbatore, Mysore, Malabar, and Salem, in order that I may have an opportunity of obtaining practical information on these subjects.

5. Should the Government see fit to grant this, I also beg that I may be accredited to those Government officers in the above-named districts, who may be able to afford me information and assistance concerning the objects of my journey. I am already greatly indebted to the kindness of Mr. Grant, collector of Coimbatore, who has provided me with specimens of some important products of the district in his charge. I should also be greatly assisted if Government would be pleased to supply me, henceforward, with copies of papers concerning natural products which might be susceptible of possible chemical applications.

6. If Government should dissent from the proposals advocated in my report and in this letter, I beg that I may be honoured with definite instructions respecting the course they desire me to follow.

MR. BROUGHTON'S REPORT.

1. Among the instructions that I had the honour of receiving from the Home Government,* I am directed to institute investigations for the purpose of enabling Her Majesty's Government to arrive at a decision with respect to the best and cheapest means of preparing the Chinchona febrifuge for use among the labouring classes of India. I am also required to consider the questions connected with the manufacture of the febrifuge for the use of hospitals and troops in India.
2. It may now, I would submit, be considered as proved that the Chinchona barks of the Government plantations of these hills contain, in at least an equal amount, all the active medicinal principles of the American barks. The utilisation in the most economical and effective manner of these extensive plantations, is now the important question to be solved. I believe that this question cannot be too soon attacked. There is now a large number of trees of *C. Succirubra* in a perfectly fit state for furnishing, without injury to the plantations, all the necessary materials that can be required for the manufacture of medicinal preparation for trial, even on a considerable scale. The number of such trees is constantly increasing. By the time that Government has arrived at a decision as to the best method of dealing with their bark, a very large amount will be ready for practical use. I may also observe that the early cropping of some portion of the bark would afford a suitable trial of the practical working of the system of mossaing.
3. It appears almost self-evident that, at any rate, the greater part of the cheap febrifuge required for use in this country must necessarily be here prepared. The preparation of the bark for transit, the exportation of so bulky a material, the importation of the alkaloids, are (as has already been observed by Mr. C. R. Markham†) items of such considerable expense, that it can only be on the failure of every attempt to manufacture in this country that such a course should be adopted. Failure, however, I consider as quite improbable.
4. But it is to be observed that, in order to reduce the total amount of labour entailed by such manufacture and its consequent expense to a minimum, it will be necessary to depend principally on this country for the supply of the requisite materials, and to dispense, as far as is expedient, with those whose cost of importation would diminish the gain of manufacture on the spot. The preparation of chinchona bark that is adopted for extensive medical use in this country must, therefore, combine as far as possible the qualities of thorough medicinal efficacy, readiness, and precision of administration, and practicability of manufacture with indigenous materials. In fulfilment of the instructions referred to in paragraph 1, I shall subsequently have the honour of proposing preparations which, while fulfilling in their respective degrees the two latter conditions, will most probably be found to possess the first.
5. The advantage of manufacturing on the spot where the bark grows, is increased by another circumstance. The barks part with their alkaloids more readily when fresh. The usual labour of drying, and subsequently powdering the bark, preparatory to manufacture, is thus rendered unnecessary, while the time and labour required to obtain the alkaloids in a state of solution is reduced.
6. The object I have the honour of discussing is also facilitated by the great addition to our knowledge of the medicinal effects of the several alkaloids, recently contributed in the Report of the Chinchona Commission.‡ From the evidence adduced in this report, corroborated by the report of the similar Commission in the Bombay Presidency, I believe I am justified in assuming that the four alkaloids occurring in our barks are nearly equal in febrifuge power. Hence, in the manufacture of the alkaloids, it will not be necessary, for ordinary purposes, in this country, to separate the quinine from the chinchonine, chinchonidine, and quinidine, with which it is associated. Thus an operation of considerable labour will be avoided, while a much larger amount of product will be available for medical use.
7. Though my own experience in India is limited, and extends over a short period, I have not, I trust, lost sight of the difficulties of detail which must be met and combated before a manufacture of chinchona alkaloids can be successfully carried out in this country. They are such as would be incident to the initial establishment of any new branch of industry. It is for this reason that I would recommend that any manufacture that the Government may eventually see fit to undertake, should at first be on a small scale, and tentative in its nature. It should be extended only when the expediency of extension has been shown by definite results. Its growth might thus be simultaneous with the demand exercised by the gradually increasing yield of the plantations. An extensive chemical manufactory on a European plan would, I think, be anomalous in India, and would not improbably prove a partial failure. But I learn that a manufacture of a somewhat comparable

Reasons for early trial of bark preparations.

The medicinal preparations should be made in India.

Conditions to be fulfilled to obtain the greatest advantage.

An advantage of manufacturing on the spot.

Manufacture simplified by recent medical experiments.

Difficulties.

Proposed plan of proceeding.

* Proceedings Madras Government, Revenue Department, 14th December 1866.

† Government Return, 1866, p. 218.

‡ Proceedings Madras Government, Revenue Department, No. 302, 19th March 1867.

able nature (inasmuch as it consists in the separation of a proximate vegetable principle in a colourless crystalline state) is now successfully being worked in this country, though once considered almost impracticable out of Europe. I allude to the manufacture of refined sugar from the cane and palm.

8. The medicinal substances that will be under various conditions most suitably manufactured from chinchona bark are of three kinds: first, crystalline salts of the alkaloids; second, the free alkaloids themselves in an uncombined state; third, extracts of the fresh barks for local use. The ordinary pharmacopœia tinctures, &c., of chinchona can of course be made from Indian as well as from Peruvian barks, and need not be considered here.

Classification of proposed bark preparations.

9. Among the many preparations of chinchona alkaloids that have been adopted since their discovery, the crystallised sulphates have obtained the most extended use. Their special merit consists in the fact that while they are comparatively easy to prepare, their crystalline form ensures, within certain limits, both purity and uniformity of composition, and hence *ceteris paribus*, constancy of medicinal effect. Many other crystalline salts have at various times been proposed, which possess special advantages, but on the whole (with the exception of hydrochlorate of chinchonine) have not been advantageously replaced in general practice. The proved efficacy of sulphate of quinine, and its long-continued use, induce me to believe that it must, to a certain extent, be always employed in medicine, even should other preparations supersede its now almost universal use. It appears, however, to be very probable, that should the sulphates of the alkaloids be ever extensively manufactured in this country, that the sulphates of the mixed alkaloids, as they occur in the bark, would be found most expedient to prepare. The sulphate of quinine would be thus mixed with the sulphates of chinchonidine and quinidine. I have the honour to forward a specimen (No. 1) of such a salt which, with the exception of the sulphuric acid it contains, has been exclusively prepared from indigenous materials. Its efficacy follows as a direct inference from the results obtained by the Chinchona Commission.

Sulphates of the chinchona alkaloids.

10. A preparation that I would now recommend for the consideration of Government, as offering considerable advantages, is that of the alkaloid precipitated from solution in an amorphous state. During the last five months I have spent much time in endeavouring to find a process which would yield the alkaloids in a state of sufficient purity by simple means. The specimen (No. 2) which I have the honour of forwarding, is prepared by a method which an ordinary apothecary would have little difficulty in learning to follow. It is comparatively inexpensive, and it could, I believe, be adapted to the means of all the smaller Government plantations, and would thus enable them to become centres of supply of the febrifuge for the district in which they are situated. The preparation would be most conveniently administered in the same dose, and in precisely the same manner as sulphate of quinine, namely, by dissolving in dilute acid. It may also possibly be found to possess some advantages of its own (see Appendix, paragraph 7).

Amorphous alkaloid.

11. Should the Government see fit to entertain such a proposition, I would suggest that some medical experiments be made with this substance, which I will supply, at first in small quantities; if it prove successful, I would then, with the sanction of Government, extend the manufacture, and, as opportunity offers, include that of crystalline sulphates. By such a mode of proceeding will, I believe, the subject of the utilisation of the plantations be most conveniently placed on a practical basis.

Proposal of a plan of proceeding.

12. The best form in which the febrifuge can be prepared on the spot for use by the owners of a few trees, has also occupied my attention. This will almost necessarily be a liquid preparation. At the suggestion of the principal inspector General Medical Department, some trials will be made on this subject by Mr. Wade, the gentleman in charge of the dispensary at Goodalore, in Wynaad, to whom I will supply the necessary material.

Ready preparation from chinchona bark.

13. I shall shortly have the honour of communicating a report on some other results to which my work has been directed. The above being connected only with a special part of my duties, I have thus, to avoid delay, taken the liberty of making it a separate communication.

(signed) J. Broughton,
Quinologist to Government.

Ootacamund, 27 November 1867.

APPENDIX.

1. I here take the opportunity of suggesting some circumstances connected with the chemical history of the barks and alkaloids, which appear to me to corroborate, in an interesting manner, the results arrived at by the Chinchona Medical Commission.

2. Mr. Howard has already pointed out the fact that the famous cure of the Countess of Chinchon was effected by a bark whose main febrifuge constituent was chinchonidine.*

3. Quinine

* Government Return, 1866, p. 135, and Nueva Quinologia of Pavon, sub. voc. Chuarguera.

3. Quinine was discovered in 1820, from whence its use in medicine commenced. Chinchonidine was discovered by Winckler in 1845. Quinidine was first identified by Van Heijningen in 1849. The two latter alkaloids were, however, very generally compounded with each other, and called by the common name of quinidine. It was not till Pasteur, in 1853, clearly distinguished the two alkaloids, and ascertained their true composition, that our knowledge of these important substances attained precision.

4. The consideration of these facts leads to the conclusion that, at least for 30 years much of the commercial sulphate of quinine employed in medicine would inevitably, from the method employed in its manufacture, be largely mixed with the sulphates of quinidine and chinchonidine, without their presence being suspected, and would occasionally consist entirely of the latter salts. The test now generally employed to ascertain the purity of sulphate of quinine did not come into use till the year 1854. Hence, during the period that quinine gained its reputation as being the first of febrifuge medicines, it was constantly liable to large admixture with its associated alkaloids. Had the latter not possessed similar medicinal properties, the high reputation which now attaches to quinine must necessarily have been greatly modified.

5. Pereira (*Materia Medica*, Ed. 1857, vol. 3, pp. 132, 133), bears from his own practice unequivocal testimony to the efficacy both of chinchonine and the then called quinidine. He also quotes the opinion of many authorities in support of this fact.

6. The chemical constitution, and properties of the four several alkaloids of chinchona, singularly resemble each other. Quinidine and quinine are identical in composition, and unite with acids in precisely the same proportions. The same is the case with chinchonine and chinchonidine, and they differ but slightly from the former pair in composition. The similarity in their therapeutic action is thus in harmony with their other properties. Among the very numerous alkaloids of opium, where a far greater divergence in composition and properties occurs, the physiological action of the various numbers differs widely from each other, as has lately been well shown by the experiments of Claude Bernard.

7. I observe in the interesting report of one of the members of the Chinchona Commission,* it is stated that the administration of chinchonidine has a tendency to produce nausea and vomiting. This has been also found by some earlier observers to have been the case with chinchonine. The taste of the salts of these two alkaloids, though greatly resembling that of quinine, has in addition a disagreeable after-taste, which becomes on a second dose particularly sickening. It appears probable that should the effect alluded to by Mr. Chipperfield be a frequent consequence of the exhibition of chinchonidine, it may be ascribed to this cause. I would suggest that it could be remedied by administering the chinchonidine not in the state of solution, but in the form of the free alkaloid, either as dry powder, or diffused through water. The alkaloid being but very slightly soluble has but little taste. As it would probably be desirable to make a few experiments on this subject with patients on whom the sulphate produces vomiting, I beg permission to forward some chinchonidine, nearly pure, which has been prepared from our red bark.

8. I here also take the opportunity of mentioning a circumstance, which might, unless corrected for, modify in some degree the results obtained in a strict quantitative comparison of the therapeutic effects of the sulphates of the respective alkaloids. These sulphates, when crystallising from solution, combine with different amounts of water. Thus, unless it should so happen that the precaution has already been taken of drying the sulphates at a steam heat (which would destroy the beauty of the crystals), they will thus contain variable quantities of water, and as a consequence the same doses may really contain somewhat different proportions of true alkaloid, which is of course the curative substance.

Thus the normal crystalline sulphates contain of water as follows:—

Sulphate of quinine contains	14·9	per cent of water.
Ditto quinidine contains	12·8	- ditto.
Ditto chinchonine contains	4·7	- ditto.
Ditto chinchonidine contains	16·9	- ditto.

Commerical samples, even if quite pure, may contain variable amounts of water within the above limits. Whether this circumstance obtains to a sufficient extent to affect the present experiments of the Chinchona Commission, I am not competent to say.

(signed) *J. Broughton.*

Order of the Madras Government, 13th December 1867.

1. The Government have perused with much interest Mr. Broughton's report on the utilisation of the chinchona barks of the Government plantations, and fully approve his proposal that he shall proceed into the districts adjoining the hills in order to investigate their capabilities for furnishing the requisite materials for the manufacture of febrifuge preparations. The collectors of Coimbatore, Malabar, and Salem will be instructed to afford

* Proceedings of the Madras Government, No. 302, 19th March 1867, Appendix III.

afford him every assistance in his researches, and the Government will request the commissioner of Mysore to ensure him all due facilities in the Mysore territories, when the pursuit of his investigations may take him into that country. The importance of the object in view can scarcely be overrated.

2. The Government will be prepared to place the services of a competent interpreter at Mr. Broughton's disposal to accompany him on his tour, and request him to communicate with the collector of Coimbatore in view to the selection of a properly-qualified person for the duty, unless Mr. Broughton can himself name any one whom he would prefer to employ. The Inspector General, Indian Medical Department, will instruct all officers of his department in the districts named, that the Government rely on their co-operating with Mr. Broughton to the best of their ability, in any way consistent with the discharge of their regular duties, which may seem calculated to promote success in the attainment of the object in view.

3. The Government would recommend to Mr. Broughton's attention some inquiry into the native remedies for fever, and into the medicinal properties of the barks of indigenous trees and other vegetable products of the country.

4. His request to be furnished with copies of papers concerning natural products susceptible of possible chemical application, will be attended to as opportunity may offer.

5. The specimens of the sulphate of mixed alkaloids and of the amorphous alkaloid, mentioned in paragraphs 9 and 10 of the report, will be forwarded to the Inspector General, Indian Medical Department, with reference to paragraph 11, for his remarks, and for such trial as, in communication with his colleagues in the Chinchona Commission, he may consider most suitable to test the efficacy of the preparations.

6. The Government authorise Mr. Broughton to draw a travelling allowance of seven rupees a day while absent from his head quarters, on the duty which he has volunteered to undertake. He will report what camp equipage he will require, which the Government will provide. They will await with interest his report of the results of his inquiries.

(signed) *W. Hudleston,*
Secretary to Government.

Enclosure 2, in No. 33.

From the Secretary to the Government of Madras to the Commissioner for the Government of the Territories of His Highness the Maharajah of Mysore.

Sir,

20 December 1867.

In forwarding the accompanying report from Mr. Broughton, the Government quinologist, on the utilisation of the chinchona barks of the Government plantations on the Neilgherry Hills, I am directed to state that Mr. Broughton has been permitted by Government to proceed into the districts adjoining the hills, in order to investigate their capabilities for furnishing the requisite materials for the manufacture of febrifuge preparations, and to request that you will be good enough to ensure him all due facilities in the Mysore territories, when the pursuit of his investigations may take him into that country.

(signed) *W. Hudleston,*
Secretary to Government.

Enclosure 3, in No. 33.

From the Commissioner for the Government of the Territories of His Highness the Maharajah of Mysore, to the Secretary to Government, Revenue Department, Fort St. George, Bangalore 23rd December 1867.

In acknowledging the receipt of your letter, of the 20th instant, and its enclosure, I have the honour to state, for the information of the Right honourable the Governor in Council, that instructions will be communicated to the district officers of Mysore, with a view to their rendering every possible aid to Mr. Broughton in his researches in this province.

Enclosure 4, in No. 33.

From the Inspector General, Indian Medical Department, to the Secretary to Government, Revenue Department, Fort St. George, 29th January 1868.

1. With advertence to the proceedings of Government noted in the margin, I have the honour to submit the enclosed very satisfactory report, by Assistant Apothecary Wade, on the "liquid preparation" of chinchona sent to him for trial by Mr. Broughton.

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2. The other preparations mentioned by Mr. Broughton in paragraphs 9 and 10 of his report, and in paragraph 7 of the Appendix, have also been sent to Mr. Wade for trial, and the result will be duly communicated to Government.

From Assistant Apothecary M. Wade, in medical charge, Goodalore, to the officiating secretary, principal Inspector General, Indian Medical Department, Fort St. George, Goodalore, 23rd January 1868.

1. I beg to submit, for the information of the principal Inspector General, the accompanying two tabulated sheets of the experiment connected with the "liquid preparation of chinchona," as supplied me by J. Broughton, Esq., quinologist of Ootacamund.

2. As will be seen from the accompanying communication from that gentleman, an ounce of this preparation was considered equivalent to 12 grains of quina disulphate.

3. Twenty-one well-marked cases have been thus treated, in 20 of whom it tended to effect a cure.

4. In appearance this preparation resembles a thick decoction of chinchona, as is usually seen in hospital practice, of a sourish bitter taste, and which, as anticipated, is very disagreeable to take.

5. Of the number treated, one dose of the preparation was sufficient to cut short the attack of fever in eight cases, while nine required a second dose, and three a third dose, thus showing that the majority of the cases required more than one dose to stay the attack.

6. In the trial already made, it will be seen that the greater number (11) suffered, while under treatment with this preparation, either from nausea, vomiting, diarrhoea, or a burning sensation in stomach, while in 10 such symptoms were not complained of; but a more lengthened experience of its effects would be necessary before it can be considered a gastro-intestinal irritant, as may be concluded from the above results.

7. Chinchonism was fully established in one-third of the cases treated, in three it was only partially induced, while in 11 this symptom was not complained of, though inquired for.

8. Case, No. 4, calls for explanation, as it will be seen that only two doses were taken, and this plan of treatment discontinued for quinine. The patient for the past year has been from time to time treated with the alkaloids for fever, and which usually cut short the attack in his case in one day, therefore not only enabling him to be the sooner about, a busy office man, but also to place great faith in that plan of treatment. Finding that the two doses of the liquid chinchona preparation on two successive days did him little or no good, he became alarmed and begged for treatment in the usual way; added to this, that not only is he of a very timid disposition, but that the fever was assuming a remittent form, I deemed it expedient to resort to diaphoretics and quinine for his recovery. This cannot be regarded as a failure of the preparation to stay the attack in this instance, and, with this exception, the medicine did not fail in the other cases.

9. Eighteen of the cases thus treated have, since discharge, enjoyed good health, and have not as yet had a second attack; the remaining two, cases 16 and 20, have already had a second attack; they are Nair men of the Mofussil police, who are weakly constitutioned and ill-adapted to withstand the malarious influences surrounding them.

10. One ounce of this preparation (as it was believed to be equivalent to about 12 grains of the disulphate of quinine) combined with an ounce of water formed the dose in each case, being repeated on each successive day till the paroxysm was checked.

11. In conclusion, I would beg to state that this simple and easily prepared febrifuge, though a rough preparation, can be readily obtained by the possessors of a few chinchona plants, the use of which is attended with benefit in mild paroxysmal fevers.

— No. 34 —

From the Government of Madras to the Secretary of State for India.

Madras, 17 March 1868.

WITH reference to paragraph 4 of your Despatch, dated 16th January 1867, we have the honour to forward, for your information, the accompanying tabular report on the progress and condition of the Chinchona plantations on the Neilgherries for the half-year ending 31st January 1868.

Enclosure in No. 34.

REPORT on the Number, Distribution, and Condition of Chinchona Plants on the Neilgherries, for the Half-Year, ending 31 January 1868.

Species.	Botanical Names.	Commercial Names.	Number of Plants.	Value per lb. of Dry Bark in the London Market.	REMARKS.	
1	C. succirubra - -	Red Bark - -	1,052,433	s. d. s. d. 2 6 to 8 9	The total number of plants permanently planted out remains the same as in last report, viz. 740,912. All the species of Chinchona still continue to grow luxuriantly; the oldest plants of C. succirubra, micrantha, and officinalis, have this year again produced a large quantity of good seeds, and are now blooming freely.	
2	C. Calisaya - -	Yellow Bark - -	40,395	2 10 to 7 -		
	Frutex - -					
	Vera - -					
3	C. officinalis - -	—	—	—		
	Var. Condamenia	Original Loxa Bark -	1,005,869	2 10 to 7 -		
	Var. Bonplandiana	Select Crown Bark -	87,509	2 10 to 7 -		
	Var. Crispa -	Fine Crown Bark -	4,355	2 10 to 6 -		
4	C. lancifolia - -	Pitayo Bark - -	279	1 8 to 2 10		
5	C. nitida - -	Genuine Grey Bark -	2,786	1 8 to 2 9		
6	C. Species without name.	Fine Grey Bark -	8,500	1 8 to 2 10		
7	C. micrantha - -	Grey Bark - -	47,430	1 8 to 2 9	Notwithstanding the dry season of last year, and the failure of the north-west monsoon, the rain fall being only 8·24 inches against 17·78 inches of last year, making a yearly total of 37·09 inches for 1867, against 40·86 inches for 1866,	
8	C. Peruviana - -	Finest Grey Bark -	3,389	1 8 to 2 10		
9	C. Pahudiana - -	Unknown - -	426	Unknown.		
TOTAL Number of Plants - - -			2,253,370			

TABLE showing the Growth of the differentSpecies of Plants planted out in the Plantations, for the Half-Year ending 31st January 1868.

Number of Plants.	Species.	Where Planted.	When Planted.	Maximum Growth.	Average Growth.	Height of the Tallest Tree.	Girth near the Ground.
12	C. succirubra.	Neddivutum.	30 August 1862.	in. 4	in. 2½	ft. 17½	in. 21½
12	C. Micrantha.	Neddivutum.	1862 - -	5	2½	17½	21
12	C. officinalis.	Dodabetta	30 September 1863.	14½	8½	12½	8½

The high winds of last year's south-west monsoon had unfortunately a severe effect upon the large plants of Grey Bark which were fully exposed to their violence, and many have since died from the injuries received; while large plants of C. succirubra and C. officinalis, standing on the same land, and equally exposed to the wind, have escaped without serious injury.

The increase by propagation is 337,340 plants, the monthly average being 56,223, making the total 2,253,370.

TABLE showing the Propagation, Distribution, &c., of Plants and seed during the Half-Year ending 31st January 1868.

DATE.	Total number of Plants Propagated.	Total number permanently planted out.	Total number of Plants Distributed to Private individuals.	Total quantity of seeds Distributed.
1867:				oz.
August - -	123,480	- -	40,390	2
September - -	31,320	- -	135	5½
October - -	54,640	- -	19,897	8
November - -	59,920	- -	500	7
December - -	17,280	- -	-	9
1868:				
January - -	50,700	- -	10,020	6½
Previously -	337,340 1,916,030	- - 740,912	70,942 128,358	38 34
Grand Total -	2,253,370	740,912	199,300	72

The number of plants issued to the public is 70,942, making the total distributed 199,300. In addition to these, 38 ounces of seeds have been gratuitously distributed to the public, making the total quantity 72 ounces.

Ootacamund,
29 February 1868.

(signed) W. G. McIlwarr,
Superintendent Government Chinchona Plantations.

— No. 35. —

From the Government of Madras to the Secretary of State for India.

Madras, 5 May 1868.

WITH reference to our Despatch, dated 18th February 1868, we have the honour to forward, for your information, the accompanying interesting report from Mr. Broughton, the Government quinologist, on the result of his researches in the districts adjacent to the Neilgherry Hills for products which could be employed as materials in the manufacture of alkaloids and other medicinal preparations of the Chinchona barks of the Government plantations. Our proceedings on this report, dated 22nd April 1868, are also forwarded.

Enclosure in No. 35.

From *J Broughton, Esq.*, Quinologist to Government, Ootacamund, to the Secretary to Government, Revenue Department, Fort St. George, Ootacamund, 4th April 1868.

1. I have the honour to state, that I was engaged from 1st January to 25th February in examining the districts adjacent to the Neilgherry Hills, for products which could be employed as materials in the manufacture of alkaloids and other medicinal preparations of the Chinchona barks of the Government plantations.

2. **RESULT OF THE INQUIRY.**—The result to which my inquiries have led me is, on the whole, satisfactory. With the exception of Sulphuric Acid, the whole of the materials required for this manufacture are obtainable in the districts surrounding the hills.

3. **INQUIRY NOT EXHAUSTIVE.**—It is perhaps scarcely necessary to state, that the search that I have been able to make is by no means an exhaustive one. The time that I was able to employ would make any pretence to the contrary absurd, when the great extent and variety of the districts are considered. I trust, however, with some confidence, that no abundant natural product that would be of essential service towards the desired end has been passed over. But when the nearest or most convenient source of any material has been ascertained, its possible occurrence in remoter places has been in some instances disregarded.

4. **MATERIALS IN QUESTION.**—The materials which I had on a former occasion the honour of mentioning as important* were lime, soda, pearl-ash, magnesia, animal charcoal, acid, alcohol, and their possible substitutes. In the course of investigation I have been necessarily led to make some experimental trials and analysis of the natural substances supplying these materials; and also, in the hope of obtaining practical information, have paid some attention to the uses to which they are applied by the natives. As the facts with which I have become acquainted may not be without an interest beyond their immediate object, I here beg permission to record some special details concerning the above-mentioned substances.

5. **LIME.**—There does not appear to be any true limestone in the neighbourhood of the Neilgherries. The lime employed for building purposes in these districts is derived, as is well known, from the deposit called "kunkur," which capriciously occurs in nodular masses, over the great part of Coimbatore, Salem, and in the southern division of Mysore. The lime obtained by burning this stone, is by no means so pure as could be desired; nevertheless, with care it can be successfully employed for chemical purposes. Analyses were made of specimens obtained from Metapoliem, in Coimbatore, and some collected from about four miles west of Goondulpett in Mysore, a mean specimen being taken from several nodules.

	Goondulpett, Mysore.	Metapoliem.
Sand and clay - - - -	10.12	19.72
Oxide of iron - - - -	traces	1.58
Carbonate of Magnesia - - - -	2.74	2.77
Carbonate of lime - - - -	87.14	75.31
Organic matter and loss - - - -	-	0.62
	100.00	100.00

6. The

* Proceedings
Madras Govern-
ment, Revenue
Department, No.
240, 14th December
1867.

6. The above results show a greater amount of impurity in the Mettapolliem stone. Nevertheless, a more extended examination did not establish this as a characteristic of the deposit from that locality. While the proportions of carbonate of lime and magnesia appear to be mutually tolerably constant, they are associated in each nodule with very variable amounts of impurity, in the form of sand and more or less ferruginous clay.

In order to obtain an analysis that would fairly represent the mean composition of a considerable amount of the Metapolliem kunkur, a specimen was carefully prepared by mixing the powered stone obtained from very many nodules.

The results of its analysis were as follow :—

Silica - - - - -	7.54	} sand, clay, &c.
Oxide of Iron - - - - -	2.65	
Alumina - - - - -	2.06	
Carbonate of Lime - - - - -	82.32	}
Ditto - Magnesia - - - - -	3.02	
Oxide of Iron - - - - -	1.72	
Organic matter and loss - - - - -	0.69	
	100.00	

7. The above analyses have been carried somewhat further than was necessary for my own purposes. The mineral being the source from whence is obtained the building lime employed on the hills, it was thought that data might be thereby afforded to those conversant with the subject, as to its fitness for hydraulic and other cements.*

8. SODA.—Of this substance South India has a large supply in the “Choutoomunnoo,” Overmunnoo, Soudoo or Dhobies’ earth. This most interesting and, I believe, most important product is surface earth, impregnated with carbonate of soda, mixed with other soda salts. Large tracts of waste land are covered during the dry season with a white efflorescence, consisting mainly of the former salt. From the sparing notices I have been able to find of this soda earth, I am led to think that it has hardly attracted the attention in this country that its value deserves. In the Memoirs of the Geological Survey, Vol IV., Part 1, pages 215 and 216, occurs the following passage :—

“Soda is of wide-spread occurrence in the South Arcot and Trichinopoly districts, chiefly on the gneiss and on the alluvium, more rarely on the cretaceous rocks.† It occurs in a whitish soil, known as “Soud” or Dhobies’ earth, usually occurring in marshy places, and very treacherous to the unwary pedestrian. A large extent of it occurs between Trichinopoly and Tanjore, to the south of the Cauvery; and the alluvial plain to the north of the Vellaur, in the neighbourhood of Chetia-tope and Bhonagiri, is formed in great part of a similar soil. Small patches of “Soud” are also frequently met with on the gneiss to the west of the cretaceous rocks in South Arcot, chiefly where the prevailing soil is regur. The earth is collected by washermen, and used instead of soap for washing cloth. The soda is frequently mixed with common salt, and probably also with other soluble salts, but it has not been analysed.

9. The most convenient supply for the hills appears to be near the village of Teloogoo-paulium, Coimbatore, where it is found in a tract of Government waste land, said to be of 80 acres in extent. I was led to pay particular attention to this earth. I found the yield of dry carbonate of soda from various specimens to be as follows :—

I. Taken from a heap of earth a dhoby was collecting - - -	7.0
II. Ditto - ditto - collected by dhoby - - -	1.2
III. Collected with care by myself - - -	12.6
IV. Ditto - ditto - all possible care - - -	26.6
V. An ordinary specimen from Dharapurum in Coimbatore - - -	3.26
VI. Ditto - ditto - Sooramungalum in Salem - - -	7.2
VII. Ditto - ditto - Poodoor - - -	6.0
VIII. Ditto - ditto - Sherapully - - -	7.0
IX. Ditto - ditto - near Mysore - - -	5.0

10. It occurs also at very many other places, and varies greatly in yield according to the care taken in its collection. The carbonate of soda is readily obtained by lixiviating the earth with water, and evaporating the solution either in the sun or by artificial heat. The richness of the earth in soda will, no doubt, be increased by judicious conservation of the land producing it. In order to ascertain this, I have requested Mr. Grant to enclose a small portion of the Teloogoo-paulium tract. I think it is likely that by allowing the efflorescence to take place for some time undisturbed, a surface richer in soda will be obtained, while the labour of extraction will be diminished. The carbonate of soda should of course be separated on the spot to diminish the cost of carriage.

11. The

* An interesting account of the kundur deposits is given in the Memoirs of the Geological Survey, Vol. IV., Part 2, p. 120 and seq.; also Part 1, p. 207.

† Never derived from the cretaceous rocks but from the decomposition of the many varieties of hornblende and felspathic gneiss.—T. Oldham.

11. The natives appear fully to appreciate the uses of this substance. In an unintelligent manner they make most ingenious uses of its chemical properties. Besides its direct employment as detergent, it furnishes the alkali for soap-making; a caustic dye being prepared from it by means of chunam. It is employed in dyeing, both for fixing the mordants and for modifying the tints of the dye. The crude carbonate of soda obtained from the earth furnishes the alkali required for glass making, considerable quantities being prepared during the dry season for this purpose. The whole process of the manufacture of glass for bangles could not fail to excite the admiration of any one interested in the natural principles involved. At Poodoor, in Salem, the crude carbonate of soda is fused with pounded quartz in reverberatory furnaces of a most simple and effective form, the proportions being three parts by measure of the former to one of the latter. In the preparation of the alkali an addition is always made of a certain proportion of cow dung, a constituent which, besides sanctifying the result, has also the practical effect of reducing the sulphates to sulphides, and of rendering the mixture more readily fusible and of assisting in the decomposition of the carbonates.

12. Though there is a considerable internal trade in Soudoo earth and its products, there are large tracts existing of which but little use is made. It might be supposed that constant cropping of the efflorescing surface would in time exhaust the yield. But such does not appear to be the case. In Buchanan's "Mysore," mention is made of a tract near the village of Mudium, 40 miles from Bangalore, which furnished at the beginning of the present century the necessary soda to the local glass works. I ascertained that the tract still supplies Soudoo as heretofore, and obtained a specimen. As no analysis has been made of Soudoo, I chose this specimen for the purpose. The composition was as follows :—

Sand and insoluble matter	-	-	-	-	-	-	-	-	74.92
Carbonate of lime	-	-	-	-	-	-	-	-	10.70
Sesqui carbonate of soda	-	-	-	-	-	-	-	-	8.41
Sulphate of soda	-	-	-	-	-	-	-	-	1.24
Chloride of sodium	-	-	-	-	-	-	-	-	1.02
Water	-	-	-	-	-	-	-	-	3.27
Nitric and nitrates	-	-	-	-	-	-	-	-	traces.
Organic matter and loss	-	-	-	-	-	-	-	-	0.44
									100.00

13. It will be observed that the soda does not exist in the form of normal carbonate, as in common English washing soda, but as that which is usually called sesqui carbonate. The natives are practically aware of this, for they occasionally use the salt as a kind of "baking powder," in order to make chapatties light, a use for which common carbonate is unfit. The substance called "uppala kharum," generally employed in the preparation of "peppidams," appears to be a very similar substance. Specimens of the latter, which I have examined, contained, besides the carbonate of soda, a considerable proportion of clay, and also a material bearing a suspicious resemblance to cow dung.

14. It would be difficult, without practical trial, to estimate the actual cost of soda from this source. It would consist mainly of the expenses of the labour of collection, preparation, and carriage. As these items are far less in amount than those expended in the manufacture of English soda (which is, in all respects, an artificial product), the economy of the employment of native soda appears to be promising. The impurities which it contains, sometimes in considerable quantities, will, I believe, not influence its usefulness for the purposes required.

15. PEARLASH.—For the object for which these inquiries were instituted, the occurrence of a supply of soda renders that of potash of comparatively less importance. Wood ashes is of course the source from which the pearlash must be derived; and in a country where wood is the only available fuel, it is not likely to fail the demand. I could, however, not learn that pearlash was manufactured to any extent by the natives of the district through which I passed. On the Malabar coast the ashes of the cocoa palm-wood and nuts form the source from which the inhabitants obtain the alkali necessary for a limited manufacture of soap. In this ash, however, carbonate of soda is also an essential constituent. The natives of the hill jungles of Coimbatore make use of the ash of a particular kind of wood which is rich in potash salts. The ashes that I have examined yielded to boiling water the following per-centages of carbonate of potash :—

Mean specimen of ash from a burning Neilgherry shola	-	-	-	15.0
Ash of the wood-fuel of Ootacamund	-	-	-	14.5
Specimens of ash from the locomotives of Madras Railway Company	-	-	-	4.8

The latter ash had obviously been injured by exposure.

16. MAGNESIA.—In the most interesting district of Salem, about three miles from the town, on the Woomaloor-road, exists a very remarkable deposit of magnesite. It occurs in seams in the gneiss rock. The mineral is white, and of a texture resembling porcelain. The

The effect of these layers of white material, striping and dotting the low and barren hills, is very striking. Local tradition identifies it as the bones of a monstrous bird, whose death is described in the epic of the *Ramayana*.* The mineral covers some miles of country, and the white masses consist nearly entirely of pure carbonate of magnesia. I had completed some analysis before I was aware that it had been analysed in 1836 by Mr. E. Prinsep. I quote both results:—

	Mr. Prinsep's Analysis, 1836.	Analysis, 1868.
Magnesia - - - - -	48.34	47.29
Carbonic acid - - - - -	51.66	51.53
Silica - - - - -	- -	1.18
	100.00	100.00

17. The analyses only differ from the circumstance that the specimens I have met with contain, as impurity, a small amount of silica. The freedom of the mineral from lime and other impurities is very remarkable. No source of magnesia at all approaching this in purity exists in England. Within the last ten years the English demand for magnesia has been supplied from magnesite formed in the northern part of the island of Eubœa, from which much Epsom salts and calcined magnesia is now manufactured. The specimens I have seen of the Greek magnesite were, however, certainly inferior in purity to the Salem mineral. The latter is, however, difficult to powder unless previously heated, a quality that causes a little difficulty in some of its applications.†

18. ANIMAL CHARCOAL.—This material will have to be prepared, when required, by calcining bones in the same manner as is usual in the sugar manufactories. Bones are tolerably plentiful, and are cheaper than in England.

19. ACID.—Sulphuric and hydrochloric acids are practically unknown in the districts above-mentioned, although some of the nitre used for the manufacture of English sulphuric acid is the product of these very districts.

20. ALCOHOL.—This liquid cannot advantageously be dispensed with in the manufacture of the pure sulphate of the Chinchona alkaloids. I have, for this reason, paid attention to the processes employed in the native arrack distilleries. The method of proceeding made use of in the latter is a very remarkable one, and has frequently given rise to some misapprehension when popularly described. The same process and proportions of material are employed over very wide distances of country, and both appear to be of great antiquity.

21. The main peculiarity of the process consists in the addition, to the hot solution of jaggery, of chips of “Velvaylum puttav,” or the bark of *Acacia leucophlea*. This is so invariably done, that it is not unusual for one to be informed that “native spirit is made from acacia bark;” the jaggery being overlooked. Acacia bark does not contain any constituent that is likely to yield spirit under the circumstances. Indeed it is, at first sight, difficult to perceive the *rationale* of the employment of the bark at all, since spirit can be obtained from the jaggery without the intervention of what would appear to be an additional source of expense, for the bark costs five rupees per bandy-load. Observation, however, combined with a few experimental trials, convinced me of the important use of the bark. Jaggery contains, as impurity, variable quantities of albuminous and other nitrogenous substances, which when brought into solution, rapidly begin to putrify, and the nauseous products of their decomposition would thus impair the flavour of the spirit. The presence of these substances also, in a state of change, injuriously modifies the process of the fermentation, so that instead of spirit small quantities of other and less palatable substances are formed.

* Jatāya, king of birds, who having fought for a long time in the sky with Rāvana, was finally killed by the latter. His bones were scattered in various parts of Southern India, then a vast forest. Thus the occurrence of the white mineral in various parts of Salem and Trichinopoly is explained. Reference is given me to *Ramayana Arania Candah*, cap. 51 and 52.

† Within the last few months a new use for magnesia has arisen which bids fair to become an important one. I allude to the magnesia cement of M. Sorel,* where powdered calcined magnesia is mixed to the consistence of a thin paste with a solution of chloride of magnesia, the whole sets in a few hours to a solid of far greater hardness than that produced from plaster of Paris, and takes a polish equal to marble. I have verified this with the materials prepared from the Salem magnesite. The cement possesses the great advantage of setting, even when mixed with twenty times its weight of inactive materials as sold, a quality in which it greatly surpasses plaster of Paris, which will not solidify with more than twice its weight. Chloride of magnesium is easily prepared by saturating hydrochloric acid with the powdered magnesite, or can be obtained from the mother liquors of sea salt manufacture.

* Comptes Rendus T. 65, P. 102, and Zeitschrift für Chemie Bd. III. S. 607.

formed. The Acacia bark is rich in tannin, and this tannin has the property of combining with the albuminous substances, and by rendering them insoluble, entirely arrests their decomposition. In arrack manufacture, the tannin of the Acacia bark precipitates the injurious impurities, and thus removes them out of the field. I have found by direct experiment, that the addition of an infusion of the bark for these reasons actually increases the amount of spirit yielded by nearly a sixth part of the whole. Jaggery fermented without the addition of tannia, yields a spirit of bad flavour and of a strongly acid re-action. When bark is used, the greater part of the tannia is found, at the end of the process, nearly unaltered, and hence, probably, a less proportion would answer the purpose instead of the considerable amount now generally employed.

22. I may here mention that the nauseous flavour of spirit obtained from jaggery alone can be nearly all removed by rectifying from a small quantity of caustic potash, but even thus improved it is still rather inferior to that obtained by the employment of bark. The ingenuity evinced in the employment of Acacia bark is admirable, and it is difficult to imagine how such a process could have originated among a people where philosophy is opposed to experiment, and who do not possess the knowledge from which the method could be deductively obtained. Indigenous technical expedients of this nature, which have arisen from a source so totally independent of western science, appear to me to merit, in all cases where they occur, an attentive and respectful study.

For manufacturing purposes, however, I would prefer spirit of as nasty a taste as possible, in order to discourage thieving.

In the case where arrack is made directly from fresh toddy (instead of from the intermediate preparation of jaggery) the bark is not employed. The albuminous substances do not begin to decompose before the fermentation and distillation are completed, and hence there is no necessity for its use.

23. In most works where the native stills, composed of clay chatties and bamboo-pipes, are employed, the loss by evaporation and liquid diffusion is considerable. By comparing the yield of true alcohol, obtained in two works, in one of which native stills were used, and in the other copper stills and worms of European pattern, I was enabled to calculate that nearly 10 per cent. of the sugar was practically wasted by the loss of its resulting alcohol from these causes.

24. None of the arrack works that I have visited appear able to supply spirit at less cost than that supplied by the Commissariat Department, and which I have long employed on my laboratory. There are, however, several sources from which spirit perfectly fit for chemical purposes could be prepared at a still smaller cost, supposing that the supply required would justify the starting of a special distillery. This is a matter of no present urgency, and its consideration, I would submit, could be well deferred until the whole subject of alkaloid manufacture has been placed on a mature basis. For the latter purpose alcohol should be considered rather as a tool than a material, since when it has performed its works, it is again recoverable by distillation, and is thus available for an indefinite number of operations.

25. In accordance with the instructions I received, I have also made inquiries concerning native febrifuges. Of these I have obtained specimens, the most promising of which I will submit to chemical examination, whenever my more direct duties will permit.

ORDER of the Madras Government, 22nd April 1868.

1. THE Government are glad to learn that Mr. Broughton's researches have been followed by such satisfactory results, and thank him for his interesting report, which will be communicated to the Supreme and Home Governments.

2. Twelve copies will be furnished to Mr. Broughton, as requested in his covering letter.

(signed) *W. Hudleston,*
Secretary to Government.

— No. 36. —

From the Secretary of State for *India*, to the Government of *Madras*.

India Office, dated 9 July 1868.

18th February 1868.
17th March 1868.
5th May 1868.

I HAVE received and considered in Council your Excellency's Despatches (Revenue Department), of the dates noted in the margin, on the subject of Chinchona cultivation, and of Mr. Broughton's chemical investigations.

Mr.

Mr. Broughton's report on the capabilities of the districts near the Neilgherry Hills, for furnishing materials for the manufacture of febrifuge preparations, is exceedingly satisfactory, and hope soon to hear that your Government acting on the suggestions of Mr. Broughton, has been able to mature a plan for supplying the febrifuge, in a cheap but efficacious form, and in sufficient quantities, to the hospitals in your presidency.

I fully concur with my predecessors in looking upon the supply of the chinchona febrifuge to the natives of India, as one of the most important objects to be secured by its cultivation, although, of course, the desirability of making the undertaking a financial success should not be lost sight of.

— No. 37. —

From the Government of Madras to the Secretary of State for India.

Madras, 16 June 1868.

1. IN continuation of our Despatch, dated 18th February 1868, we have the honour to forward, for your information, the accompanying letter from the Inspector General, Indian Medical Department, giving cover to a further report and tabular statements by Assistant Apothecary Wade, in medical charge at Goodaloor (Wynaad), of the therapeutic effects of the chinchona preparations marginally specified, sent for trial by Mr. Broughton.

2. We have requested Mr. Broughton to furnish the Inspector General with the further larger supply of the preparations required by that officer for extended trial.

3. You will perceive that the results already ascertained are very satisfactory.

No. I.—Sulphate of mixed alkaloids of red bark.
No. II.—Alkaloid prepared by native "soudoo."
No. III.—Chinchonidine from red bark.

Enclosure in No. 37.

From the Inspector General, Indian Medical Department, to the Secretary to Government, Revenue Department, Fort St. George, 7th May 1868.

1. I HAVE the honour to submit, herewith, report and tabular statements by Assistant Apothecary Wade of the therapeutic effects of the chinchona preparations marginally named, recently sent for trial by Mr. Broughton.

2. So far as it goes the report is highly satisfactory, but before pronouncing a definite opinion on the virtues of these preparations, it would of course be desirable that they should be tested on a larger scale, and in other localities, where different types of malarious fever prevail.

3. The quantity of each furnished by Mr. Broughton was so small, that no satisfactory result would have been obtained by distributing it to different places, and the whole was therefore sent to Goodaloor, which is the most malarious of our stations.

4. I would now suggest that Mr. Broughton be asked to send a considerably larger quantity of these preparations, for trial in different parts of the country.

No. I.—Sulphate of mixed alkaloids of red bark.
No. II.—Alkaloid prepared by native "soudoo."
No. III.—Chinchonidine from red bark.

From Mr. M. Wade, in Medical Charge, Goodaloor, to the Officiating Secretary to the Principal Inspector General, Indian Medical Department, Fort St. George, Goodaloor, 23rd April 1868.

1. IN obedience to your instructions conveyed in Memorandum No. 385, of 29th January last, forwarding proceedings of Government of date 13th December 1867, with the salts marginally named for experimental trial, I beg to submit, for the information of the Principal Inspector General, the accompanying three tabular reports of the results obtained by their use.

2. Thirty-one well-marked cases are thus shown to have been successfully treated, all of whom, with one exception, were of the Quotidian type.

No. I.—Sulphate of the mixed alkaloids of red bark.
No. II.—Alkaloid prepared by native "soudoo."
No. III.—Chinchonidine from red bark.

3. *Preparation No. I.*—From the small quantity supplied of this salt, only seven cases could be brought under its influence, in four of whom the attack was cut short by a single dose, two requiring a second, and one a third dose, the latter rejecting from the stomach the first and second doses prescribed. It readily dissolved with dilute sulphuric acid, imparting a blue tint to the solution, so characteristic of quinine. It has been used in a case complicated with dysentery, and in another whose constitution was thoroughly shattered by secondary syphilis and privation with happy results. The occupation of most of the patients thus treated is of a nature calculated to expose them not only to the direct solar rays, but also to the sources of malaria.

4. *Preparation No. II.*—Twelve cases were treated with this salt, in six of whom one dose was sufficient to stay the attack, three required a second, two a third, and one a fifth dose; the latter, a constable of the Mofussil Police, was stationed in one of the most unhealthy parts of the district, where he contracted a severe attack, and which from a short neglect increased in severity; hence five doses on five successive days were persevered in so as to effectually cure. This preparation is heavier than the other two, and has been used in combination with dilute acid, as directed by Mr. Broughton in paragraph 10 of the Proceedings of Government above referred to.

5. *Chinchonidine.*—With this salt 12 cases have been treated, in nine of whom one dose was sufficient, two requiring a second, and one a third dose. Vomiting was induced in two cases only, and a relaxed state of the bowels for two days affected two others. Its therapeutic effect as a febrifuge has already been reported upon in connection with the alkaloids.

6. Chinchonism was fully established in 14 of the cases treated, while in six it was only partially induced; in nine others this system, though inquired for, was not complained of; the remaining two were children, from whom it could not be satisfactorily ascertained.

7. From the experiments already carried out with these salts, the patients, save one, have up to this time enjoyed an immunity from a subsequent attack. Case, No. 23, after the lapse of a month, had had a second attack. He is a sub-overseer on the temporary establishment of the Department Public Works, of an anæmic character, and constitutionally weakened by previous attacks. He is a native of Calicut, of spare habit of body, and unable to withstand the malarious influences to which he is subjected. His removal to the coast has been recommended to the executive engineer in charge.

8. The dose usually administered was 10 grains three hours before expected attack, repeated on each successive day till the paroxysm was checked.

9. From the small quantity of the salts supplied, I have been unable to test their efficacy in small and repeated doses, but the results obtained by the above practice, I would beg to point out, show that a 10-grain dose of any of the preparations tends either to cut short the attack altogether, or mitigates the severity of a succeeding paroxysm, and may be used with advantage in pallial fevers.

— No. 38. —

From the Government of Madras to the Secretary of State for India.

Madras, 22 June 1868.

WE have the honour to advise you of the transmission, by steamer, of a box containing Neilgherry chinchona bark, to be submitted to Mr. Howard for analysis and report. A letter from the Superintendent on the subject is enclosed.

Enclosure in No. 38.

From the Superintendent of the Government Chinchona Plantations, to the Secretary to Government, Revenue Department, Fort St. George, Ootacamund, 16th June 1868.

1. I HAVE the honour to inform you of having dispatched by banghy, addressed to your care, a box containing chinchona bark for transmission through the Secretary of State for India to J. E. Howard, Esq., for analysis and report.

The

The contents of the box are as follow :—

- No. 1, *Chinchona Succirubra*.—Renewed bark of 12 months' growth from a tree seven years' old, this being the fourth harvest of bark from the same tree.
- No. 2, Ditto.—Root bark from a tree seven years old.
- No. 3, Ditto.—Root bark from small roots of the same tree.
- No. 4, Ditto.—Original and renewed bark of *C. Crispa* grown under moss.
- No. 5, Ditto.—Section of the stem of a tree illustrating the successive renewal of the bark and the expansion of the tree, the first bark being removed at A., where the operation was somewhat imperfectly performed, leaving a scar which, however, immediately healed over. The second removal of bark at B. having been performed more effectually, has left scarcely any scar. The third removal having taken place at C., while the present bark is the fourth produce. The scars are always more distinct on the sunny than on the shady side of the tree.
- No. 6, Ditto.—Shows the second renewal of bark on a branch, the first bark having been removed at A.
- No. 7, Ditto.—Illustrates the union of the renewed and the original bark, together with a few packets of fresh seeds of the different species.
2. The results of specimen, No. 1, will be most interesting, as it forms the fourth harvest of bark (being the third harvest of renewed bark) from the same tree, Mr. Howard having already furnished us with his results from the three preceding crops of this bark.

— No. 39. —

From the Government of Madras to the Secretary of State for India.

Madras, 23 June 1868.

WITH reference to the accompanying letter from the Superintendent, Government Chinchona Plantations, we have the honour to advise you of the transmission, by steamer, of the box therewith received, containing samples of Neilgherry chinchona bark, together with seeds of different species of chinchona grown in the Neilgherries, and request that you will be good enough to cause it to be transmitted to Mons. Delondre, Rue de Lille, 19, Paris, for the purpose stated by Mr. McIvor.

Enclosure in No. 39.

From the Superintendent of the Government Chinchona Plantations, to the Secretary to Government, Revenue Department, Fort St. George, Ootacamund, 5th June 1868.

1. I HAVE the honour to inform you of having dispatched this day, by banghy, addressed to your care, a box containing samples of Neilgherry chinchona bark, together with seeds of different species of chinchona grown in the Neilgherries, and trust the Government may be pleased to forward this box to Mons. Delondre, Rue de Lille, 19, Paris, in order that the true value of our chinchona barks may be confirmed on the Continent by analysis and report of eminent French chemists.

2. The contents of the box are detailed in the following list :—

LIST.

- No. 1, *Chinchona Succirubra*.—Renewed bark of 12 months' growth from a tree seven years old, this being the fourth harvest of bark from the same tree.
- No. 2, Ditto.—Root bark from a tree seven years old.
- No. 3, Ditto.—Root bark from small roots of the same tree.
- No. 4, Ditto *Condamenia (Officinalis)*.—Strong growing variety. Upper portion original

original bark, and lower portion renewed bark, illustrating the manner in which the barks unite.

No. 5, Ditto *Condamenia* (*Officinalis*).—Same variety as preceding. Renewed bark grown under moss 18 months and 12 months old.

No. 6, Ditto (*Officinalis*).—Same variety as preceding. Specimen showing the longitudinal union of renewed and original bark.

No. 7, *Chinchona Succirubra*.—Original quill-bark 12 months under moss. This is a fair commercial sample of the bulk of our present bark.

No. 8, *Chinchona Condamenia* (*Officinalis*).—Strong growing variety. Original quill-bark 12 months under moss. This is a fair sample of the Crown bark which we can at present send into the market.

No. 9, *Chinchona Calisaya* var *Josephiana*.—Original bark 12 months under moss.

No. 10, *Chinchona Succirubra*.—Original and renewed bark. Specimen selected to show the longitudinal union of the two barks.

No. 11, Ditto.—Section of the stem of a tree, illustrating the successive renewal of the bark and the expansion of the tree, the first bark being removed at A., where the operation was somewhat imperfectly performed, leaving a scar which, however, immediately healed over. The second removal of bark at B., having been performed more effectually, has left scarcely any scar. The third removal having taken place at C., while the present bark is the fourth produce. The scars are always more distinct on the sunny than on the shady side of the tree.

No. 12, Ditto.—Shows the second renewal of bark on a branch, the first bark having been removed at A.

No. 13, Ditto.—Illustrates the union of the renewed and the original bark.

. Together with several packets of fresh chinchona seeds of the different species, and seeds and fibre of the *Urtica heterophylla*.

(signed) *W. G. McIvor*,
Superintendent Government Chinchona Plantations.

— No. 40. —

From the Government of Madras to the Secretary of State for India.

Madras, 24 June 1868.

To Secretary of State,
dated 25th March
1867.
From ditto, dated
24th May 1867.
Proceedings of Go-
vernment, dated 15th
June 1868.

WITH reference to the Despatches noted in the margin, we have the honour to forward herewith the further report of the president and members of the Chinchona Commission on the results of the trial of the chinchona alkaloids in a large number of cases of paroxysmal malarious fevers. These results are very satisfactory.

Enclosure in No. 40.

From the President and Members of the Chinchona Commission to the Secretary to Government, Revenue Department, Madras, 18th April 1868.

Dr. Orr, C.B., De-
puty Inspector
General, Indian Me-
dical Department.
Dr. Barclay, De-
puty Inspector
General, British
Medical Service.

1. THIS Commission having been re-assembled, with an accession of members, as noted in the margin, we have the honour, in continuation of the report submitted to Government on the 28th February 1867, to state that since that date tabular statements exhibiting the treatment of a large number of cases of paroxysmal malarious fevers, by means of the sulphates of quinidine, chinchonidine, and chichonine, have been received from the various stations and places at which the experiments were conducted. A few of these tabular statements pertain to the year 1866, being those referred to in last year's report as having been in the hands of the printer, and not in readiness to be included in the tables which accompanied that document. For the purpose of comparing the febrifuge effects of these medicines with that of chemically pure sulphate of quinine, the medical officers engaged in carrying out the experiments have, under instructions issued to them, likewise furnished tabular returns of the treatment of fevers by that alkaloid. The whole of these reports are now before the Commission, and appear to afford data sufficient to enable us to arrive at a decisive opinion regarding these alkaloids as therapeutical agents in the fevers

fevers of this country. The result of the experimental inquiry is fully and specifically detailed in the tables given in the Appendix. Briefly enumerated, it is as follows:—

Total Number of Cases treated by the four Alkaloids.	Cured.	Failed.
2,472	2,446	27

2. The fevers treated occurred chiefly at stations and in localities known to be malarious, viz., at Goodaloor in Wynaad; Doomagoodiem, and other places in that vicinity, on the Upper Godavery; Goonah, in Central India; Kurnool, Labuan, Jeypore, Russelcondah, Kimeddy, Sumbulpore, and Cochin; and may, therefore, be considered fevers of the true paroxysmal character caused by malaria.

3. We submit the following abstract statements of the respective alkaloids taken from the tables in the Appendix:—

Chemically pure Sulphate of Quinine.—Number of cases treated, 846; cured, 840; failed, 6. Dose varied from 2, 4, 6, 8, 10, to 20 grains, administered as shown in the table in Appendix. The effects on the general system were deafness, singing noises in the ears, vertigo; also, at times, nausea, vomiting, and purging; occasionally the circulation was excited, sometimes depressed. In a few instances there was headache. The check of paroxysm in a large proportion of the cases was speedy; viz., from one, two, three or four, to seven days; in the aggregate, it ranged from 1 day to 16 days.

Sulphate of Quinidine.—Number of cases treated, 664; cured, 660; failed, 4. Dose varied from 2, 5, 7, 8, 10, 20 to 30 grains. The effects on the general system were deafness, singing noises in the ears. Frequently bilious purging, occasionally vomiting; in a few cases vertigo. In some the circulation was excited; in others, depressed. In a large majority of the cases, check of paroxysm ranged from one day to eight days; in many it was from one day to four days.

Sulphate of Chinchonidine.—Number of cases treated, 403; cured, 399; failed, 4. Dose varied from 3, 5, 6, 8, 10 to 20 grains. The effects on the general system were, deafness and singing noises in the ears, vertigo, sometimes nausea, vomiting or purging; also, headache and general depression. Check of paroxysm, in a large number of the cases, ranged from one day to four days. In the aggregate it was from 1 day to 16 days.

Sulphate of Chinchonine.—Number of cases treated, 559; cured, 546; failed, 13. Dose varied from 2, 3, 4, 5, 6, 8, 10, 20 to 30 grains. The effects on the general system were, deafness, singing noises in the ears, also vertigo, nausea, vomiting and purging; occasionally general depression, dryness of throat; sometimes excitement, headache. Check of paroxysm, in the greatest number of cases, ranged from one day to eight days. In the aggregate it was from 1 day to 16 days.

4. *Regarding the Doses used and the Mode of Administration adopted.*—In a very large proportion of the cases the doses were eight or ten grains, most commonly the latter, and were given once during the intermissions, a few hours before the expected paroxysm. In a good many instances, however, 4, 5, 6, or 7 grains were administered two or three times during the apyrexial period. These two modes of exhibition appear to have been equally efficacious in controlling recurring paroxysms. A few medical officers employed similar doses during the paroxysms, and occasionally gave doses of 15, 20, and even 30 grains. The effects produced on the general system by doses of 10 grains and upwards of the various alkaloids, including chemically pure sulphate of quinine, were in all respects very similar to those caused by equal doses of ordinary sulphate of quinine. Deafness, singing noises in the ears, and vertigo were the symptoms most frequently observed; nausea; bilious vomiting or purging occasionally occurred. In a few instances the circulation was excited, in others depressed; in some drowsiness followed. From this general description we except sulphate of chinchonine, which was found generally more disturbing, and particularly liable to cause nausea and vomiting. Smaller doses, from five to seven grains, were better borne, and were seldom followed by the disagreeable symptoms above noted.

5. In much the greatest number of fevers, shown in the returns to have been successfully treated, the alkaloids were exhibited with speedy and marked benefit; that is, the paroxysms were checked in one, two, or three days. In many of the cases the check was

established in one day, and by a single dose of 10 grains; sometimes a dose of 4, 5, 6 or 7 grains produced the same effect. Most of the medical officers employed in using the alkaloids seem fully impressed with the belief that they are equally or very nearly as efficacious as ordinary quinine; and, as already shown, the mass of information furnished in the tabular reports proves that such belief is well founded, excepting in the case of chinchonine, which, it will be observed, has much the largest ratio of failures. On the other hand, it must be stated that a few of the medical officers do not consider that any of the new alkaloids are, in equal doses, as efficacious as ordinary quinine, though they admit their valuable febrifuge power.

6. It has been shown that the total number of fevers treated by the new alkaloids and chemically pure quinine is 2,472, of which 27 are stated to have failed. The failures, it will be observed, are but a little in excess of one per cent. of the aggregate number treated, which is certainly a most favourable result, especially when it is known that many of the patients were saturated with malaria and ill-fed, as evidenced by their enlarged spleens and emaciated and anæmic condition. Such was most commonly the deteriorated health-state of the fever-stricken patients who applied for aid at Goodaloor, where the alkaloids were most fully and largely tested; many of the sick from fever treated at Cochin were in a like unfavourable state. The patients in whose cases the alkaloids were principally tried were natives of the stations and places shown in the tables in the Appendix; but it may also be stated that they were likewise used on a small scale in fevers of the paroxysmal form affecting Europeans and East Indians. Twenty-five Europeans were treated successfully, and with speedy effect; in one case only the check of paroxysm was deferred; but in this instance the remedy is stated not to have had a fair trial, in consequence of the patient having been moving about the district in the discharge of his duty. Thirty-two East Indians were cured of fever by the alkaloids. In one the paroxysms were not fully controlled sooner than the tenth day.

7. Of the 27 failures, 11 are recorded in the reports from Labuan, and it is observed that in 10 of these cases the paroxysms were checked by two and three 6-grain doses of quinine, and in one by two 12-grain doses of chemically pure quinine, by which the superior efficacy of quinine is evidently implied. It is necessary, however, to note that the fever-patients at Labuan were invariably given only a single 8 or 6-grain dose a few hours before the expected paroxysm, which we think can scarcely be deemed a quantity sufficient to check in every instance recurring febrile attacks of a paroxysmal nature. Of the six failures shown in the returns from Thayetmyo, it is stated that in two cases quinine had been resorted to, but the result of the use of that remedy is not shown. Four of these cases were treated by sulphate of chinchonine, two by sulphate of quinidine, nausea and vomiting having been caused by the latter alkaloid. In all these cases the failure was pronounced on the second and third days. The dose is stated to have been 10 grains given during the paroxysms. The want of success may, we think, be reasonably attributed to the unfavourable time of administering the remedy. Of the remaining 10 cases in which failure is recorded, six were treated by chemically pure sulphate of quinine, and four by the new alkaloids.

8. In regard to the relative effects of the three new alkaloids, and with them chemically pure sulphate of quinine, the evidence derived from their use shows that, with the exception of sulphate of chinchonine, as already stated, they, in a remarkable degree, so closely resemble each other in therapeutical and physiological action, as to render distinctive description of little or no practical utility. In a large proportion of the cases in which they were tried, chemically pure sulphate of quinine, and sulphates of quinidine and chinchonidine, appeared to indicate nearly equal febrifuge power, and in equal circumstances their use produced almost the same physiological effects.

9. As surmised in the former report of the Commission, the various detailed statements of the experiments with these alkaloids show that the difference of their therapeutical and physiological action are of degree, and not special. Either of them, and also quinine, when administered in adequate febrifuge doses, have not unfrequently a disturbing influence on the general system, manifested by effects apparently common to all, and excepting chinchonine, varying very little in regard to particular symptoms. All have a positive effect on the digestive system; generally, small doses improve digestion, but with the larger doses the effect is varied, as the case may be, from loss of appetite, to nausea, bilious vomiting, or purging. According to the amount of the dose, a like gradation of action on the nervous and circulatory system was observed. In their remedial agency the differences of the respective alkaloids is best shown by the following table, exhibiting the ratios of failure per 1,000 cases treated, in judging of which, however, what has been already stated in paragraph 7 regarding the failures should be kept in mind:—

Chemically pure sulphate of quinine	-	-	-	-	-	7.092
Sulphate of quinidine	-	-	-	-	-	6.024
„ „ chinchonidine	-	-	-	-	-	9.925
„ „ chinchonine	-	-	-	-	-	23.255

10. The

10. The following table shows the number of cases treated with each alkaloid by medical officers and subordinates respectively :—

	OFFICERS.		SUBORDINATES.	
	Cases.	Failures.	Cases.	Failures.
Sulphate of Quinine (chemically pure)	530	5	316	1
„ Quinidine - - -	221	3	443	1
„ Chinchonidine - -	167	3	236	1
„ Chinchonine - - -	238	18	326	—
TOTAL - - -	1,151	24	1,321	3

11. In connection with the subject of this inquiry, it is important to note that in the Appendix to the Report of the Government Quinologist, dated 27th November 1867, it is stated “ that at least for 30 years much of the commercial quinine employed in medicine would inevitably, from the method employed in its manufacture, be largely mixed with the sulphates of quinidine and chinchonidine, and would occasionally consist entirely of the latter salts.” This statement, in our opinion, goes far to establish that those two alkaloids are but very little, if at all, inferior to quinine.

12. Referring to the four reports in the Appendix, it will be observed that considerable difference of opinion exists therein as regards the efficacy of the alkaloids in comparison with quinine. The reports from Doomagoodiem and Labuan, by Drs. Houston and Fitzgerald, state that the new alkaloids are all more or less inferior in febrifuge effect to quinine, whilst those furnished by Dr. Whitton and Mr. Wade from Cochin and Goodaloor record a different belief, and represent the alkaloids in remedial efficacy equal to quinine. We have already offered an opinion relative to the probable cause of the failures at Labuan, and therefore we are inclined to attach greater weight to the views entertained by Dr. Whitton and Mr. Wade, and it is satisfactory to add that their combined estimate of these agents is based on their employment in the treatment of fevers on much the largest scale.

13. As the notably malarious stations of Doomagoodiem, Labuan, and Goodaloor, from their difference in geographical position, appear most likely to have furnished cases of paroxysmal fever of the most varied description, in regard to intensity of malarial influence, the returns from these places have been selected as data on which to form a comparative numerical estimate of the febrifuge power of the respective alkaloids and chemically pure sulphate of quinine. Tables, Nos. 5 and 6, in the Appendix, show the per-centage of cases of fever at these places, in which less than 20 grains of the alkaloids checked the paroxysms; and the per-centage of cases which required 20 grains and upwards to effect the same purpose.

The subjoined table gives the aggregate per-centage of these cases, and may be accepted as affording a fair therapeutical value of the alkaloids in the treatment of fevers :—

	Number of Persons Treated.	Number of Cases in which Less than 20 Grains checked the Paroxysm.	Number of Cases which required 20 Grains and upwards to check the Paroxysm.	Per centage of	
				Cures effected with Less than 20 Grains.	Cures effected with 20 Grains and Upwards.
Quinine, chemically pure - - -	416	320	96	76.92	23.07
Quinidine - - - - -	412	312	100	75.72	24.27
Chinchonidine - - - - -	323	242	81	74.92	25.07
Chinchonine - - - - -	385	282	103	73.24	26.75

14. In reviewing the whole of the operations for testing the therapeutical effects to the Chinchona alkaloids, the result confirms generally the favourable opinion expressed by the Commission last year; and likewise conclusively establishes beyond doubt that ordinary sulphate of quinine, chemically pure sulphate of quinine, and sulphate of quinidine possess equal febrifuge power; that sulphate of chinchonidine is only slightly less efficacious; and that sulphate of chinchonine, though considerably inferior to the other alkaloids, is notwithstanding a valuable remedial agent in fever.

15. In conclusion, the Commission beg to recommend that these alkaloids may be tested as prophylactics against fevers among European troops, and, with this view, would suggest that a supply of each of these salts may be made over to the Inspector General, British Medical Service, for distribution to the various British regiments serving in this presidency.

From the Officer in Medical Charge, Goodaloor, to the Officiating Secretary, Principal Inspector General, Indian Medical Department, Fort St. George, dated Goodaloor, 1st January 1868, No. 1.

1. In forwarding the accompanying two tabulated sheets for the month of December 1867, I beg to state that, in accordance with your instructions conveyed in Memorandum, No. 4591, the experiments with the alkaloids ceased on the 19th instant, owing to the last supply having been expended, and the report on its therapeutic properties as an anti-periodic is now submitted.

2. In the latter part of September 1866, Assistant Surgeon J. Keess, who was specially employed on this duty, was removed to Madras. During the four months the experiments were carried on previous to his departure, the results proved so satisfactory that I was induced to continue them.

3. Since then, 1,079 cases have been treated by these salts with success, as is shown in the accompanying general tabular statement.

4. *Disulphate of Quinine* (chemically pure).—The experiments connected with this salt are of a later date than the other alkaloids, having been put into practice in March last. The increase of the number treated over that of chinchonidine and chinchonine may be attributable to the fact that not only at the time of its introduction were paroxysmal fevers very prevalent, but its use was continued for a longer number of days monthly than the two above-named alkaloids. Out of 284 cases thus treated, one dose was sufficient to stay the attack of fever in 251 cases, while 32 required a second dose, and one solitary case complicated with congestion of left lung required the administration of a fourth dose.

5. *Quinidine*.—With this salt 300 cases have been treated, of which number one dose was sufficient in 268 cases, while 30 required a second dose, and only two a third dose, so as to effectually stay the attack of fever. It exactly, not unlike quinine, dissolves with dilute sulphuric acid, and is very similar in its effects to that drug, if not equal to it.

6. *Chinchonidine*.—With this preparation 242 cases have been treated, one dose being sufficient in 219, while 21 had a second dose, and two a third dose. It, to some extent, creates nausea, and even induced vomiting in a few cases, leaving a disagreeable sensation for some time afterwards; nevertheless, its properties as an anti-periodic can be depended upon.

7. *Chinchonine*.—This salt was at first carefully and cautiously used, as I was led to believe that it was an irritant of the stomach and bowels, and though in a few cases vomiting was induced, and in others diarrhoea (doubtless quinine acting likewise in similar cases), yet its use proves that it is not a gastro-intestinal irritant. It has, in common with the other alkaloids, been used in cases complicated with diarrhoea and dysentery, in combination with laudanum, successfully: 253 cases were thus treated, 215 requiring one dose for their cure, while in 38 a second dose was administered.

8. *Decoction of Bark* was prepared with the dried leaves, twigs and bark of the chinchona plant as supplied by the superintendent of the Government Chinchona Plantation. It was continued for a couple of months only. Twenty-two cases were thus treated, in 20 of whom the attack was stayed, whilst in two it failed, quinine being resorted to. Of the two failures, one case of a month's duration, complicated with anasarca and general debility, may not be surprising; but the other, which was a mild attack and of short duration, yet derived no apparent benefit from the decoction, though it was steadily continued for five days. The dose usually administered was four ounces three times a day, and though the alkaloids effect a more speedy cure, which perhaps is more desirable with a working population, yet this simple anti-periodic can be obtained by the possessors of a few chinchona plants.

9. Chinchonine was very generally complained of by the patients treated with the alkaloids, but it was apparent that it was more readily induced by the chemically pure disulphate of quinine and quinidine than by chinchonidine and chinchonine.

10. The

10. The alkaloids, not unlike quinine, have a tonic effect, helping digestion and increase of appetite.

11. The majority of the cases were out-patients of this dispensary, they were bad specimens for experimental purposes, many being half-starved and emaciated, generally with enlarged spleens, a small weak pulse, invariably anæmic, and with marked pulsation.

12. Of the number treated, 87 were in-patients of this dispensary, and though they were for some time afterwards under treatment, either for other diseases or observation, they continued to remain free from fever while in hospital. Of the remaining number treated as out-patients, many were free from attacks, for long periods, enjoying good health, whilst many again returned to the dispensary after the lapse of weeks for treatment for a second attack; but I submit that their return should be regarded more as a necessary consequence attributable to a continued residence in a notedly malarious climate, than to the inefficiency of the salts to stay the attack.

13. The alkaloids were generally administered in 10-grain doses dissolved in water—quinine and quinidine being soluble, chinchonidine and chinchonine partially so—each dose being invariably taken in my presence.

14. In conclusion, I would beg to state that, after a trial of 19 months with these salts in a malarious district, where paroxysmal fevers are very prevalent, a 10-grain dose of any of the alkaloids, as was usually given, tends either to cut short the attack of fever for some time, or mitigates markedly the severity of another paroxysm.

APPENDIX.

TABLE I.—Showing the Results of the Treatment of Paroxysmal Malarious Fevers by Sulphate of Quinine (chemically pure).

NAME of MEDICAL OFFICER.	DISTRICT or STATION.	TYPES OF FEVER.					RESULT.		REMARKS.
		Quotidian.	Tertian.	Quartan.	Remittent.	Total.	Cured.	Failed.	
Assistant Apothecary, M. Wade.	Goodaloor, Wynaad	288	14	6	—	308	307	1	Dose, chiefly 10-grains, in water, given during the intermissions, from 2 to 4 hours before the expected paroxysm. In a few cases 2, 3, 4, 5, 7 or 8 grains were given in the manner stated. Paroxysm checked in 249 cases in 1 day, in 53 in 2 days, in 4 in 3 days, in 1 in 4 days; 1 case remained unchecked. In all the cases the patients were under observation for some time after the paroxysm had been checked. Duration of fever prior to treatment ranged from 1 to 30 days; many of the sick had previously suffered from fever. Splenic enlargement in 122 cases. Effects of the remedy on the general system were deafness and ringing noise in the ears; in a good many, nausea or vomiting, or purging. The various doses were effective in checking the paroxysms. The larger more certain and immediate than the small. Goodaloor is a jungly and malarious locality.
Dr. J. Fitz Gerald -	Labuan - - -	35	1	—	—	36	36	—	Dose, 4, 6, or 8 grains, in solution, once during intermissions about 2 hours before the expected attack. Check of paroxysm varied from 3 to 16 days. The delay, in the latter instance, appears to have been due to the remedy not having been regularly given. Duration of fever prior to admission was from 1 to 6 days. Effects of the remedy on the system are not recorded. No decided difference apparent as regards the efficacy of the various doses. Country around station low, woody, and malarious.
Dr. J. M. Houston -	Doomagoodiem -	62	9	—	1	72	71	1	Dose, 5, 6, 8, or 10 grains, generally given twice during the intermissions. In a few cases the smaller doses were given 3 times; check of paroxysm in the total number of cases varied from 1 to 12 days, but in a large proportion of the cases it was from 1 day to 5 days. Duration of fever prior to admission ranged from 1 to 24 days; splenic enlargement in 1 case. Effects of the remedy on the general system were acceleration of pulse; in a few instances, ringing in the ears, headache, nausea or vomiting. The various doses as administered appear to have been about equal in effect. Country around station jungly and malarious.
Dr. H. C. Brodrick -	Goonah (Central India).	24	7	4	—	35	35	—	Dose, 3, 4, 5, 6, 7, 8, 10, 12, 15 or 20 grains during the intermissions, the smaller doses were given generally 3 times daily during intermissions, the large doses once about 2 hours before the expected paroxysm. Check of paroxysm varied from 2 to 9 days. Duration of fever prior to admission ranged from 1 to 23 days; splenic enlargement in 4 cases. Effects of remedy on the system not recorded. The various doses as administered were about equal in point of efficacy. Station malarious.
Dr. G. E. Whitton -	Cochin - - -	31	7	—	—	38	38	—	Dose, 5 or 10 grains during intermissions, from 2 to 5 hours before the expected paroxysms. Check of paroxysm varied from 1 to 3 days. Duration of fever prior to treatment ranged from 2 days to 3 months; splenic enlargement in 6 cases. It is noted that there were no effects of the remedy on the general system observed. No material difference of the efficacy of the 5 and 10-grain doses. Surrounding district malarious.

432.	Dr. H. R. Oswald	-	Bangalore	-	-	16	-	-	-	16	16	-	Dose, 3, 5 or 10 grains during the intermissions, the smaller doses were repeated 2 or 3 times. Check of paroxysm varied from 1 to 8 days. Duration of fever prior to treatment ranged from 1 day to 12 months; splenic enlargement in 1 case. Effects of the remedy on the system not recorded. Station occasionally malarious.
	Dr. J. M. Miller	-	Thayetmyo	-	-	2	-	-	-		1	1	Dose, 5 grains given twice during intermissions, paroxysm checked in 1 case in 3 days. In one the paroxysm was unchecked after 9 days, and when 90 grains had been taken by the patient. Duration of fever prior to admission was in both cases 3 days. No effects of the remedy on the general system have been noted.
	Dr. J. Houston	-	Mysore	-	-	164	13	23	-	200	199	1	Dose, 5, 6, 8, 10, 12, 15, or 20 grains given during the intermissions, and sometimes in the hot stage of paroxysm. The smaller doses were generally repeated 2 or 3 times. Check of paroxysm varied from 1 to 7 days. Duration of fever prior to treatment ranged from 1 day to 9 months; splenic enlargement in 50 cases. Effects of the remedy on the general system were commonly singing noises in the ears and acceleration of pulse, occasionally lowering of the pulse, headache; as administered the large and small doses were apparently equally effective in checking the paroxysm. District malarious.
433.	Assistant Apothecary H. A. Harrison.	-	Sumbulpore	-	-	4	-	-	4	8	8	-	In the Quotidian type 5 or 6 grains were given 3 times daily during the intermissions, and in some cases during the paroxysms. In 3 cases of the remittent form of fever the doses were 2, 3, or 6 grains 3 times daily during the remissions; in 1 case throughout the period of fever. Effects of the remedy on the general system were giddiness, ringing in the ears, acceleration of the circulation. Check of paroxysm varied from 1 to 5 days. Duration of fever prior to treatment ranged from 3 to 12 days. Splenic enlargement in 2 cases. Station malarious.
	Dr. J. Henderson	-	Bangalore	-	-	6	-	-	-	6	4	2	Dose, 3 or 5 grains twice during intermissions. Check of paroxysm in 4 cases from 3 to 5 days. Of the 2 failures, in 1 case the paroxysm was only partially checked, and in 1 dysentery supervened. Duration of fever prior to treatment ranged from 1 day to 8 months. Effect of remedy on the system was in 1 instance diarrhoea. Station occasionally malarious.
	Dr. G. W. Walters	-	Secunderabad	-	-	7	1	-	-	8	8	-	Dose, 8, 12, or 20 grains given in the mornings without reference to the paroxysm. Check of paroxysm ranged from 2 to 10 days. Duration of fever prior to treatment ranged from 8 to 46 days. Splenic enlargement in 3 cases. Effects on the general system were singing noises in the ears, vertigo. The mode of administration is vaguely stated. The large doses appear to have had the most immediate effect. Stations at time malarious.
	Dr. S. T. Heard	-	Shemoga	-	-	40	2	2	-	44	44	-	Dose, 5, 6, 8, 10, 12, or 15 grains given during the intermissions, commonly twice during a certain period anterior to the expected paroxysm. Check of paroxysm varied from 1 to 13 days. Duration of fever prior to treatment ranged from 1 day to 8 months. Splenic enlargement in 6 cases. No effects of the remedy on the general system. The larger doses appear to have been most effectual in checking the paroxysm. Station and district malarious.
	Dr. D. Kearney	BR	Sumbulpore	-	-	61	12	-	-	73	73	-	Dose, chiefly 10 grains given during the intermissions, about 3 hours before the expected paroxysm; on 3 occasions 20 grains were given in same manner. In a few cases 3 or 5 grains from 2 to 5 times during intermissions. In the 73 cases check of paroxysm varied from 1 to 14 days, in 70 it was from 1 to 6 days; enlargement of spleen in one case only. The effect of the remedy on the general system was slight excitement of the circulation. As administered, the respective doses were effectual in checking the paroxysms. Those of 10 grains appeared to be most immediate. Station malarious.
						740	66	35	5	846	840	6	

SERVANT

TABLE II.—Showing the Results of the Treatment of Paroxysmal Malarious Fevers by Sulphate of Quinidine.

NAME of MEDICAL OFFICER.	DISTRICT or STATION.	TYPES OF FEVER.					RESULT.		REMARKS.
		Quotidian.	Tertian.	Quartan.	Remittent.	Total.	Cured.	Failed.	
Assistant Apothecary, M. Wade.	Goodaloor, Wynaad	253	10	2	—	265	265	—	Dose, generally 10 grains in water during the intermissions, from 1½ to 4 hours before the expected paroxysm. In a few cases 5 or 7 grains were given in like manner. In 238 cases the paroxysm was checked in 1 day; in 27 cases, in 2 days. Sick were under observation for some time after date of check of paroxysm; 117 patients had splenic enlargement, and a large proportion of all treated had previously suffered repeatedly from fever. The duration of attack of fever prior to admission ranged from 2 days to 2 months; the effects produced by the remedy were commonly deafness and singing noise in the ears, with occasionally nausea or bilious vomiting or purging; in a few instances vertigo and drowsiness occurred. The smaller doses of 5 and 7 grains appear to have been equally as efficacious as the larger doses of 10 grains. Goodaloor is situated in Wynaad, on the Western Ghats. It is surrounded by dense jungle, and is notoriously malarious.
Dr. J. FitzGerald -	Labuan - - -	84	14	1	—	99	99	—	Dose, commonly 8 grains in solution, once during intermissions, and about 2 hours before the expected paroxysms. In a few cases 6 grains were given in the manner stated. Check of paroxysm varied from 2 to 8 days. Splenic enlargement in 4 cases. Duration of fever prior to admission ranged from 1 to 10 days; not shown whether the patients had previously suffered or not from fever. Effects of remedy on the general system not recorded. Labuan is a small island near to Borneo. It is low, woody, and malarious.
Dr. J. M. Houston -	Doomagoodiem -	47	—	—	1	48	48	—	Dose, chiefly 8 or 10 grains twice during intermissions. In a few cases 3, 4, or 6 grains were given 2 or 3 times during the apyrexial period. In 21 cases paroxysm checked in 2 days; in 24, in 3 days; in 3 cases, in 4, 5, and 8 days respectively. Duration of fever prior to admission ranged from 1 to 10 days. Splenic enlargement in 4 cases. In 33 cases the patients had suffered previously from fever. The effects produced by the remedy were acceleration of pulse in all; in a considerable number, diarrhœa; in 2, ringing in the ears; in 3, bilious vomiting and purging. The larger doses appear to have been somewhat more efficacious than the smaller. Doomagoodiem is on the Upper Godavery, the other stations at which the sick were treated are Lower. The whole district is low, scrubby jungle, abounding in malaria. In one case after the paroxysm had been checked, pneumonia supervened with fatal effect.
Dr. H. C. Brodrick -	Goonah (Central India).	9	5	—	—	14	14	—	Dose, 5, 8, 10, 15, or 20 grains. The doses of 5 or 8 grains were given 3 times during the intermissions. The large dose, 1 or 2 hours before the expected paroxysms. Check of paroxysm varied from 2 to 9 days. Spleen normal in every case. Duration of fever prior to admission ranged from 1 to 5 days; not stated whether the patients had been previously subject to fever. Effects of the alkaloid not recorded; no material difference in the efficacy of the repeated smaller doses and the single large dose. Station malarious.

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Dr. J. Dougall -	Jeypore - - -	8	1	-	-	9	9	-	Dose, 10, 15, 20, or 30 grains, administered chiefly during the paroxysms. In 4 cases paroxysm was checked in 1 day; in 1 in 2 days; in 2 in 3 days; in 1 in 4 days; and in 1 in 8 days. Splenic enlargement in 3 cases. The sick treated had been subject to attacks of fever previously as follows:—In one case 2 months; in two 5 months; in one 6 months; in one 14 months; in one 2 years; and in three 4 years. Effects of remedy, vertigo, and ringing in the ears. In a few instances feeble action of heart and lowering of pulse. In others bilious vomiting or purging. The patients were all of the Jeypore police, and had been long and much exposed to the influence of malaria in the hilly and jungly tracts of that district.
Dr. J. McCarthy -	Kurnool - - -	31	-	-	-	31	31	-	In 12 cases, dose, 10 grains twice during intermissions. In 19 cases, dose, 5 grains given every hour during the 3 hours immediately preceding the expected paroxysm. Check of paroxysm varied from 2 to 11 days. In 24 cases the check was from 2 to 5 days. Spleen enlarged in 6 cases. Duration of fever prior to admission ranged from 1 to 27 days. Effects of alkaloid, in 4 cases vertigo, in 2 headache, in 7 diarrhoea. The two modes of administering the remedy were equal in point of efficacy. Station and district malarious.
Second Dresser, C. Appiah.	Balligoodah - -	33	-	-	-	33	33	-	Dose, chiefly 10 grains (in a few instances 15 grains) during the paroxysms. Check of paroxysm varied from 1 to 36 days. A considerable proportion of the patients are stated to have been weak and anæmic, 1 case of splenic enlargement. Duration of fever prior to admission ranged from 1 to 30 days in 32 cases. In 1 case fever had prevailed 14 months. Effects of remedy, increased perspiration, vertigo. In a few instances headache and bilious vomiting. Locality malarious.
Apothecary, T. Horrox	Russelcondah - -	60	6	-	2	67	66	1	Dose, generally 10 grains during paroxysms. In a few cases the same dose was given in the intermissions. In others, 3 or 5 grains during the paroxysms. Check of paroxysm in the whole of the cases varied from 1 to 4 days, but in the greatest number it took place in 1 and 2 days. Splenic enlargement in 11 cases. Duration of fever prior to admission ranged from 1 to 30 days; not recorded whether the patients had or had not fever previously. Effects of the remedy, increased perspiration, vertigo, general depression and lowering of pulse. In a few instances nausea and bilious purging, in others diarrhoea. The large doses appear to have been slightly more efficacious than the small. Russelcondah is situated at the foot of the hill tracts of Orissa, and is decidedly malarious.
Dr. G. E. Whitton -	Cochin - - -	4	2	-	-	6	5	1	Dose, 5 grains during intermissions, from 1 to 3 hours before expected paroxysm. Check of paroxysm in 2 cases in 2 days, in 4 in 3 days. Duration of fever prior to admission ranged from 4 to 45 days. Splenic enlargement in 2 cases, no effects of remedy observed. District malarious; failure attributed to the doses being too small.
Dr. J. M. Miller -	Thayetmyo - -	4	-	-	-	4	2	2	Dose, 10 grains during paroxysms, at intervals of 4 hours. In 2 cases paroxysm checked in 3 and 8 days respectively; in 2 paroxysm unchecked after 2 days, and when each patient had taken 60 grains of quinidine. Duration of fever prior to treatment in all the cases was 4 days. Spleen normal in every case. Effects of remedy were increased frequency and volume of pulse in all. In the 2 cases in which the alkaloid failed, it caused nausea and vomiting.

TABLE II.—Showing the Results of the Treatment of Paroxysmal Malarious Fevers by Sulphate of Quinidine—*continued*.

NAME of MEDICAL OFFICER.	DISTRICT or STATION.	TYPES OF FEVER.					RESULT.		REMARKS.
		Quotidian.	Tertian.	Quartan.	Remittent.	TOTAL.	Cured.	Failed.	
Second Dresser Davood Beg.	Talook of Mangalore	8	—	—	—	8	8	—	Dose in 1 case, 2 grains twice daily during paroxysms. In 6 cases 5 grains, and in 1 10, in the manner stated. Paroxysm checked in 2 days by the 2-grain doses, and in 3 and 4 days by the 5 and 10-grain doses. Duration of fever prior to treatment ranged from 20 days to 4 months. Spleen stated to be normal in every case. Effect of remedy, diarrhoea in 6 cases. District malarious.
Third Class Hospital Assistant, T. Ponombalum.	Camp Kurakul -	28	4	7	—	39	39	—	Dose, 3, 4, 5, or 8 grains twice a day during intermissions. Check of paroxysm varied from 5 to 12 days. Splenic enlargement in 6 cases. Duration of fever prior to treatment ranged from 2 days to 21 months. Effect of remedy, improved digestion; no material difference in efficacy of the various doses used.
Assistant Apothecary, J. J. Watts.	Chetterpore (Ganjam)	7	1	—	—	8	8	—	Dose, 3 or 5 grains 2 or 3 times during intermissions in the quotidian form of fever. In the tertian, 5 grains an hour before the expected paroxysm, and every 6 hours on the day of fever. Check of paroxysm from 3 to 5 days. Duration of fever prior to treatment from 3 to 12 days. Splenic enlargement in 2 cases. District malarious.
Assistant Apothecary, J. A. Falloon.	Kimedy - - -	21	2	—	—	23	23	—	Dose, 3, 5, 10, 15, or 20 grains during the paroxysms. Check of paroxysm varied from 1 to 5 days; in most of the cases it took place in 1 and 2 days. Duration of fever prior to treatment varied from 1 day to 12 months and upwards. Splenic enlargement in 6 cases. Effects of remedy, ringing in the ears, frontal headache, lowered action of heart and pulse. In a few instances bilious vomiting or diarrhoea. The large doses slightly more efficacious than the smaller. Mr. Falloon considers quinidine more efficacious than quinine. Station notably malarious.
Dr. D. Kearney	Sumbulpore - -	9	1	—	—	10	10	—	Dose, generally 10 grains, once during intermissions, 3 hours before the expected attack. In 2 cases, 10 grains were twice given in the intermissions. Check of paroxysm from 3 to 6 days. Duration of fever prior to admission from 2 to 6 days. Effects of remedy were slight excitement in all the cases; in 1, vertigo, in 3, vomiting and purging. Country around station jungly and malarious.
		665	46	10	3	664	660	4	

TABLE III.—Showing the Results of the Treatment of Paroxysmal Malarious Fevers by Sulphate of Chinchonidine.

NAME of MEDICAL OFFICER.	DISTRICT or STATION.	TYPES OF FEVER.					RESULT.		REMARKS.
		Quotidian.	Tertian.	Quartan.	Remittent.	TOTAL.	Cured.	Failed.	
Assistant Apothecary M. Wade.	Goodaloor, Wynaad	206	4	1	1	212	212	-	Dose, chiefly 10 grains, in water, during intermissions from 2 to 4 hours before the expected paroxysm. In a few cases 4, 5, 7, or 8 grains were given in same manner. In 193 cases paroxysms checked in 1 day; in 17 cases in 2 days; in 2 in 3 days. In 97 cases there was enlargement of the spleen. Duration of fever prior to admission ranged from 1 to 30 days. Effects of the remedy were generally deafness and ringing noise in the ears; in a few instances, vomiting or diarrhoea. The various doses appear to have been equal in efficacy. Station jungly and malarious
Dr. J. FitzGerald -	Labuan - - -	57	6	-	-	63	60	3	Dose, 8 grains in solution, given once during the intermissions, about 2 hours before the expected paroxysm. Check of paroxysm from 1 to 11 days. Splenic enlargement in 4 cases. Duration of fever prior to admission ranged from 1 to 5 days. Effects of remedy on the general system not recorded. Of the 3 failures, in 2 the paroxysms are stated to have been subsequently checked by two 6-grain doses of ordinary quinine; in 1 by two 12-grain doses of chemically pure quinine. Country around station low, woody, and malarious.
Dr. J. M. Houston -	Doomagoodiem -	43	4	-	1	48	48	-	Dose, 4, 6, 8, or 10 grains; the smaller doses were given 2 or 3 times during intermissions; the larger twice, in same manner. Check of paroxysm varied from 2 to 5 days; 1 case of splenic enlargement. Duration of fever prior to admission ranged from 1 to 9 days. Effects of remedy were, acceleration of pulse in all the cases. In a few instances deafness, vertigo, nausea, vomiting, thirst. The various doses appear to have been equal in efficacy. Station jungly and malarious.
Dr. J. Dougall - -	Jeypore - - -	8	1	-	-	9	9	-	Dose, in 7 cases 20 or 30 grains given during the paroxysm. In 2, the same quantities were given during paroxysms and intermissions. In 4 cases, paroxysm checked in 1 day; in 3, in 2 days; in 2, in 4 days. Splenic enlargement in 1 case. Duration of fever prior to treatment ranged from 1 day to 22 months. Effects of the remedy were generally ringing in the ears, vertigo, headache; in 2, nausea; in 3, bilious vomiting and purging. Station notably malarious.
Dr. D. J. M'Carthy -	Kurnool - - -	32	-	-	-	32	32	-	In 19 cases the dose was 5 grains in solution every hour during 3 hours immediately preceding the expected paroxysm. In 13 cases 10 grains were given twice during the 2 hours before the expected attack. The 5 and 10-grain doses, as administered, were about equal in point of efficacy. Splenic enlargement in 3 cases. Duration of fever prior to treatment ranged from 1 to 15 days. Effects of the remedy were, in a few cases, headache and diarrhoea. Station and district malarious.

TABLE IV.--Showing the Results of the Treatment of Paroxysmal Malarious Fevers by Sulphate of Chinchonine.

NAME of MEDICAL OFFICER.	DISTRICT or STATION.	TYPES OF FEVER.					RESULT.		REMARKS.
		Quotidian.	Tertian.	Quartan.	Remittent.	TOTAL.	Cured.	Failed.	
Assistant Apothecary M. Wade.	Goodaloor, Wynaad	249	10	-	-	259	259	-	Dose, generally 10 grains, in water, given during intermissions from 2 to 4 hours before the expected paroxysm. In a few cases 3, 5, or 7 grains were given in the same manner. In 225 cases paroxysm was checked in 1 day; in 34 cases in 2 days. The patients were kept for some time under observation subsequent to the check of paroxysm. Splenic enlargement in 81 cases. Duration of fever prior to treatment ranged from 1 to 30 days; a large proportion of the sick treated had previously suffered from fever. Effects of the remedy on the general system were most commonly deafness and ringing noise in the ears; in a few cases, drowsiness and vertigo, or vomiting or purging. The various doses appear to have been equally effective in checking the paroxysm. Country around Goodaloor jungly and malarious.
Dr. J. FitzGerald	Labuan - - -	64	13	1	-	78	70	8	Dose, 8 grains in solution once during the intermission, about 2 hours before the expected paroxysm. Check of paroxysm in the total number of cases, from 3 to 16 days: in 53 of these cases, it was from 3 to 7 days. In the 8 failures the paroxysms are stated to have been subsequently checked, in 3 instances, by two 6-grain doses of quinine, and to 1 by three 6-grain doses; in three by two 6-grain doses of chemically pure quinine, and in 1 by three 6-grain doses. Duration of fever prior to admission ranged from 1 to 8 days. Splenic enlargement in 5 cases. Effect of the remedy on the general system not stated. Country around station low, woody, and malarious.
Dr. J. M. Houston	Doomagoodiem -	46	2	-	-	48	48	-	Dose, 4, 5, or 6 grains 2 or 3 times during intermissions, or 8 or 10 grains, and an additional dose of 5 grains in the apyrexial period. Paroxysm checked in 20 cases in 2 days; in 21, in 3 days; in 6, in 4 days; in 1, in 6 days. Duration of fever prior to treatment varied from 1 to 7 days; in 42 cases the patients had previously suffered from fever. Effects of the remedy on the general system were, acceleration of pulse, vertigo; in a few instances nausea or vomiting, dryness of throat, thirst. The small and larger doses, administered as stated, appear to have been of equal efficacy. Country around station jungly and malarious.
Dr. H. C. Brodrick	Goonah (Central India.)	12	2	-	1	15	14	1	Dose, 3, 5, 8, 10, or 20 grains during intermissions; in a good many instances, both small and large doses were given. In the cases in which the small doses only were employed, the dose was administered two or three times daily. The large doses were commonly given from 1 to 2 hours before the expected paroxysm. In all the cases, check of paroxysm varied from 2 to 11 days; in 12 cases it was from 2 to 5 days. Duration of fever prior to treatment, from 1 to 8 days. There were 2 cases of splenic enlargement. Effects of the remedy on the general system were, by the large doses, in 7 cases vomiting, in 1 extreme nausea. In the failure recorded, the remedy had only the effect of changing the type of fever, viz., from tertian to quartan. The large and small doses, as administered, appear to have been equal in efficacy. Station malarious.

TABLE IV.—Showing the Results of the Treatment of Paroxysmal Malarious Fevers by Sulphate of Chinchonine—*continued*.

NAME of MEDICAL OFFICER.	DISTRICT or STATION.	TYPES OF FEVER.					RESULT.		REMARKS.
		Quotidian.	Tertian.	Quartan.	Remittent.	TOTAL.	Cured.	Failed.	
Dr. J. Dougall - -	Jeypore - - -	7	1	-	-	8	8	-	Dose, 20 or 30 grains during paroxysm and intermissions. Paroxysm checked in 4 cases in 1 day; in 2, in 2 days; in 1, in 3 days; in 1, in 4 days. Duration of fever prior to treatment, from 1 day to 12 months. Effects of the remedy on the general system were, in 6 cases, vertigo, 3 of which had also ringing in the ears; in 2, circulation excited; in 2, depressed circulation; in 5 cases there was nausea. Station very malarious.
Dr. D. J. McCarthy -	Kurnool - - -	32	-	-	-	32	32	-	Dose, 10 grains, given twice during the 2 hours immediately preceding the expected paroxysm. In 28 cases, paroxysm checked from 2 to 5 days; in 4 cases, from 6 to 8 days. Duration of fever prior to treatment, from 1 day to 10 days. One case of splenic enlargement. Effect of remedy on the general system, vertigo, headache, diarrhoea. Station and district malarious.
Second Dresser C. Appab.	Baligoodah - -	14	-	-	-	14	14	-	Dose, 8 or 10 grains, given during the paroxysms. Check of paroxysm varied from 2 to 8 days in all the cases; in 12, from 2 to 5 days. Duration of fever prior to admission, from 1 to 10 days. Effects of remedy on the general system were vertigo, headache, nausea, vomiting, or diarrhoea. Station and district malarious.
Apothecary T. Horrox	Russelcondah - -	6	-	-	-	6	6	-	Dose, 10 grains, given during the paroxysms. Paroxysm checked in 2 cases in 1 day; in 4, in 3 days. Duration of fever prior to treatment ranged from 1 day to 10 days. Four cases of splenic enlargement. The effects of remedy on the general system in all the cases were lowering of the pulse. In a few instances, vertigo, vomiting, or purging, with increased perspiration. Station malarious.
Dr. G. E. Whitton -	Cochin - - -	14	3	-	-	17	17	-	Dose, 5, 10, or 20 grains from 2 to 4 hours before expected paroxysm; in 2 cases the doses were given during the hot stage of the attack. Paroxysm checked in 12 cases in 1 day; in 2, in 2 days; in 3, in 3 days. Two cases of splenic enlargement; 6 had tenderness in region of spleen. Duration of fever prior to treatment ranged from 3 days to 8 months, and the majority of the patients had previously suffered from fever. Effects of the remedy on the general system were vertigo, deafness, diarrhoea, or nausea, and vomiting. The large doses checked the return of paroxysm at once. The small doses also acted effectively, but less immediate than the large. District malarious.

432.	Dr. J. M. Miller	-	Thayetmyo	-	17	-	-	-	17	13	4	Dose, 10 grains, given at intervals of 4 hours, throughout paroxysms in 15 cases; in 2 cases the same dose was given 3 times during intermissions. Check of paroxysm varied from 1 to 10 days. In the 4 failures, quinine was subsequently given to the patients, but the result is not shown. One case was complicated with rheumatism, which probably retarded the cure. Duration of fever prior to admission ranged from 2 to 5 days. Effects of the remedy on the general system were, in 2 cases, vertigo and tremor of limbs; in 2, nausea and vomiting; in 5, acceleration of pulse.
	Dr. J. Henderson	-	Bangalore	-	6	-	-	-	6	6	-	Dose, 5 grains in solution 3 or 4 times during intermissions. In 2 cases, paroxysm checked in 2 days; in 4 cases, in 4, 5, 7, and 8 days respectively. Duration of fever prior to admission, from 7 days to 4 months. Two cases of enlarged spleen; no effects of the remedy on the general system observed. Station at times malarious.
	Third-class Hospital, Assistant T. Ponam- balum.	-	Camp, Karakal	-	29	9	2	-	40	40	-	Dose, 2, 3, 4, 5, or 7 grains, 2 or 3 times daily during intermissions. Check of paroxysm in all the cases varied from 3 to 10 days; in 25 cases it was from 3 to 7 days. Duration of fever prior to treatment ranged from 7 days to 7 months. Splenic enlargement in 5 cases. The only effects of the remedy stated are that it improved digestion. Locality malarious.
43	Assistant Apothecary J. J. Watts.	-	Chetterpore (Ganjam)	-	2	1	-	-	3	3	-	Dose, 5 grains in solution once or twice daily during intermissions. Paroxysm checked in 2 cases in 3 days; in 1, in 6 days. Duration of fever prior to treatment, from 6 to 10 days. Splenic enlargement in 1 case. Effects of remedy on the system not stated. District malarious.
	Dr. D. Kearney	-	Sumbulpore	-	8	-	-	-	8	8	-	Dose, 10 grains, given once or twice daily during intermissions. Check of paroxysm in 4 cases in 3 days; in 2, in 4 days; in 1, in 5 days; and 1 in 8 days. Duration of fever prior to treatment ranged from 3 to 10 days. Splenic enlargement in 1 case. Effects of remedy on the general system were slight excitement in all the cases; in 1, vertigo. Station and district malarious.
	Dr. H. R. Oswald	-	Bangalore	-	1	1	2	-	4	4	-	Dose, 3, 5, or 10 grains, repeatedly during intermissions. Check of paroxysm in 1 case in 1 day; in 2, in 3 days; and in 1, in 4 days. Duration of fever prior to treatment, from 15 days to 2 months. Splenic enlargement in 1 case. Effects of remedy not recorded. The various doses, as administered, were effective in checking return of paroxysm; the large most immediate. Station occasionally malarious.
	Assistant Apothecary J. A. Falloon.	-	Kimedy	-	4	-	-	-	4	4	-	Dose, 10, 15, or 20 grains, given during the paroxysms. Check of paroxysm, in 1 case, in 2 days; in 2, in 2 days; in 1, in 4 days. Splenic enlargement in 2 cases. Effects of the remedy on the general system were, in 3 cases, ringing in ears, with frontal headache in 1 instance; in 2, nausea; in 2, bilious vomiting. Duration of fever, prior to treatment, ranged from 1 month to 2 years. Station notably malarious.
					511	42	5	1	559	546	13	

TABLE V.

SULPHATE OF		Total Number of Persons Treated.	Number of Cases in which less than 20 grains checked the Paroxysm.	Number of Cases which required 20 grains and upwards to check the Paroxysm.	Per-centage of	
					Cures effected with less than 20 grains.	Cures effected with 20 grains and upwards.
Dr. Houston, Doomagoodiem	Quinine, chemically pure - -	72	29	43	40.27	59.72
	Quinidine - - - - -	48	15	33	31.25	68.75
	Chinchonidine - - - - -	48	26	22	54.16	45.83
	Chinchonine - - - - -	48	28	20	58.33	41.66
Dr. Fitzgerald, Labuan	Quinine, chemically pure - -	36	30	6	83.33	16.66
	Quinidine - - - - -	99	58	41	58.58	41.41
	Chinchonidine - - - - -	63	22	41	34.92	65.07
	Chinchonine - - - - -	78	24	54	30.76	69.23
Mr. Wade, Goodaloor	Quinine, chemically pure - -	308	261	47	84.74	15.25
	Quinidine - - - - -	265	239	26	90.18	9.81
	Chinchonidine - - - - -	212	194	18	91.50	8.49
	Chinchonine - - - - -	259	230	29	88.80	11.19

TABLE VI.

SULPHATE OF		Total Number of Persons Treated.	Number of Cases in which less than 20 grains checked the Paroxysm.	Number of Cases which required 20 grains and upwards to check the Paroxysm.	Per-centage of	
					Cures effected with less than 20 grains.	Cures effected with 20 grains and upwards.
Quinine, chemically pure	Dr. Houston, Doomagoodiem - -	72	29	43	40.27	59.72
	Dr. FitzGerald, Labuan - - -	36	30	6	83.33	16.66
	Mr. Wade, Goodaloor - - -	308	261	47	84.74	15.25
	TOTAL - - -	416	320	96	76.92	23.07
Quinidine	Dr. Houston, Doomagoodiem - -	48	15	33	31.25	68.75
	Dr. FitzGerald, Labuan - - -	99	58	41	58.58	41.41
	Mr. Wade, Goodaloor - - -	265	239	26	90.18	9.81
	TOTAL - - -	412	312	100	75.72	24.27
Chinchonidine	Dr. Houston, Doomagoodiem - -	48	26	22	54.16	45.83
	Dr. FitzGerald, Labuan - - -	63	22	41	34.92	65.07
	Mr. Wade, Goodaloor - - -	212	194	18	91.50	8.49
	TOTAL - - -	323	242	81	74.92	25.07
Chinchonine	Dr. Houston, Doomagoodiem - -	48	28	20	58.33	41.66
	Dr. FitzGerald, Labuan - - -	78	24	54	30.76	69.23
	Mr. Wade, Goodaloor - - -	259	230	29	88.80	11.19
	TOTAL - - -	385	282	103	73.24	26.75

ORDER of the Madras Government, 15th June 1868.

1. Ordered that these papers be transmitted to the Secretary of State, in continuation of those recorded in the proceedings of Government, dated 19th March 1867, No.

2. The results of the trial of the chinchona alkaloids in a large number of cases of paroxysmal malarious fevers, reported by the president and members of the Chinchona Commission, are satisfactory.

3. The suggestion made by the Commission in paragraph 15 of the irreport is approved, and the necessary orders will be issued to the Inspector General, British Medical Service, through the military department. The Inspector General, Indian Medical Department, will put that officer in possession of a supply of the alkaloids.

(signed) *W. Hudleston,*
Secretary to Government.

— No. 41. —

From the Government of Madras to the Secretary of State for India.

Madras, 4 August 1868.

1. IN paragraphs four and five of our proceedings, dated 1st July 1868, No. 1,837 (copy herewith forwarded), we authorised Mr. Broughton, the Government quinologist, as a special case, for the reasons therein referred to, to purchase in the home market the chemicals and apparatus required by him to an amount not exceeding 500 rupees, or 50 £.

2. You will perceive from the accompanying letter from Mr. Broughton, that he has, under that authority, transmitted orders to England for the chemicals and apparatus in question, and that he has directed the cases to be sent to the wharves of the India Store Department, Lambeth, in order that they may be transmitted by an early vessel chartered by Government, as in the case of his former consignment. We request that the manager of the store department may be instructed to receive the cases, and to arrange for their transmission to Madras; his attention being at the same time drawn to the concluding paragraph of Mr. Broughton's letter regarding the stowage of the cases.

Enclosure 1, in No 41.

From *J. Broughton, Esq.*, Quinologist to Government, Ootacamund, to the Secretary to Government, Revenue Department, Fort St. George, Ootacamund, 18th June 1868.

1. THE progress of work and the consequent development of plans requires me to make the following requests of Government, that appear to me to be more or less necessary to the conduct of the undertaking with which I am officially concerned. Though somewhat diverse in nature, for the sake of convenience I herewith submit them for the approval and sanction of Government.

2. I have already submitted to Government (Proceedings Madras Government, Revenue Department, 13th December 1867) the reasons that appear to me to require the early institution of a small experimental manufactory for the supply of larger quantities of febrifuge preparations than I am able to make in my laboratory. Subsequent experience has quite corroborated these views. As the matter is an important one, from the circumstance that a small manufactory may probably become the nucleus of a more extensive undertaking, I am desirous of having an opportunity of carefully considering certain details before submitting a specific proposal for the sanction of Government. The workshops of the Lawrence Asylum building appear to me such successful examples of constructions intended for technical purposes on these hills, that I am induced to request that the opinion and experience of the officer who has been concerned in their erection may be officially afforded me. When the proposed details are arranged, I propose to request Government to allow the buildings they sanction to be erected by the Department of Public Works.

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I should be glad, also, if I could be authorised to make inquiries (when needful), in order to determine on a suitable site on Government land, and, if possible, in the neighbourhood of my present laboratory.

3. In a report, dated 4th April (Proceedings of Madras Government, Revenue Department, 22nd April 1868), I had the honour of discussing the properties of the "Soudoo earth," which abounds in the plains adjacent the hills, and its capacity of supplying a material required in alkaloid manufacture. In paragraph 10 of that report I endeavoured to show the desirability of enclosing some portion of a tract which exists near the village of Telungapoliem in Coimbatore. The collector of Coimbatore has been good enough to forward me an estimate of the cost of enclosing 10 acres, which estimate I beg to enclose. It amounts to 111 rupees, and I request the sanction of Government for this sum, in order that the fencing may be done at the end of the rains.

4. In my budget estimate for the current year, I included 500 rupees for supplies of chemicals and apparatus from England. This was disallowed by the Madras Government, because the money will have to be disbursed in England. I have now to request that I may be allowed to make purchases to that amount at home.

5. I believe the usual proceeding in such cases is to indent for the required supplies, and that on sanction they are obtained and transmitted to India by the Home Government. I hope that Government will make my case an exception to this rule, and allow me to order my supplies directly. My grounds for desiring this are as follows:—

The work for which they are required is of a special nature, and might be greatly hindered by a supply of apparatus selected by any person, however generally competent, who is not aware of the exact purpose for which the articles are required. It is for this reason that before leaving England I spent much time (by the permission of Government) in selecting personally the apparatus that I now use. By allowing me now to have the command of the expenditure, I shall be able to avail myself of the arrangements I then made for further supplies, and shall be able to have the advantage of the assistance of scientific friends at home, whose acquaintance with my personal habits of work will save me much subsequent trouble. On this matter, I await the decision and instructions of Government.

ORDER of the Madras Government, 1 July 1868.

1. The Government sanction the proposals made in the above letter.
2. The superintending engineer, 7th division, will instruct Major Farewell to afford Mr. Broughton all the assistance he may require in planning and estimating for the experimental manufactory buildings, and the collector of Coimbatore will aid him in selecting a suitable site from the Government land available in the neighbourhood of Mr. Broughton's laboratory.
3. The collector is also authorised to incur the estimated expense of 111 rupees in fencing-in the 10 acres of land at Telungapoliem containing "Dhoby's earth" (Soudoo) which, it is assumed, is public property.
4. As a special case, the Government authorise Mr. Broughton to purchase chemicals and apparatus in the home market to an amount not exceeding 500 rupees, or 50*l.*, and costs of carriage, the bills being submitted to the Accountant General as vouchers for the charge in Mr. Broughton's accounts.
5. The Government admit the force of Mr. Broughton's reasons for this deviation from the established rule, which they consider justified by the peculiar nature of his duties, and by the fact that the Secretary of State employed Mr. Broughton in England in procuring the supplies needed for his first operations.

(signed) *W. Hudleston,*
Secretary to Government.

Enclosure 2, in No. 41.

From *J. Broughton*, E-q., Quinologist to Government, to the Acting Secretary to Government, Revenue Department, Fort St. George, dated Ootacamund, 22nd July 1868.

1. PURSUANT to the permission accorded in Government Order in Revenue Department, of 1st July, I have transmitted orders home for the chemicals and apparatus I require. I have directed the cases to be sent to the wharves of the Indian Store Department, Lambeth, in order that they may be transmitted to me by an early vessel chartered by Government, as in the case of my former consignment. I would now request that the manager of the Store Department be informed by the first mail of this, and that he be authorised to receive them.

2. The cases will be addressed to me, and two or three will contain *acids*, which latter will be *securely* packed for stowage on deck.

— No. 42. —

From the Government of Madras to the Secretary of State for India.

Madras, 4 August 1868.

1. WE have the honour to forward, for your information, the accompanying report from Mr. McIvor on the Government Chinchona Plantations and Botanical Gardens on the Neilgherries for the year 1867-68, and a letter from Mr. Broughton, the Government quinologist, containing a brief report of his operations for the same period.

2. The reports now forwarded indicate very satisfactory progress in the Chinchona experiment.

Enclosure 1, in No. 42.

From the Superintendent of Government Chinchona Plantations, to the Secretary to Government, Revenue Department, Fort St. George, Ootacamund, 16 May 1868.

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

REPORT on the Government Chinchona Plantations and Botanical Gardens, Ootacamund, Neilgherries, for the official year 1867-68.

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

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

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

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

5. The details of this Report are arranged under the following heads:—

- 1st. Propagation.
- 2nd. Condition and growth of plants.
- 3rd. Cultivation.
- 4th. Ditto under the shade of living trees.
- 5th. Ditto results obtained by private planters.
- 6th. Formation of alkaloids.
- 7th. Chinchona, new varieties introduced, remarks on.
- 8th. Sales of bark in the European market.

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9th. Establishment.

- 9th. Establishment.
- 10th. Convict labour.
- 11th. Progress of operations.
- 12th. Botanical gardens.
- 13th. Tea plantation.
- 14th. Concluding remarks.
- 15th. Appendix (A.), Accounts from the commencement to 31st March 1868.
- 16th. Appendix (B.), Meteorological observations at Neddivuttum.
- 17th. Appendix (C.), Ditto - - ditto - - at Ootacamund.

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

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

8. CONDITION AND GROWTH OF PLANTS.—The growth of the *C. succirubra* and *C. officinalis* continues to be most satisfactory; the stems, especially of the former, have increased to that degree of stability as to have been able to withstand uninjured the violence of our last very stormy season. When the plants get up, and their branches begin to meet, they resist storms as effectually as most species of indigenous trees on these hills. *C. succirubra* evidently succeeds best at an elevation of from 4,000 to 6,000 feet, as at Neddivuttum, where the vigour of growth and luxuriant appearance indicate that they are quite at home. A few plants of this species have been planted in a sheltered spot in the Doda-betta Plantation as a trial of elevation, but their progress is by no means satisfactory, their yellow appearance and stunted growth showing the altitude to be too great. The varieties of *C. officinalis* thrive well at all elevations in which they have been planted. On the Neilgherries there is no elevation too great for the successful cultivation of these kinds. The three original varieties, known as *C. officinalis* (α.) *Condamenia*, *C. officinalis* (β.) *Bonplandiana*, and *C. officinalis* var. *Crispa*, are sufficiently characteristic to mark them as distinct varieties, but numerous intermediate forms occur, partaking more or less of the characteristics of one or other of these varieties. The original variety of *C. Calisaya* (*Josephiana*?), introduced from Java and from Kew, flourishes; but owing to its diminutive size, and bark of inferior value, is not likely to become a profitable or desirable plant to cultivate, consequently it has not been extensively propagated. Several kinds of *Calisaya*, with very distinct characteristics, have been raised from Mr. Money's seeds; some of these promise to attain a considerable degree of luxuriance, and if the bark is good they will no doubt supply the hitherto deficient yellow bark from our plantations.

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

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

11. The

11. The first frosts last year occurred in October, fully a month before they were expected, consequently some of the young plants of last season's planting were nipped and more or less injured, especially such as were in hollows filled with condensed moisture every night, while the plants on hill tops or sloping land escaped without injury, except when the plants had overtopped the shading of turf, &c., placed around them. In such cases the top of the plants was generally entirely destroyed, while the bottom was uninjured. It is therefore important that the turf shading should on all occasions be raised higher than the plant for the first cold season after planting. When the plant attains a height of from two to three feet from the ground, it is not affected by frost in these localities.

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

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

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

* REPORT of an Analysis of the Sixth Remittance of Bark from India.

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

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

No. 1.—Mossed crespilla bark, 3½ years old :

Crystallised sulphates, per 100 parts	-	-	-	-	-	-	2.46
Alkaloids soluble in ether, chiefly uncrystallised quinine †	-	-	-	-	-	-	0.44
Insoluble in ether (chinchonine and chinchonine) ‡	-	-	-	-	-	-	0.86
							3.76

* It now resembles more the Loja Nonsense of Jussieu.

† The remainder, probably chinchonidine. I neglected to substitute the word chinchonidine for the word quinine in treating of the var. *Crispa* in my last report. The analyses in which it appears were quoted *verbatim* from Pereira, and were made 14 or 15 years ago, when accuracy as to this discrimination was not valued as it now is. I have no reason, from recent analysis, to believe that quinine is contained in the Loja barks.

‡ The amount of crystallised chinchonine is small in all the Loja barks.

samples of bark above mentioned, the yield of alkaloid in mossed crispa is given at 3.76, a very satisfactory result. Thus it may be considered established that the *C. officinalis* var. *Crispa*, under the mossing process, is a variety well worthy of cultivation. *C. Pahudiana* has also been much improved. Mr. Howard's analysis in his report, dated 4th February 1867, giving 0.761 as the yield of alkaloids in this bark, while in that under date 28th August 1867, 2.21 is given as the result obtained from this bark, which hitherto has been considered worthless. This result is worthy of being communicated to Herr van Goorkum, the superintendent of chinchona cultivation in Java, as this energetic gentleman will, no doubt, at once turn so important a discovery to the benefit of the public, and to the profit of the Dutch Government. In Java they possess an unlimited number of *C. Pahudiana*, and as the bark of this species can, by the mossing process, be converted in a few months into one of great value, large supplies could thus be thrown into the market at once.

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

16. I may

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

Crystallised sulphates - - - - -	2.92
Soluble in ether (chinchonidine and quinine) - - - - -	0.41
Insoluble in ether (chinchonicine and chinchonine) - - - - -	1.20
	4.53

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

Total weight of precipitated alkaloids - - - - -	2.43
Oxalate quinine - - - - -	1.40
Unecrystallised quinine - - - - -	0.17
Chinchonicine - - - - -	0.70
Resin and loss - - - - -	0.16
	2.43

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

Crystallised sulphates - - - - -	1.60
Soluble in ether (quinine and aricine) - - - - -	0.61
Insoluble in ether (chinchonine) a trace - - - - -	
	2.21

Memorandum.—None of the above crystallised sulphates would perfectly stand the test, all containing a little chinchonidine. The same remark applies to a portion (the second crystallisation) of oxalate quinine.

I adopted for No. 3 the plan of securing the total weight of alkaloid in the first instance, as I was uncertain of any further result, having only 300 grains of bark to work upon, and that of poor quality. This plan is, however, deceptive, the alkaloids not being purified. The loss is also more than is apparent, since the amount of the oxalic acid must be added for minute accuracy.

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

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

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

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

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

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

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

20. **PROGRESS OF OPERATIONS.**—No extension of buildings has been found necessary in the propagating department. Our operations in this respect must shortly be decreased as in a few months, sufficient plants will be propagated to complete our plantations. The total

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

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

total number of plants propagated up to 31st March of the current year is 2,353,370, exclusive of 170,740 plants distributed to the public.

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

D A T E.	Total Number of Plants Propagated.	Total Number Permanently Planted out.	Total Number of Plants Distributed to Private Individuals.	Total Quantity of Seeds Distributed to the Public.
				Oz.
April 1867 - - - - -	85,880	156,340	—	—
May " - - - - -	30,360	-	141	5
June " - - - - -	27,270	188,361	-	6½
July " - - - - -	48,360		2,170	—
August " - - - - -	123,480	-	30,390	2
September 1867 - - - - -	81,320	-	135	5½
October " - - - - -	54,640	-	1,337	8
November " - - - - -	59,920	-	500	7
December " - - - - -	17,280	-	-	9
January 1868 - - - - -	50,700	-	10,020	6½
February " - - - - -	40,000	-	-	2
March " - - - - -	60,000	-	-	14
	579,210	339,701	44,693	65½
Previously - - - - -	1,774,160	301,211	126,047	22½
TOTAL - - - - -	2,353,370	740,912	170,740	88

22. On the Neddivuttum plantation 82 acres have been planted. Thus the total extent under cultivation there is now 526 acres; this extension has been in the completion of the Kilgrasion and No. 2, Denison plantations, 180,000 pits have been prepared and ready for planting, and 70,000 pits made, but not filled. On the Hooker plantation, 35 acres have been planted, making a total of 61 acres permanently planted out on this plantation, and 50,000 pits prepared for this season's planting. The roads, drains, and fences, throughout the planted portion have been completed. At the gaol a detached building, 66 by 30 feet, has been erected as a hospital, and is capable of accommodating 20 patients. It consists of two sick wards, each 25 by 14½ feet, well ventilated and provided with wooden cots, mattresses, and bolsters; a surgery, office, and bath-room; two new blocks of police lines have also been erected, consisting of 11 rooms, 10½ by 10½ feet, each room being supplied with a wooden cot. These lines have been erected in lieu of four huts which had to be removed to make room for the new hospital. A comfortable bungalow has also been built for the police inspector, together with a new block of warder's lines, so that the whole of the buildings on this plantation are now completed.

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

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

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

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

as a medicine is established by Mr. Broughton's analysis (noted at foot)* of tubers grown in the gardens here, by which it will be seen that the quantity of the peculiar principle on which its virtue depends, is as great as in tubers grown in its native country. The scammony has also grown very freely, but the collection of the medicine differs from jalap, in requiring more time, since jalap as a drug is simply the tuber sliced and dried in the sun, while scammony, as gathered in Asia Minor, is the milky juice collected into shells or other suitable vessels as it flows from the growing root. Such a mode is necessarily a work of time, and as we have not yet collected the juice in sufficient quantity, we are unable to speak to its value as a drug when grown here. A quantity of plants of both the jalap and scammony have been propagated for distribution, in the hope that both may become profitable products of these hills. The *Aralia papyrifera* has now been planted in the open ground for about 10 months; it grows well, and its large foliage and luxuriant habit makes it a fine ornamental plant. The *Phonium tenax* or New Zealand flax, has been thoroughly acclimatised, and grows vigorously in every situation in which it has been planted, though these have been much varied to test the endurance of the plant. From various experiments which have been made from time to time in England, it appears that the fibre of the plant occupies a place of great importance as in economical product, indeed at one time attempts were made to cultivate it in Ireland with a view to commerce, but the winters proved too severe. Here the plant grows luxuriantly, but hitherto a difficulty has been found in cleaning the fibre, but even if the fibre was not extracted, there is no doubt the leaves cut and dried would answer for weaving into mats, coarse bags, and blinds, and be much more durable than the common date and bamboo mats of the country. The cowdie pike of New Zealand has been established, and is growing freely. For some time we have endeavoured to introduce the *Gynerium argenteum* or Pampas grass, but all the seeds we have received have hitherto failed to germinate; we have, however succeeded in introducing a plant, which is even more handsome than the Pampas grass, this is the *Arundo conspicua* or New Zealand sedge. Our oldest plants of this are producing their second crop of flowering spikes of over eight feet high, and of a most graceful and feathery aspect. The Cashmere cherry, referred to in my report of last year, has again flowered freely, but though attempts were made to fertilise many of the blossoms, it failed to perfect a single fruit, this will probably be overcome as the tree gains age. In April last, prior to my leaving for England on six months' leave, the Government sanctioned my introducing a consignment of new and useful plants, such as it might appear desirable to select in England and on the Continent, and to be brought out to India on my return. A large consignment of about 1,100 plants, was, therefore, prepared some time before my departure from England, these I brought out with me, and nearly all reached the Neilgherries in good order. It would be out of place here to give an entire list of the plants thus brought out, but no plant which appeared to be of value and likely to succeed in India was omitted. The list includes a great number of Japanese plants lately introduced to Europe, indeed it is only within the last few years that the flora of Japan has been well represented in European gardens. The advance horticulture has made in Japan has been productive of many curious forms of plants, and variegation seems to be an essential characteristic of popular plants among the Japanese, the consequence is that almost every species in addition to its normal form, has also its variegated form which is sometimes of great beauty. Among the plants introduced and now growing freely, are several kinds of hybrid clematis, many species of *Arbutus*, *Laurus*, *Anouba*, and *Berberis*, the *Aralia Subuldi* and its variegated form, a handsome plant with fine foliage, rivalling the fine *A. papyrifera* noted above, variegated forms of *Yucca* (Adam's needle) and of *Phonium tenax* (New Zealand flax), *Lapageria rosea* and *L. rosea alba*, two superb climbers, natives of Chili, and belonging to the natural order *Smilacaceae*, also *Ampelopsis Virginica*, a handsome free-growing creeper. The common holly of England has been frequently introduced, but though we have plants many years old they are not more than a foot high. For a long time it has been wished to introduce some substitute for this favourite and handsome plant, and one that grows freely and retains the characteristics of the holly, this has now been secured by the successful introduction of several species of the Japanese genus *Osmanthus*, in foliage these are identical with the holly, both in its green and variegated forms, and they promise at present to do well here. Of the highly ornamental and very useful Japanese timber trees, *Sciadopitys verticillata* (the umbrella pine), *Retinospora pisifera*, *R. plumosa*, *Thujopsis dolabrata*, *Thujopsis latevirens*, *Thuja aurea*, and several species of *Podocarpus*, have been successfully introduced, several of these are now being propagated. The *Olea Europæa*, or true olive, has also been introduced, both in its normal and variegated forms. Many fine bedding and border herbaceous plants have been introduced, and are now being propagated in great quantities, the most interesting of which are all the leading varieties of perennial phlox violets, Russian and Neapolitan, perennial lobelias, the best kinds of Delphinium, Sedum and Saxifrage, also the very ornamental Chinese colts-foot, *Tussilago parviflora*, also the best kinds of fuchsia, all these are now being extensively

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

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

extensively propagated. In addition to the living plants introduced, many opportunities afforded while travelling through the various horticultural establishments at home, to collect seeds of plants likely to be of value to this country. To the following gentlemen I am under special obligation for valuable assistance in preparing our collection of plants, viz., to Dr. Hooker of the Royal Gardens, Kew, Messrs. Veitch & Sons of Chelsea, Mr. James McNab of the Edinburgh Botanical Gardens, and Dr. Moore of the Dublin Botanical Gardens. When in the south of Europe, Mrs. McIvor succeeded in obtaining seeds of a very prolific variety of apricot, and of some handsome datura, which have been reared and are growing freely. Dr. Hooker has recently furnished us with a packet of seeds of *Juniperus Bermudiana* and Syrian tobacco. To Major Beddome we are indebted for rare orchids and ferns, also some new garden varieties of flowering plants. To Mr. J. Deschamps, Madras, for a large and valuable collection of European seeds, embracing many kinds of flowering plants quite new to our gardens, also seeds of several new kinds of fodder plants from the south of France, several of the latter promise to prove of great utility in this climate. To E. B. Thomas, Esq., for seeds of *Magnolia grandiflora*, olive, gooseberries, currants, filberts, walnuts, and many other things. From this gentleman we receive occasional supplies of seeds, showing the great interest he takes in the development of horticulture in India.

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

				Fruit Trees and Shrubs.	Timber Trees.	Shrubs and Flowers.	Collection of Seeds.	Amount.		
								Rs.	a.	p.
April	-	1867	- - -	—	112	28	9	40	2	—
May	-	"	- - -	54	6	545	14	259	4	—
June	-	"	- - -	—	250	208	14	131	—	—
July	-	"	- - -	12	19	32	10	57	1	—
August	-	"	- - -	—	22	108	14	82	8	—
September	"	-	- - -	—	12	51	22	109	—	—
October	-	"	- - -	—	51	97	39	152	3	—
November	"	-	- - -	12	—	57	11	55	11	—
December	"	-	- - -	—	—	12	—	9	8	—
January	1868	-	- - -	—	—	33	7	33	12	—
February	"	-	- - -	42	—	13	5	26	7	—
March	-	"	- - -	—	—	51	6	34	10	—
Total distribution - - -				120	472	1,233	151	992	2	—

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

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

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

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

(signed) W. G. McIvor,
Superintendent,
Government Chinchona Plantations.

Ootacamund, 15 May 1868.

(A).—SANCTIONED ESTIMATE COST of each CHINCHONA PLANTATION from Commencement of Operations to 31st March 1868.

PARTICULARS.	Superintendent and Office Establishment.			Nursery Department.			Dodabetta Plantations.			Neddivuttum Plantations.			Pykara Plantations.			Malkondah Plantations.			TOTAL.
	1860 to 1866.	1866-67.	1867-68.	1861 to 1866.	1866-67.	1867-68.	1860 to 1866.	1866-67.	1867-68.	1861 to 1866.	1866-67.	1867-68.	1862 to 1866.	1866-67.	1867-68.	1863 to 1866.	1866-67.	1867-68.	
Establishments, including salaries, &c.	Rs. 34,378	Rs. 7,773	Rs. 8,804	Rs. 20,234	Rs. 3,711	Rs. 4,684	Rs. 29,418	Rs. 10,736	Rs. 8,044	Rs. 57,444	Rs. 12,856	Rs. 17,120	Rs. 17,611	Rs. 2,860	Rs. 3,036	Rs. 8,720	Rs. 4,225	Rs. 4,376	Rs. 2,56,030
Buildings -	-	-	-	4,000	-	100	8,160	2,500	1,600	11,330	3,300	2,500	3,530	-	-	3,250	1,075	200	41,545
Tool and store-rooms -	-	-	-	-	-	-	500	200	100	650	-	250	975	-	200	275	400	100	3,650
Coolies' quarters -	-	-	-	-	-	-	900	-	200	2,700	300	200	1,200	100	150	750	200	-	8,700
Felling -	-	-	-	-	-	-	2,450	400	-	6,900	800	-	3,150	800	500	7,050	900	300	23,250
Clearing, weeding, &c. -	-	-	-	-	-	-	2,330	300	1,000	6,900	650	1,600	3,150	500	500	900	800	100	18,630
Pitting -	-	-	-	-	-	-	2,450	800	500	7,900	400	500	1,900	700	500	900	800	300	17,650
Carriage of plants -	-	-	-	-	-	-	700	1,000	700	2,200	1,000	1,000	800	200	150	50	300	100	8,200
Planting and shading -	-	-	-	-	-	-	1,250	700	700	2,350	900	1,000	2,000	500	150	-	100	100	9,750
Trenching -	-	-	-	-	-	-	2,900	308	-	6,000	-	-	9,950	-	-	1,250	542	-	20,950
Inclosing -	-	-	-	756	-	-	6,400	500	-	5,250	600	-	1,300	200	-	1,325	500	-	16,831
Road-making -	-	-	-	-	-	-	2,825	-	-	3,070	-	-	2,150	450	-	2,675	433	-	11,603
Tools -	-	-	-	-	400	200	2,525	1,000	200	3,182	1,200	400	1,782	600	180	1,841	600	100	14,210
Contingencies -	-	95	100	996	600	200	3,099	700	1,000	5,634	1,300	1,600	2,896	500	300	1,396	500	400	21,316
Clothing -	-	-	-	-	100	30	-	150	100	-	200	200	-	50	70	-	50	100	1,050
TOTAL - - - Rs.	34,378	7,868	8,904	25,986	4,811	5,214	65,907	19,294	14,144	121,510	23,506	26,270	52,394	7,460	5,736	30,382	11,425	6,176	4,71,365

ACTUAL EXPENDITURE on each CHINCHONA PLANTATION from Commencement of Operations to 31st March 1868.

PARTICULARS.	Superintendent and Office Establishment.			Propagation and Nursery Department.			Dodabetta Plantations.			Neddivuttum Plantations.			Pykara Plantations.			Malkondah Plantations.			TOTAL.
	1860 to 1866.	1866-67.	1867-68.	1861 to 1866.	1866-67.	1867-68.	1860 to 1866.	1866-67.	1867-68.	1861 to 1866.	1866-67.	1867-68.	1862 to 1866.	1866-67.	1867-68.	1863 to 1866.	1866-67.	1867-68.	
Establishments, including salaries, &c.	Rs. 32,354	Rs. 7,715	Rs. 8,116	Rs. 16,810	Rs. 6,536	Rs. 6,832	Rs. 18,678	Rs. 6,405	Rs. 6,389	Rs. 39,538	Rs. 15,350	Rs. 15,861	Rs. 5,574	Rs. 1,935	Rs. 1,686	Rs. 2,642	Rs. 3,050	Rs. 2,163	Rs. 1,97,634
Buildings -	-	-	-	10,725	1,504	660	12,615	3,023	3,200	15,110	3,294	2,117	1,683	-	87	1,740	442	375	56,575
Tool and store-rooms -	-	-	-	-	-	-	430	-	200	1,469	-	-	845	-	-	300	-	-	3,214
Coolies' quarters -	-	-	-	-	-	-	1,058	-	350	3,650	-	-	1,900	-	-	250	-	-	7,208
Felling -	-	-	-	-	-	-	3,950	257	-	6,280	983	720	5,750	-	436	3,251	-	101	21,728
Clearing, weeding, &c. -	-	-	-	-	-	-	3,500	78	1,160	4,900	700	1,614	5,375	322	408	2,450	415	597	21,519
Pitting -	-	-	-	-	-	-	5,108	384	1,011	6,738	913	859	2,955	-	660	1,488	240	856	21,212
Carriage of plants -	-	-	-	-	-	-	1,535	250	1,330	3,511	300	849	1,015	200	264	-	150	441	9,845
Planting and shading -	-	-	-	-	-	-	4,065	621	1,163	3,938	939	1,078	765	150	426	-	250	445	13,840
Trenching -	-	-	-	-	-	-	2,600	800	299	5,387	1,104	-	1,700	300	35	200	200	175	12,790
Inclosing -	-	-	-	-	-	548	4,357	350	590	3,210	280	887	1,429	200	156	1,050	-	-	13,067
Road-making -	-	-	-	-	-	-	5,670	625	644	4,427	1,030	100	2,404	662	275	2,177	22	90	18,126
Tools -	-	-	-	170	-	70	2,754	450	350	3,518	239	441	2,750	200	50	1,000	350	81	12,423
Contingencies -	250	-	-	1,150	383	170	3,461	616	989	5,105	617	978	1,000	160	207	475	135	190	15,886
Excavating -	-	-	-	-	-	-	-	450	-	-	1,195	-	-	-	-	-	-	-	2,289
Clothing -	-	-	-	-	-	54	-	-	120	-	-	159	-	-	38	-	-	35	406
Various -	-	-	-	-	-	-	-	-	1,900	-	-	2,250	-	-	200	-	-	235	4,585
TOTAL - - - Rs.	32,604	7,715	8,116	28,855	8,423	8,334	69,781	14,309	20,329	1,06,781	26,944	27,913	35,145	4,129	4,928	17,023	5,254	5,784	4,32,367

(B.)—METEOROLOGICAL OBSERVATIONS made at the Government Chinchona Plantations at Neddivuttum, from 1st April 1867 to 31st March 1868.

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

(C.)—METEOROLOGICAL OBSERVATIONS made at the Botanical Gardens, Ootacamund, from 1st April 1867 to 31st March 1868.

MONTHS.	Hygrometer.		Maximum in Shade.	Minimum in Shade.	Solar Radiation.	Rain in Inches.	Days with Rain.	Days without Rain.
	Dry Bulb.	Wet Bulb.						
April - 1867	63.13	56.26	73.45	52.45	120.03	4.01	13	17
May - "	63.38	58.67	73.24	54.27	113.59	5.19	16	15
June - "	58.94	56.42	65.90	51.60	100.17	2.81	18	12
July - "	59.27	57.19	64.43	52.80	95.40	9.06	22	9
August - "	57.19	55.26	66.72	50.46	98.79	1.77	15	16
September "	57.09	55.14	64.45	50.65	101.38	4.48	23	7
October - "	58.51	56.39	69.03	51.03	105.90	6.80	23	8
November "	56.16	51.23	68.76	43.87	113.00	1.16	5	23
December "	57.62	48.60	70.87	44.35	132.60	0.28	3	28
January - 1868	57.06	52.08	69.63	45.81	118.94	4.14	5	26
February - "	58.44	49.69	67.42	39.97	119.74	-	-	29
March - "	59.97	51.03	75.50	48.80	133.80	0.84	4	27
TOTAL - - -	-	-	-	-	-	40.54	147	219
MEAN - - -	58.97	54.60	69.12	48.84	112.78			

Ootacamund, 15 May 1868.

(signed) W. G. McIvor,
Superintendent, Government Chinchona Plantations.

Enclosure 2, in No. 42.

From the Superintendent of Government Chinchona Plantations to the Acting Under Secretary to Government, Revenue Department, Fort St. George, Ootacamund, 1st June 1868.

1. WITH reference to your official Memorandum, dated 27th ultimo, I have the honour to inform you that the cause of the cessation in the demand for Chinchona plants by the public, arises in consequence of the gratuitous distribution of Chinchona seed, which, together with the "Notes on Chinchona cultivation," has enabled planters to rear the seeds successfully. This being the case, it would not pay planters to remove the plants even if they were furnished by us gratuitously.

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

(signed) *W. G. McIvor*,
Superintendent Government Chinchona Plantations.

Enclosure 3, in No. 42.

From *J. Broughton*, Esq., Quinologist to Government, to the Secretary to Government, Revenue Department, Fort St. George, Ootacamund, 21st May 1868.

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

1. *Arrangement of Working Laboratory.*—In May, the rooms erected as a laboratory were completed, and the chemical apparatus, which shortly after arrived from England, enabled me to furnish them for experimental and analytical work. The arrangements then made have since been found effective.

2. *Investigation into the Quality of the various Species of Chinchona.*—In the early part of the year, an examination of the various species of Chinchona barks was made, when the yield was in nearly all cases found to be satisfactory. The results obtained were published in Proceedings of the Madras Government, Revenue Department, 12th April and 26th July 1867.

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

4. *Search for Indigenous Materials for Alkaloid Manufacture.*—The ready procurability of certain economic products being important in reference to the question of alkaloid manufacture in this country, I obtained the permission of Government for the personal investigation of this subject, and spent some time in the examination of the products of the districts adjacent to the Neilgherries. The results were communicated to Government (Proceedings of Madras Government, 22nd April 1868), and were satisfactory.

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

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

(signed) *J. Broughton*,
Quinologist to Government.

— No. 43. —

From the Secretary of State for India to the Madras Government.

My Lord,

India Office, 7 October 1868.

16 June 1868.
 22 " "
 23 " "
 24 " "
 4 August "
 4 " "

Para. 1. I HAVE considered in Council your Despatches in the Revenue Department of the dates noted in the margin,* on the subject of chinchona cultivation.

2. The samples of bark forwarded with your Despatch, dated June 22nd, were sent to Mr. Howard, and I now enclose 50 copies of the report of his analysis, together with an account of Dr. de Vrij's analysis of specimens of root bark.

3. The additional report from the Chinchona Commission on the results of the trial of different alkaloids in cases of fever, as confirming their previous impressions, is highly satisfactory.

4. Mr. Broughton's reasons for desiring to be allowed to make purchases in England, instead of obtaining them through the store department of this office, are sufficient to justify a departure from the usual mode of procedure, as a special case. The necessary instructions for the packing and shipment of Mr. Broughton's stores will be issued to the Director General.

5. I observe, from Mr. McIvor's report, that planters are now successful in rearing chinchona seeds, which are distributed to them gratuitously, and that they are thus enabled to avoid the risk and expense of removing young plants from the nurseries belonging to Government to their estates.

6. The samples of bark and seeds forwarded for M. Delondre have been transmitted to him, and the result of his analysis will be communicated to you as soon as it is received.

I have, &c.
 (signed) *Stafford H. Northcote.*

— No. 44. —

From the Government of Madras to the Secretary of State for India.

Madras, 21 September 1868.

In continuation of our Despatch, dated 17th March 1868, we have the honour to forward, for your information, the accompanying tabular report on the progress and condition of the chinchona plantations on the Neilgherries, for the half-year ending 31st July 1868.

Enclosure in No. 44.

REPORT on the Number, Distribution, and Condition of Chinchona Plants on the Neilgherries, for the Half-year ending 31st July 1868.

Species.	Botanical Names.	Commercial Names.	Number of Plants.	Value per lb. of Dry Bark in the London Market.	REMARKS.
				s. d. s. d.	
1	C. Succirubra - -	Red Bark - - -	1,187,288	2 16 10 8 19	The number of plants permanently planted out in the plantations is 117,100, making the total 858,012.
2	" Calisaya - -	Yellow Bark - - -	40,395	2 10 to 7 -	
	" " Fentex - -				
	" " Vera- - -				
3	" Officinalis - -	Original Loxa Bark - -	1,065,119	2 10 to 7 -	All the species of Chinchona still maintain their usual luxuriance; the older plants of Chinchona Succirubra, Micrantha, and Officinalis have this year again produced a large quantity of good seeds.
	" Var. Condamenia - -	Select Crown Bark - -	87,609	2 10 to 7 -	
	" Var. Bonplandiana - -	Fine Crown Bark - -	4,355	2 10 to 6 -	
	" Var. Crispa - -	Pitayo Bark - -	279	1 8 to 2 10	
4	" Lancifolia - -	Genuine Grey Bark - -	2,786	1 8 to 2 9	
5	" Nitida - -	Fine Grey Bark - -	8,500	1 8 to 2 10	
6	" Species without name - -	Grey Bark - -	46,730	1 8 to 2 9	
7	" Micrantha - -	Finest Grey Bark - -	3,389	1 8 to 2 10	
8	" Peruviana - -	Unknown - - -	425	Unknown.	
9	" Pahudiana - -				
TOTAL Number of Plants - - -			2,396,770		

TABLE showing the Growth of the different Species of Plants planted out in the Plantations for the Half-year ending 31st July 1868.

Number of Plants.	Species.	Where Planted.	When Planted.	Maximum Growth.	Average Growth.	Height of the Tallest Tree.	Girth near the Ground.
				Inches.	Inches.	Feet.	Inches.
12	<i>C. Succirubra</i> .	Neddivat-tum.	30 Aug. 1862	39	29½	19½	25½
12	<i>C. Micrantha</i> .	Neddivat-tum.	30 " "	47½	32	20½	21½
10	<i>C. Officinalis</i> .	Dodabetta -	30 Sept. 1863	12	9½	13½	10½

The increase by propagation is 143,400, the monthly average being 23,900, making the total 2,396,770.

TABLE showing the Propagation, Distribution, &c. of Plants and Seeds during the Half-year ending 31st July 1868.

DATE.	Total Number of Plants Propagated.	Total Number Permanently Planted out.	Total Number of Plants Distributed to Private Individuals.	Total Quantity of Seeds Distributed.
				Oz
February 1868 - -	40,000	- -	- -	2
March " - -	60,000	- -	- -	14
April " - -	20,000	82,000	- -	8
May " - -	6,800	23,000	- -	6
June " - -	7,050	12,100	- -	37
July " - -	9,750	- -	- -	- -
	143,400	117,100	- -	67
Previously - -	2,253,370	740,912	170,740	72
GRAND TOTAL - -	2,396,770	858,012	170,740	139

The total number of plants distributed to the public is 170,740: 67 ounces of seeds have also been gratuitously distributed, making the total quantity 139 ounces.

Ootacamund,
22 August 1868.

(signed) W. G. McIvor,
Superintendent Government Chinchona Plantations.

With reference to your official Memorandum, No. 109, of the 31st ultimo I have the honour to inform you that 170,740 is the correct number of plants distributed. The error in entering 199,300 in my report for the half-year ending 31st January 1868, arose by showing 10,000 plants distributed to Mr. Phillips of Kotagberry, and 18,560 to Colonel Fyers; these plants were raised here from seed furnished to those gentlemen, and should have been entered as seed only.

— No. 45. —

From the Government of Madras to the Secretary of State for India.

Madras, 6 October 1868.

In continuation of our Despatches, dated 25th April and 12th August 1867, we have the honour to forward for your information the accompanying further report from the Government Quinologist on the progress of his chemical investigations of the Chinchona barks, together with our proceedings thereon, dated 22nd September 1868.

Enclosure in No. 45.

From J. Broughton, Esq., Quinologist to Government, to the Acting Secretary to Government, Revenue Department, Fort St. George, Ootacamund, 17 August 1868.

1. In commencing a report on the progress of the chemical investigations of the Chinchona barks grown on the Government plantations, the slight changes that have recently taken place in their composition may be briefly discussed.

2. Although the earlier analysis I had the honour of making, and communicating to Government (Proceedings Madras Government, Revenue Department, 12th April 1867), were, from the circumstances under which they were conducted, scarcely wide enough in their scope to permit of an entirely rigid comparison, yet I have quite convinced myself that during a year the amount of alkaloid in our oldest trees has increased. This increase may, I believe, be fairly estimated at not less than an additional yield of three-quarters of a per cent. in the trunk bark of the oldest parts of the plantations of *C. Succirubra*.

3. The increase has not been confined to the red barks, but is quite perceptible in the crown barks. In so various and wide a range of possible yield as in that of the trees constituting a whole plantation, of which no regular crops have yet been taken, some uncertainty must always attend the estimation of averages. I therefore prefer to incur the risk of under-estimation in stating that the mean increase in the yield of the barks of *C. Officinalis*, during a year, has been not less than 0.7 per cent. When it is remembered that barks, whose total yield has not exceeded three-quarters of a per cent., have been of sufficient value to re-pay their collection in America, and exportation to Europe, the present condition of the plantations must be considered at least as satisfactory as heretofore. Both observation and *a priori* considerations lead us to expect that the average yearly increase in the yield of alkaloids will take place by increments of annually diminishing value, until a limit be reached, where the destructive agencies at work balance the rate of their formation. Though this limit may probably be not far distant, I am in possession of evidence showing that it had not been reached in May last.

4. My experience of the Red Bark plantations does not lead to the conclusion that the amount of quinine has shared in the increase observable in that of the other alkaloids. To this subject I shall subsequently return.

5. I cannot illustrate these observations better than by quoting the numbers obtained by taking the mean of two analyses performed on two separate quantities of bark, obtained by mixing in each case the trunk bark of ten trees, 5½ years old. It may be fairly considered to represent the mean quality of the trunk bark of the oldest trees in May last.

Total Alkaloids 6.74 per cent.

*Total Sulphates obtained, crystallized . . . 6.06 „

Quinine 2.40 „

Chinchonidine and Chinchonine 4.34 „

Sulphate of Quinine, crystallized 2.21 „

Ditto - Chinchonidine, ditto 3.85 „

6. Quinidine, though occasionally present in red bark, could not be detected in the two samples from which the above mean yield is deduced. Its practical absence was satisfactorily

* The sulphate of Chinchonine is excluded in this and subsequent analytical statements.

factorily shown by determining the optical properties of the crystallized sulphates after that of quinine had been carefully separated. Their specific rotatory power was found to differ extremely slightly from that of quite pure sulphate of Chinchonidine. Operating on the crystalline sulphates, the accumulated products of more than 20 analyses of barks taken from all parts of the plantations, the same means enabled me to prove that sulphate of quinidine did not occur in greater amount than two per cent. of the sulphates of alkaloids other than quinine. I therefore am justified in concluding that quinidine will not be a common or abundant product of the present plantations. Chinchonine is always present in red barks.

7. In like manner, I beg leave to subjoin a mean of analyses of samples of the crown barks from trees 4½ years old, and collected with a view to obtain numbers that would fairly represent the mean yield of the barks of *C. Officinalis*.

Total Alkaloids	-	-	-	-	-	-	4.40	per cent.
Total Sulphates	-	.	-	-	-	-	3.10	„
Quinine	-	-	-	-	-	-	2.49	„
Chinchonidine and Chinchonine	-	-	-	-	-	-	1.91	„
Crystalline Sulphate of Quinine obtained	-	-	-	-	-	-	2.49	„
Ditto - Chinchonidine obtained	-	-	-	-	-	-	0.70	„

8. Repeated analyses of *C. Officinalis*, var. *Crispa*, have corroborated the opinion that I on a former occasion expressed concerning the value of this bark.* Experiments (which, as they concern another subject, I do not propose to detail in the present report) have indicated the cause of the discrepancy between my results obtained from this bark and those of other chemists.

9. I have already expressed my conviction of the great value of our crown barks. Further investigation has given no reason to alter that opinion. The quinine which they contain yields a pure white crystalline sulphate with ease. Many specimens I have met with have been actually free from “uncrystallizable quinine.” Hence, the quinine is frequently so pure as to yield its theoretical amount of crystallized sulphate. I have met with specimens of crown bark which yield upwards of five per cent. of purified alkaloid.

10. Mr. Howard (whose correspondence and assistance have been of great service to my work) has informed me that he has satisfactorily identified a sub-variety of our *Chinchona Officinalis* with that which yielded the bark known as *Amarilla del Rey*. This is a sort which has long enjoyed a high reputation among pharmacutists and quinine manufacturers, and its possession is a very fortunate circumstance. It appears very easy to work, and yields quinine readily crystallizable as sulphate. In actual amount, however, it does not appear to differ essentially from its companion sub-varieties.

11. Among the crown barks which were grown from seeds brought by Mr. Cross, are a few scattered trees which present a marked difference from the rest of their companions. The leaves are of a narrow lanceolate shape. My attention being directed to the study of those varieties whose numerical importance claimed the earliest observation, it was not till recently that I made an analysis of this variety. Surprised by the result, I took the precaution of making an analysis of the adjoining trees of *Chinchona Officinalis*, in order to eliminate the possible influence of peculiar conditions of soil, site, &c.

12. The per-centages of the respective alkaloids stand thus :—

	Bark of Lanceolate Species.	Bark of Adjoining Trees.
Total Alkaloids - - - - -	8.0	4.48
Quinine - - - - -	7.15	2.06
Chinchonidine and Chinchonine - - - - -	0.85	2.42
Sulphate of Quinine obtained crystallized -	7.37	Undetermined.
Ditto - Chinchonidine obtained crystallized-	0.15	Ditto.

13. The specimen, therefore, was of the finest bark in our possession. I do not think I over-state, when I add that in yield of quinine it is of the finest quality that has ever been recorded. It possesses every characteristic constituting excellence. It yields alkaloids in such purity, that the first crystallization gives sulphate of quinine which stands the usual tests as well as the refined salt. I would earnestly recommend that the plant be extensively

* Proceedings, Madras Government, Revenue Department, 26th July 1867.

extensively propagated and as rapidly as possible. The possession of this species is a most fortunate circumstance.*

14. In former reports, I have not detailed a complete analysis of the bark yielded by the branches of the *C. Succirubra*. The numbers given below are the result of an examination instituted in order to determine the mean yield of that bark, care being taken to collect it from a sufficient number of trees in order to avoid the influence of individual peculiarities. It was taken from the oldest trees.

	Bark of branches 3½ years old.	Bark of branches 2½ years old.
	Per cent.	Per cent.
Total Alkaloids - - - - -	4.31	1.91
Total Crystalline Sulphates obtained - -	2.43	1.42
Quinine - - - - -	2.00	0.77
Chinchonidine and Chinchonine - - - -	2.31	1.14
Sulphates of Quinine obtained crystallised -	1.21	0.63
Ditto Chinchonidine - - - - -	1.53	0.89

The branch bark is thus of considerable value even when young. Much of the crystalline and other preparations of the alkaloids that I have had the honour of submitting for medical trial have been the produce of branch bark. Twig bark, though bitter to the taste, is practically useless as a source of alkaloids.

15. I have had opportunities of examining bark of *C. Succirubra* grown on the Government Plantations in Coorg, and also some from Wynaad.

16. For the Coorg bark I was indebted to the Reverend J. Richter. It was from the trunk of trees three years and nine months old. The bark was thinner than that grown on the Neilgherries. The analyses were made at seasons of the year that I have since had reason to believe are not favourable to the produce of alkaloids.

	Received in July.	Received in October.
Total Alkaloids - - - - -	5.00	4.10
Quinine - - - - -	0.81	0.86
Chinchonidine, &c. - - - - -	2.15	3.24
Chinchonine - - - - -	2.70	
Total Sulphate of Quinine obtained crystallized-	0.70	Undetermined.
Total crystallized Sulphate - - - - -	Undetermined.	3.58

17. The Wynaad bark was grown on the upper limits of a *bamboo jungle*, and at an elevation that, I am informed by Dr. Bidie, does not probably exceed 2,400 feet. The trees from which it was taken were nearly four years old, and had a height of eight feet and girth of trunk ten inches. The bark was thinner than that of Neilgherry growth, but was of good appearance. It yielded as follows:—

	Per-centage.
Total Alkaloids - - - - -	4.1
Quinine - - - - -	0.6
Chinchonidine and Chinchonine - - - -	3.5
Total Sulphates obtained crystallized - - - -	3.4
Sulphate of Quinine obtained crystallized - - - -	0.5
Ditto Chinchonidine obtained crystallized - - - -	2.9

18. The

* It is not improbable that the species may be the *C. Pitayensis*, whose excellence it possesses. Mr. Batcock is taking home a large collection of specimens of Chinchonæ, and among them this important species will be doubtless satisfactorily identified and named by competent botanists.

18. The above analyses accord with some I shall subsequently adduce, in showing that quinine is formed in much less quantities at low elevations. They cannot, however, be considered unsatisfactory, since they contain a large amount of alkaloids, which recent trial has shown to equal quinine in febrifuge effect. The circumstance that these medicines, so important to a planter, can be obtained from a plant requiring no more care than its near relation to the coffee tree, should require no comment.

19. Frequent analysis made of the red barks during the last 18 months, have clearly shown that the yield of alkaloids varies according to the season of the year. The ratio that the amount of quinine bears to the other alkaloids, appears also to vary. Periodic analyses were begun 14 months since, for the purpose of ascertaining the times of maximum and minimum yield, but at least a year more must elapse before I obtain sufficient data to decide this important subject. I may, however, state that the point of maximum yield falls within the period comprised between the beginning of February and the end of May.

20. I have been able to demonstrate that the wood of *Chinchona Succirubra* contains an appreciable amount of alkaloid. I have also succeeded in preparing a small specimen of pure crystallized sulphate of quinine from the wood. Hitherto, the heart wood has been found the richest in alkaloids, the amount varying from 0.08 to 0.11 per cent. of the weight of the dry wood. The external layers of the wood of the trunk and of that of the older branches also contain alkaloid (but as far as I am at present aware) in less amount. With the large yield obtainable from our barks, I am not of opinion that the alkaloid in the wood can be remuneratively extracted, although the gross amount contained in the wood of a whole plantation must be very considerable. Wood is an unmanageable material to work with, since, in order to extract the contained bases, it is necessary that it should be in a state of fine division. It is, however, not impossible that further research may modify this opinion. The fact of the existence of quinine in the wood is an interesting one.

21. Attention has been paid to the influence of elevation (and consequently of climate) on the occurrence of the alkaloids in *Chinchona* barks. I have been able to obtain specimens of the bark *C. Succirubra*, grown at the heights varying from 2,300 feet to 7,700 feet above the sea level. The specimens were in each case taken from several trees which were as nearly of an age that circumstances would permit. The heights were measured barometrically. The analyses were made during the months of August and September, a season which I have since found to be an unfavourable one for obtaining a good yield. I do not, however, think that this circumstance would affect the comparative value of the results, which are as follows:—

	Octacamund.			Neddivuttum.		—	
	I.	II.	III.	IV.	V.	VI.	VII.
	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.
Red Barks - - -	7,770*	7,880*	7,450	6,560	6,460	3,500	2,300
Total Alkaloids - - -	2.38	2.03	4.21	5.75	3.8	4.10	4.1
Quinine - - - -	0.45	0.38	0.70	2.50	1.2	0.86	0.6
Chinchonidine and Chino- nine - - - -	1.93	1.70	3.51	3.25	2.6	3.24	3.5
Crystalline Sulphates ob- tained - - - -	1.75	1.60	3.20	4.20	3.1	3.58	3.4

22. The assertion so frequently made, that the higher the elevation the greater the yield of alkaloids, is untrue. The red bark trees growing at the higher elevations are, as Mr. Melvor has already pointed out, stunted and unhealthy in appearance. The analyses marked*, which are necessarily made from the bark of single trees, show that they are also comparatively deficient in yield. The bark from the lower portions of the Neddivuttum plantations is inferior to the upper parts, both in the amount of total alkaloids which they contain, in the readiness with which they are obtained in a pure state, and in amount of quinine. The whole of my experience leads to the conclusion that a high mean temperature is adverse to the yield of quinine, but not to that of chinchonidine. The elevation of 6,000 to 7,000 feet appears to be that most favourable to the yield of quinine, though the appearance of the increase of quinine *per saltum* in Analysis IV. is fortuitous. The elevation of the sites of the greater part of the plantations appears to me to have been selected with prescient judgment. Extension should, however, be in an upper direction rather than downward.

23. Similar observations have been made with the Crown barks, though the difficulty in obtaining mean specimens growing under conditions differing only in altitude has limited the inquiry.

	I.	II.	III.	IV.
Crown Barks - - - - -	8,000	7,770	6,007	5,450
Total Alkaloids - - - - -	3.42	3.61	3.10	2.68
Quinine - - - - -	2.10	1.83	0.75	0.45
Chinchonidine and Chinchonine - - - - -	1.32	1.78	2.35	2.23
Crystalline Sulphates obtained - - - - -	3.20	3.30	2.60	1.80

24. From the foregoing analyses, combined with others that have been made with different intentions, I conclude that the Crown barks grown at the higher elevations of the Dodabet plantation surpass those grown at the less altitude of Neddivuttum in their yield of quinine. The trees planted at the lowest slopes of the latter yield barks which are also inferior in other respects, since they contain resinous and colouring matters which increase the labour of purifying the alkaloids. The cortical fibres are also more numerous in the low-grown Crown barks. I have also detected quinidine in these barks. The quinine is in great part replaced by chinchonidine, exactly as in low-grown red barks.

25. While suitable soil can be obtained at altitudes over 7,000 feet, it does not appear to be advisable to plant Crown barks at lower elevations. Even though the advantage be not great, it is worth securing.

26. It is worthy of remark, that among the numerous analyses that have been made of red barks grown in climates whose mean temperature has ranged from that of northern Italy to that of African Tunis, I have not met with a sample that did not give a more or less satisfactory yield of febrifuge alkaloids, or in which quinine was not present. The same has been true of the Crown barks within the narrower limits that have permitted observations of that species.

27. The barks of trees that have been subjected to the mossing treatment introduced by Mr. Melvor has been so abundantly examined by Mr. Howard from specimens supplied at intervals for that purpose, that repetition by myself of the experiments on the same limited scale appears almost supererogatory. The following analyses may be adduced as quite corroborating former ones:—

	No. 1. Bark of <i>C. Sur-</i> <i>cirubra</i> 16 months under moss.	No. 2. Bark of same trees renewed under moss 16 months.
Total Alkaloids - - - - -	10.72	8.22
Quinine - - - - -	4.31	6.14
Chinchonine and Chinchonidine - - - - -	6.41	3.08
Total Sulphates obtained crystallized - - - - -	9.27	4.67
Sulphate of Quinine - - - - -	4.02	3.87
Ditto - Chinchonidine - - - - -	5.25	0.80

28. The barks yield by mossing a greatly increased amount of alkaloid, and in a state which permits them to crystallize with facility as sulphates. The bark No. II., renewed under moss, was thinner than natural bark, and lost more weight on drying. It should be remembered, however, that the renewed bark was 16 while the natural bark was 66 months old. This specimen was remarkable for the large amount of Chinchonine it contained. Had the sulphate of this base been reckoned among the total sulphates, their amount would have been upwards of six per cent. As already remarked by Mr. Howard, freshly renewed bark contains a considerable amount of uncrystallizable quinine. I have continually observed this peculiarity of young bark whether it be obtained from young trees directly, or produced by "renewal" on older trees. It would seem that it is as uncrystallizable quinine that the alkaloids are first formed by the natural processes in the plant. Thus, from the 3.23 per cent. of quinine found in some young red bark two and a half years old, but 1.97 of sulphate of quinine was obtainable crystallized; while in some bark 16 months old, but one-fifth of the quinine found, would give a crystalline sulphate.

29. The process of mossing the bark appears to require trial on a scale in which the increase both of bark and alkaloid could be systematically determined, and the cost compared with other methods of cropping the bark, such as coppicing, &c. These points are obviously necessary to an estimation of the practical value of the method, and at present are

are only guessed at. The repeated treatment of single trees, and analyses of the bark after so many concurrent experiments seems comparatively useless labour, while there exist so many other questions of a chemical nature to be settled. Unless, therefore, Government are pleased to direct otherwise, I shall only give the subject that attention which its actual practical working demands, or that its connection with the histological chemistry of the plant may require.

30. The cause of the increased yield of alkaloids obtained by mossing the bark has been adverted to in a former report, (Proceedings, Madras Government, Revenue Department, April 12th, 1867, paragraphs 15—18), when I had the honour of pointing out the injurious effect that continued exposure to sunshine has on Chinchona alkaloids and bark. The greater part of the effect produced by surrounding the living bark with a lair of moss must be ascribed to the circumstance that it is kept in darkness.

31. The bark of two trees, after a sample had been analysed, was covered in one tree with a shield of tinned plate, and in the other with black cloth. The object was to keep the bark in darkness while access of air was not impeded. The result of subsequent analyses were as follows:—

	Tree Covered with Tinned Plate.		Tree Covered with Black Cloth.		
	Original Bark.	Bark after 10 Months Protection.	Original Bark.	Bark after 6 Months Protection.	Bark after 10 Months Protection.
Total Alkaloids - -	5.29	8.10	6.04	6.91	7.92
Quinine - - -	2.16	1.65	2.26	2.03	2.34
Chinchonidine and Chinchonine - - -	3.13	6.45	2.78	4.88	5.58

32. The foregoing experiments agree in showing that deprivation of sunshine has had the effect of increasing the amount of alkaloid in the bark. The alkaloid was obtained crystallized with nearly the same readiness as in mossed bark. The amount of quinine has not, however, been increased as in the case of mossing. This is a circumstance which I did not expect, and it is opposed to deductions from other experiments. It is, however, a fact, and will doubtless be explained by increased knowledge of the subject.

33. There thus exists a strong array of concurrent evidence, pointing to the conclusion that it is to the destructive effect of insolation being prevented, that the richness in yield of the mossed bark must be ascribed. The facts may be recapitulated thus:—

1st. The experiments of Pasteur, Leverköhn, and others, who have found that the crystallizable alkaloids become coloured and uncrystallizable by exposure to sunshine.

2nd. That the solutions and salts of the alkaloids become partially decomposed when sealed up in vacuo, and exposed to the Neilgherry sunshine.

3rd. The inferior and comparatively impure yield of bark that has been exposed to continued insolation.

4th. The marked increase in yield obtained by keeping the living bark in darkness.

34. The renewal of the bark is not a consequence of the covering with moss, though the protection afforded by the latter doubtless facilitates the re-growth. The circumstance that bark carefully taken from the tree without injury to the cambium (the layer of living cells between the bark and wood) will be speedily replaced without any external treatment, thrust itself into my notice. I observed that strips of bark, which I periodically removed from the same tree in order, by analysis, to study the changes therein taking place, always rapidly grew again, not from the edges of the wound, but from the cambium, exactly as in the renewal under moss. I have since observed that wide strips of bark are replaced by the tree when the conditions of season and health of the tree have been suitable; otherwise the re-growth failed. It will be perceived that this circumstance, by permitting systematic observation of the actual living tissues under all their stages of growth, will furnish an important means of attacking the various questions connected with the formation of alkaloids. The following analyses of the naturally renewed bark are, consequently, of great interest:—

C. Succirubra.

	First Series.		Second Series.	
	I. Original Bark.	Ia. Renewed Bark Six Months old.	II. Original Bark.	IIa. Renewed Bark Ten Months old.
Total Alkaloids - - - - -	5.4	5.3	5.27	5.03
Quinine - - - - -	1.7	4.4	1.81	4.02
Chinchonidine and Chinchonine -	3.7	0.9	3.46	1.01
Crystallized sulphate of Quinine -	1.75	1.56	1.78	2.20
Do. do. Chinchonidine	Undetermined	Traces only	Undetermined	Traces only

35. From the above, it appears that the alkaloid of re-forming bark is mainly quinine, although that of the original bark it replaces, in great part chinchonidine. Much of the quinine is in the uncrystallizable state, though it is evident from the above, that the property of forming crystalline sulphates increases by age. Analogy renders it highly probable that eventually the whole will be susceptible of crystallization. The absence of chinchonidine is remarkable, the sulphate obtained at once standing the ether test; (the amount of sulphate of chinchonidine obtainable from the original bark was unfortunately undetermined, but it may safely be affirmed to have exceeded 2.5 per cent.) Microscopic observation of bark No. Ia. showed that the organization was very low, the liber fibres being few and imperfect, while No. IIa. showed that during four months its organization had so advanced that the liber had the appearance of ordinary bark one and a half years old. I have not yet been able to make an analysis of the bark of the second renewal which forms when the first has been removed.

36. The above facts corroborate the statement concerning the practice of the American cascarrilleros, of partially stripping the bark of a branch, and allowing it to grow again, which I had the honour of quoting on a former occasion.

37. The fifth year of the life of the red bark trees is marked by a great increase in the number of the liber fibres of the bark, by which that portion becomes thoroughly developed. There appears to be some grounds for the conclusion that this development is not favourable to the yield of quinine. The opinion of authorities as to the principal seat of quinine in the bark has been divided. Weddell, Wigand, Schleiden, and others have concluded on theoretical grounds that the liber is the part of the bark in which the alkaloids are situated. Howard, on the contrary, by direct trial, has satisfied himself that the main seat of the alkaloids is in the cellular portions of the bark which are external to the liber. Having far greater facilities for determining the question than any other chemist has hitherto possessed, I repeated the experiment that Mr. Howard had made, using instead of the dried South American bark, the bark of *C. Succirubra* fresh from the tree. The liber was separated from the external cellular portion, and the two portions were then submitted to analysis. The analyses were made at a season favourable to the yield of alkaloids.

	First Series.		Second Series.	
	Liber.	Cellular portion.	Liber.	Cellular portion.
Total alkaloids - - - - -	5.94	7.98	6.85	8.00
Quinine - - - - -	0.7	2.25	0.85	3.25
Chinchonidine and chinchonine -	5.24	5.74	6.00	4.75
Sulphate of quinine - - - - -	Undetermined	Undetermined	0.9	2.8
Ditto chinchonidine - - - - -	ditto.	ditto.	4.1	4.2

38. A similar

38. A similar experiment was made with bark five and a half years old that had been under moss for seventeen months.

	Liber.	Cellular portion.
Total alkaloids - - - - -	9.80	11.83
Quinine - - - - -	2.89	5.49
Chinchonidine and chinchonine - - -	6.91	6.34
Crystallized sulphate of quinine obtained - -	2.44	5.1
Ditto ditto chinchonidine obtained -	4.74	4.84

39. The whole of the above trials corroborate those of Mr. Howard in showing that the external cellular part of the bark is markedly the richest in quinine, and (to a less extent) richer in total alkaloids. When the bark becomes older, and the liber more woody, it is probable that these qualities will be still more apparent. It is remarkable that mossing, which increases the yield of quinine, also has a tendency to thicken the cellular or less organised portion of the bark. The freshly renewed barks which, as shown above, contain principally quinine, consist nearly entirely of cellular tissue. Hence existing evidence is adverse to allowing the bark to obtain an age when liber would be formed at a greater rate than the cellular tissues of the bark.

40. Attention has been called to the green colouring matter of the leaves of the *Chinchona succirubra*, as possessing properties well worthy of investigation. Its ethereal solution possesses a lovely green tint with a superb crimson fluorescence. I have therefore examined its optical properties by means of the spectroscope. I find that its absorption spectrum does not differ from that of the colouring matter of many other leaves, and like them, consists of two dark bands. The perfect coincidence is readily proved by the superposition of the two absorption spectra. The results of very extensive researches made by so many English and foreign chemists and physicists on the green principle of leaves, can be also applied to that obtained from the leaves of this species of *Chinchona*.

41. It is a fact that, in the *chinchona* barks of south India (considered as a whole) the replacement of quinine by chinchonidine obtains to a greater proportion of the total yield of alkaloids than those of South America. The actual amount of the substitution varies greatly in single trees, both according to its variety and the conditions to which it is exposed. The practical effect of this peculiarity is compensated for by the large total yield of the alkaloids. For medicinal purposes, it appears from the recent medical trials, that it is of little importance which of the two alkaloids are produced. Nevertheless, the causes which produce the replacement are obviously of the greatest interest in connection with *Chinchona* cultivation. There must be several proximate causes, and it will, I think, be evident from the foregoing experimental results, that they are in progress of being elicited. Thus it appears that a low mean temperature within certain limits is favourable to the production of quinine, as is also the loose cellular structure of the bark produced by artificial means. To these must be added a circumstance that I have long observed, more especially among the varieties of *C. Officialis*, that trees which are from their position fully exposed to sunshine have a proportionally larger amount of chinchonidine than those grown in shade.

42. Mr. Howard, to whom I communicated this observation, informed me that it quite agrees with his experience. The yield of quinine in the Ceylon Crown barks was greater in those grown in shade than those fully exposed. Dr. De Vrij has observed the same peculiarity.

43. The same fact harmonises with the opinion prevailing in South America, that the bark of the *Unifusa* varies in quality according to the aspect of its situation with respect to the sun. If it be the heat of the sunshine that produces these effects, it will be seen that exposed bark would in many respects be under the same conditions as that grown in a warmer climate. The sunshine, which is powerless to warm the dry and diathermanous air of the Neilgherries, falling on the bark at once raises its temperature.

44. These observations derive additional force from the consideration that it is in this respect of effective heat-giving sunshine that the climate of the mountain ranges of South India differs from that of the *Chinchona* regions of South America. With the same annual mean atmospheric temperature, the climate of the Neilgherries differs from that of the bark regions in having six months of unclouded sunshine when the singular dryness of the atmosphere robs the rays of none of their heating power. The bark countries of the Andes are unlike ours, situated in a region of perpetual trade winds, which (as our monsoons) bring their abundant rains and fogs during the greater part of the year to interrupt the sunshine. The travels of Markham, Karsten, Spruce, Boussingault and many others bear full testimony to this.

45. Experience of the cultivation of the *Chinchona* has convincingly shown that they cannot be successfully grown under the shade of other trees. As the plantations increase in age the trees will shade their own bark. This consideration, taken in connection with the

preceding, suggests an experiment that I would gladly see tried. It is that of planting a rood of ground closely enough, so that the bark from its early years may be thus shaded. An examination of the bark on a considerable scale would then elucidate a point which, though supported by the preponderance of existing evidence, cannot be considered at present conclusive.

46. Ammonia has been present in every specimen of Indian bark that I have examined. The hypothesis has been propounded that this substance (which is itself really an alkaloid) is a step in the formation of quinine, &c., and is (so to speak) the frame work of their constitution. The idea of an essential connection between ammonia and the vegetable alkaloids dates from the early part of the century, and advance of knowledge has but increased its probability. As far as I am aware, the action of ammoniacal manures (so largely employed in European agriculture) has never been systematically studied when applied to the alkaloid-producing plants, although the idea of supplying the elements required in the elaboration of these peculiar products is a plausible one. I would suggest that small plots of the two leading varieties of *Chinchona* in our possession be each manured with guano in one case, and in the other with common sulphate of ammonia, such as is sold in Europe for agricultural purposes, commencing when the plants are a year old. This is an experiment in cultivation that must be tried sooner or later, since the question of the action of manures is one that obviously suggests itself. The chemical study of the effect, even if it be a negative one, will be of great interest.

47. I have made many experiments on the changes produced on the barks by the various modes of drying, and have arrived at results of interest and practical importance. The subject, however, will not be complete for some time, and would only suffer if reported on by instalments. In like manner, there are several theoretical conclusions that might be inductively drawn from the foregoing portions of this Report, but as further practical confirmation must occur in the course of subsequent work, I reserve them for another occasion.

48. There are other characteristics constituents of *Chinchona* bark which require a full investigation. These are, Chinchotannic acid, Quinovin, and *Chinchona* red. These substances have doubtless intimate relations with the formation of the alkaloids, and may even possess uses and properties of their own, both medicinal and technological. The quantity in which they are produced is very great. But while so many points of direct importance occupy my time, I have not thought it right to devote attention to subjects which might possibly yield results of scientific value only.

ORDER of the Madras Government, 22nd September 1868.

1. THE foregoing report from the Government Quinologist upon the progress of his various experiments and researches will be forwarded for the information of the Right Honourable the Secretary of State. Copies will be furnished to the Governments of India and of the other Presidencies, to the Governments of Ceylon, the Straits Settlements, Batavia, and the French settlements in India.

2. The result of the analyses of the Crown barks is highly satisfactory. The further experiments made with the *Crispa* variety tend to show that Mr. Broughton's views as to its value are correct.

3. The propagation of the valuable variety, referred to in paragraphs 11, 12, and 13 of the report, should be carefully carried out by the superintendent of the *Chinchona* plantations.

4. The same officer's attention will also be drawn to the remarks contained in paragraphs 22 and 25, as to the proper elevation at which to cultivate the red barks and the crown barks, and he will arrange for making the experiments proposed in paragraphs 45 and 46.

5. Instructions will be issued on the subject referred to in paragraph 29 on receipt of the superintendent's reply to the G. O., under date 25th August 1868, No. 2,252 which should be submitted without delay. The Government understand Mr. Broughton to desire that the mowing process may be adopted on a larger scale than has hitherto been done, in order to give full effect to his experiments.

(True Extract.)

(signed) R. A. Dalryell,
Acting Secretary to Government.

— No. 46. —

From the Secretary of State for India to the Governor of Madras.

India Office, 30 November 1868.

I HAVE received and considered in Council your Despatches (Revenue Department) on the subject of Chinchona cultivation, dated September 21 (No. 45) and October 6 (No. 49) 1868; and have perused Mr. Broughton's report on his chemical investigations with much interest.

I am glad to perceive that orders have been given by your Government to carry out an experiment by which Mr. Broughton will be enabled to investigate the action of ammoniacal manures on alkaloid-producing plants. The careful analyses made by Mr. Broughton on the spot will be of great use in deciding all questions relating to the most profitable method of cultivation; and he appears to be fully alive to the importance of ascertaining, with as much exactness as is practicable, the period at which the yield of alkaloids in the barks reaches its maximum, the right time of year for harvesting, the correct elevation and exposure for each species, and the best modes of drying.

The discovery of the existence of quinine in the wood of Chinchona trees as well as in the bark, may lead to practical results, and I trust that this part of the subject will be fully investigated.

The progress of the plantations during the half year ending 31st July 1868, appears to have been very satisfactory.

— No. 47. —

From the Secretary of State for India to the Government of Madras.

India Office, 8 December 1868.

I FORWARD herewith a copy of a letter which has been received from Captain Maury, requesting that he may be supplied with Chinchona seeds, with a view to the cultivation of that plant in certain portions of the State of Virginia.

9 October 1868.

The superintendent of the Chinchona plantations on the Neilgherry Hills should be directed to set apart a supply of good seeds in the next season, to be sent to this office for transmission to Captain Maury; together with copies of the latest notes that have been printed on the cultivation of the Chinchona plants.

— No. 48. —

From the Government of Madras to the Secretary of State for India.

Madras, 9 March 1869.

IN continuation of our Despatch, dated 21st September 1868, we have the honour to forward, for your Grace's information, the accompanying tabular report on the progress and condition of the Chinchona plantations on the Neilgherries, for the half-year ending 31st January 1869.

Enclosure in No. 48.

REPORT on the Number, Distribution, and Condition of Chinchona Plants on the Neilgherries, for the Half-year ending 31st January 1869.

Species.	Botanical Names.	Commercial Names.	No. of Plants.	Value per Lb. of Dry Bark in the London Market.			
				s.	d.	s.	d.
1	C. succirubra - - - -	Red Bark - -	1,212,283	2	6	to 8	9
2	C. Calisaya - - - -	Yellow Bark - -	40,395	2	10	to 7	-
	C. " frutex - - - -						
	C. " vera - - - -						
3	C. officinalis - - - -	—	—	—	—	—	—
	C. var. Condamenia - - - -	Original Loxa Bark	1,165,119	2	10	to 7	-
	C. var. Bonplandiana - - - -	Select Crown Bark -	87,509	2	10	to 7	-
	C. var. crispa - - - -	Fine Crown Bark -	4,855	2	10	to 6	-
4	C. lancifolia - - - -	Pitayo Bark - -	279	1	8	to 2	10
5	C. nitida - - - -	Genuine Grey Bark	2,786	1	8	to 2	9
6	C. species without name - - - -	Fine Grey Bark -	8,500	1	8	to 2	10
7	C. micrantha - - - -	Grey Bark - -	46,730	1	8	to 2	9
8	C. Peruviana - - - -	Finest Grey Bark -	8,389	1	8	to 2	10
9	C. Pahudiana - - - -	Unknown - -	426	Unknown.			
TOTAL Number of Plants - - -			2,571,770				

TABLE showing the Growth of the different species of Plants planted out in the Plantations for the Half-year ending 31st January 1869.

No. of Plants.	Species.	Where Planted.	When Planted.	Maximum Growth.	Average Growth.	Height of the tallest Tree.	Girth near the Ground.
				Inches.	Inches.	Feet.	Inches.
12	C. succirubra - -	Neddivat-tum.	30th Aug. 1862.	41	21½	23½	28
12	C. micrantha - -	ditto -	1862 -	19	8	21	22½
12	C. officinalis - -	Dodabetta -	30th Sept. 1863.	12¼	10	14¼	11

TABLE showing the Propagation, Distribution, &c., of Plants and Seeds during the Half-year ending 31st January 1869.

Date.	Total Number of Plants Propagated.	Total Number Permanently Planted out.	Total Number of Plants Distributed to private individuals.	Total quantity of Seeds Distributed.
				oz.
August 1868 - - - -	50,500	30	- -	9½
September " - - - -	43,200	335	68	7
October " - - - -	13,700	18,200	16	20
November " - - - -	12,400	17,480	-	23
December " - - - -	30,000	-	-	2
January 1869 - - - -	25,200	-	26	6
Previously - - - -	175,000 2,996,770	36,045 858,012	110 170,740	67½ 139
Grand Total - - -	2,571,770	894,067	170,860	206½

REMARKS.—The number of Plants permanently Planted out in the Plantations is 36,045, making the total 894,057.

All the species of Chinchona still maintain their usual luxuriance; the older plants of Chinchona Succirubra, Micrantha, and Officinalis, have this year again produced a large quantity of good seeds.

The

The increase by propagation is 175,000, the monthly average being 29,166, making the total 2,571,770.

The number of Plants distributed to the public is 110, giving the total distribution of 170,850. Sixty-seven and half ounces of seeds have also been gratuitously distributed; making the total quantity 206½ ounces.

(signed) *W. G. McIvor.*

Ootacamund, 26 February 1869.

Supt. Govt. Chinchona Plantations.

— No. 49. —

From the Government of Madras to the Secretary of State for India.

Madras, 8 June 1869.

With reference to paragraph 5 of Sir Stafford Northcote's Public Despatch, dated 16th April 1867, we have the honour to forward, for your Grace's information, the accompanying papers relative to the experimental cultivation of Chinchona in Wynaad in 1866 and 1867.

2. We are not in possession of complete information as to the results of the similar experiments made at the other places mentioned in paragraphs 5 and 6 of the Despatch under reply. Full reports on the subject have been recently called for, which, when received, will be duly forwarded for your Grace's information.

Enclosure 1, in No. 49.

Collector of Malabar, to the Secretary to the Board of Revenue, Calicut, 1 July 1867.

1. I AM desirous of again distributing a supply of young Chinchonas in Wynaad.
2. I beg that Government will sanction my requesting the Superintendent of the Chinchona Gardens to have some 500 healthy plants of about three or four inches growth placed separately in little baskets containing each a couple of pounds or so of soil (or more if thought necessary). When the plants have become established in the baskets, I will ask him to have them sent down to the Gudalur sub-magistrate, and have them very carefully distributed.
3. I ask to have the plants put in baskets as above, because it would then only be necessary for the persons to whom they are finally distributed to place basket and all in suitable pits, without disturbing the plant. Where plants on distribution are likely to meet with real care and attention, the precaution would not be necessary; but my object is to disseminate the plant if possible widely, and although the recipients will be told to give them the greatest care, it is not to be expected that the plants will always receive it.
4. I am quite aware that a more detailed report on the previous distribution of plants should have preceded or accompanied the present application, but I have received no detailed reports from the local authorities, and so I am unable to furnish one now. Although no doubt a good number of the plants before sent have died, I know from personal inspection that some at least were alive and flourishing a few months ago, and I have heard from good authority that many are doing well. The plants when sent were very small, quite large enough for a skilled planter to put out with success, but certainly not robust enough to have much chance unless put out and tended with greater care than can be expected from all or even most of the miscellaneous recipients.
5. I am quite of opinion, however, that the experiment in every way is well worth being continued, and I trust the Board will support it.

Submitted to Government, with the Board's recommendation that the necessary directions be issued to the Superintendent of the Chinchona Plantation.

Order of Madras Government, 24th July 1867.

1. The Government approve the collector's proposal.
2. The Acting Superintendent of the Chinchona Plantations will make the necessary arrangements to meet Mr. Ballard's requisition for 500 well-established plants of the kinds most likely to thrive in the Wynaad.

3. The collector will, in due course, report the results of the experiment from the first.

(True Extract.)

To the Board of Revenue.
To the Acting Superintendent
Government Chinchona Plantations.

(signed) *W. Hudleston,*
Secretary to Government.

Enclosure 2, in No. 49.

From the Collector of Malabar to the Acting Secretary to the Board of Revenue,
Calicut, 5 October 1868.

1. I HAVE the honour to report on the experimental cultivation of Chinchona carried on in Wynaad in pursuance of the Orders of Government, dated 13th April 1866, and 24th July 1867, on my letters noted.

I made arrangements with the Superintendent of the Government Chinchona Plantations, and the Deputy Collector of Wynaad, for the timely despatch of healthy plants by the former, and for the general and judicious distribution of them among the people by the latter.

A simple memorandum of the mode of culture to be pursued was prepared and forwarded to me by Mr. McIvor, and circulated, with translation, among the planters for their guidance.

2. The first batch received in 1866, consisted of plants too small to meet with any large measure of success from a general experiment of the kind contemplated. They were, perhaps, large enough for a skilled planter to put out with success; but certainly not robust enough to stand the unskillful, and, perhaps, careless treatment they were likely to meet with from many of the recipients. The result of the first experiment, therefore, fell short of the expectations originally entertained. Under 100 plants out of 500 appear, by the returns received, to be in a thriving condition.

3. Application for supply of another batch was made in my letter of the 1st July 1867, No. 134. The plants were received in November, as that was fixed on, in communication with Superintendent of the Chinchona Plantations, as the season most favourable for planting in Wynaad. Additional precautions were then taken. Each plant was raised in a square cow-dung pot, and only issued when sufficiently established and hardened to stand without extraordinary skill and attention. More than half the plants thus distributed are reported to be coming on vigorously; and most of them are said to have grown from one to six and seven feet.

4. The Deputy Collector of Wynaad, who personally inspected the plants in different parts of the talook, reports of them in the following terms:—

"The plants on the Cutcherry Hill are getting on very well, some five or six feet high; and I hope to be able to get a number from them for a nursery. Those just planted at Vytry were coming on nicely when I last saw them.

"I find the estates about here have numbers planted some very nice trees amongst the coffee, six and seven feet high and a couple of inches in diameter, a foot from the ground,

C. Succirubra. When I last saw these Plants on the Vytry Cutcherry Hill, that is, in May last, they were very flourishing indeed.

and at Vellara Mallah a splendid nursery with some hundred plants, they appear to grow fast and would make a good shade for coffee, as well as being otherwise useful and profitable. The best kind is the broadest leaf, same as planted at Vytry and on the Cutcherry Hill."

5. I hope to visit Wynaad in the course of this month, and intended delaying my report till I had done so; but as it has been called for again, I despatch it now.

Enclosure 3, in No. 49.

From the Collector of Malabar, to the Acting Secretary to the Board of Revenue, on
Circuit at Chevayar, 11 January 1869.

* Dated 7 January 1869, on Government Order, dated 22 December 1868.

1. With reference to the Board's call* for my further report on the Chinchona plants distributed in Wynaad, I regret to say that I did not see in my tours in November and December last, as much result from the distribution of the Chinchona plants amongst the natives as I had expected to do, and I reasonably expected to find.

2. At the places that I personally visited, I found very few of the distributed plants alive, though the exceptions showed that if a little judicious care had been bestowed, there was every likelihood that the failures should have been as few as the successes really were.

3. Where the soil was pretty good and the situation sheltered in almost every place where experiment had been made, there was a plant or two that had thriven well (6 to 9 feet in height), happening to have been better fenced, or cleared from weeds, or enjoyed some casual advantage

advantage. But the number of really thriving plants in native keeping that I saw was exceedingly small, and though the existence of others was reported in places where I had not the opportunity of visiting, I imagine what I saw was too true a specimen of what prevailed elsewhere.

4. On the Cutcherry Hill at Vytry the plants* are still promising, though hardly as vigorous looking (as it struck me) as they were at an earlier stage. But at several of the coffee plantations the growths are very thriving, especially, I may mention, at Messrs. Rossall's, Minchin's, and Cox's estates, in South and South-east Wynaad. I understand there is some healthy planting in North Wynaad also, but have not personally seen any.

5. Mr. Underwood takes considerable interest in experiments of the sort, and notwithstanding the somewhat unsatisfactory report I am now submitting, I venture strongly to recommend that another supply of the red-bark plants, prepared as described briefly in paragraph 3 of my previous letter, be allowed at the next proper season (and of September or early in November) for gratuitous distribution.

Submitted to Government, with reference to paragraph 2 of their order, dated 22nd December 1868, No. 3,198.

2. With reference to the last paragraph of the letter, the board request that the Superintendent Government Chinchona plantations, may be instructed to forward another supply of the red-bark plants to the collector.

Order of Madras Government, 17 March 1869.

1. Communicated to the superintendent of the Government Chinchona Plantations, with reference to paragraph 2 of G. O., 22nd December 1868, No. 3,198, and with instructions to arrange for meeting the requisition made by Mr. Ballard in paragraph 5 of his present letter, for another supply of the red bark plants.

2. The collector will in due course report the result of the cultivation of these plants.

(signed) *R. A. Dalryell*,
Acting Secretary to Government.

— No. 50. —

From the Secretary of State for India to the Government of Madras.

India Office, 29 July 1869.

I HAVE received and considered in Council your Excellency's Despatch, dated June 8th 1869 (Revenue Department), forwarding papers relating to the persevering efforts which have been made by the collector of Malabar to introduce the cultivation of Chinchona plants into Wynaad.

The growth of these febrifuge trees by the natives throughout the hill districts, in their gardens and small holdings, will be one of the most important results of the introduction of Chinchona cultivation into India. It is a result which is certainly more to be desired than the success of the experiment as a mere commercial undertaking. The chief object of my predecessors in sanctioning the measures for the introduction of this cultivation was that, in time, the febrifuge remedy might be brought within reach of all classes of the native population.

The eventual success of any attempt to spread the cultivation among the natives of a particular district depends mainly on the interest that may be taken in the matter by the local officers; and I observe, with much satisfaction, that Mr. Ballard is resolved that Chinchona cultivation in Wynaad shall not be a failure if any efforts on his part can ensure success. I trust that he will receive any reasonable assistance that he may require in his very creditable endeavours to confer so great a blessing on the people of Wynaad.

I shall be glad to receive reports on the progress that has been made in other

hill districts, and especially in Travancore, where the enlightened character of the Rajah's government, and the energy of Sir Madava Row, justify the expectation that the small beginning made in 1866 has borne fruit.

— No. 51. —

From the Government of Madras to the Secretary of State for India.

Madras, 20 July 1869.

With reference to the latter part of paragraph 6 of Sir Stafford Northcote's Despatch of 16th April, 1867 (Public), and to paragraph 2 of our Despatch of 8th June, 1869 (Miscellaneous), we have the honour to forward, for your Grace's information, the accompanying report, from the resident in Travancore and Cochin, on the Chinchona plantation at Peermade in Travancore.

2. The memorandum by Dr. Cleghorn on this plantation, referred to in paragraph 8, of the resident's report now forwarded, was transmitted to the Home Government, and referred to in paragraph 6 of our Despatch, dated 13th March, 1866.

Enclosure in No. 51.

From the Resident in Travancore and Cochin, to the Chief Secretary to Government, Fort St. George, Trevandrum, 14 June 1869.

I HAVE the honour to acknowledge the receipt of the proceedings of the Madras government of the 3rd June 1867, and, in compliance with the order thereon, to furnish the following information regarding the Chinchona plantation at Peermade, as desired by the Right honourable the Secretary of State for India.

2. In 1862 the Travancore government established its garden at Peermade, or rather at the new station called "Mary Ville," not far from the proposed line of road from Alleppy to Madura.

* As per Order of Government, No. 2506, of 28 November 1862.

3. In March 1863 about 500 Chinchona plants, two months old, and from one to two inches high, were supplied by Mr. McIvor, from the Government Gardens at Ootacamund,* to be planted out at Peermade; but more than half were lost, some in transit and others soon after arrival, from the effects of exposure, damp, or cutting winds, as the plants were young, and the glass-house was not ready for their reception.

4. The accompanying table gives the growth of the plants that survived on the 15th November 1867:—

Names of Plants.	Commercial Names.	No. of Plants.	Grown in inches from 15th October to 15th November 1867.	Height of the Tallest.		Girth of the Thickest.	
				Ft. In.		Ft. In.	
Chinchona Succirubra	Red bark	167	1	15	11	1	9½
" Micrantha	Grey "	59	1 to 6	11	5	0	9
" Peruviana	Genuine grey bark.	36	1	13	7	0	10½
" Nitida	Finest	22	½	6	0	0	4½
" Condamenia	Select crown	55	1 to 3	10	2	0	9½
" Chinchona	Name unknown	14	1	5	10	0	4½

5. All these plants looked healthy. The tallest Chinchona of the unknown variety was in blossom in June 1867. A Chinchona Peruviana, seven feet nine inches in height, and six inches in girth, was in blossom at the same period; as also three of the largest Condamenias, varying from six feet two inches to ten feet two inches in length.

6. In

6. In 1867, 3,495 plants were raised from cuttings, and planted in a new clearing, and the following table gives their growth up to the 15th November of that year. They were then reported as looking remarkably healthy.

Names of Plants.	Commercial Names.	No. of Plants.	Grown in inches from 26th October to 15th November, 1867.	Height of the Tallest.		Girth of the Thickest.	
				Inches.	Ft. In.	Ft. In.	
Chinchona Succirubra - -	Red bark - -	2,194	1½	3	3½	0	5½
" Micrantha - -	Grey " - -	877	1 to 2½	6	0	0	4
" Nitida - -	Finest grey bark	43	½	4	11	0	3½
" Peruviana - -	Genuine grey bark.	381	1 to 6	1	10	0	½

7. Ten acres of forest land had been set aside for the purpose of cultivating Chinchona. About six acres have been cleared and planted. Particular care has been taken to reserve sufficient belts of forest to shelter the plantation from the north-west and south-east monsoons.

8. Dr. Cleghorn, Conservator of Forests at Madras, visited Peermade in company with Mr. Markham in December 1865, and in his interesting memorandum,* referred to in the proceedings of Government, dated 21st February 1866, No. 468, he observes that "the Travancore Sirkar has well seconded the efforts of the British Government, and that the result of the Chinchona experiment is more successful here than anywhere else in Southern India, excepting on the "Neilgherries."

* Dated 13th January 1866.

9. As recommended by Dr. Cleghorn in the said memorandum, 12 plants were presented in 1867 to each of the planters, and 80 more were made over to the Sirkar Conservator for trial in the Travancore forests. I am not sure how these have succeeded.

10. The superintendent at Peermade had been authorised to sell, to any of the planters, plants to the extent of 2,000, at the rate of one anna each, or six rupees per 100 plants; but no sales have been reported.

11. The following statement shows the state of the Chinchona plantations up to 31st December 1868, including those received from Ootacamund and those raised from the cuttings, &c.

No.	Botanical Names.	Commercial Names.	No. of Plants.	Growth in Inches.	Height of the Tallest.		Girth of the Thickest.
					Ft.	In.	
1	C. Succirubra	Red bark -	2,952	2	19	10	Close to the ground 22 inches, 5 feet from ground, 18 inches.
2	" Micrantha -	Grey " - -	341	-	18	0	Close to the ground 12½ inches, 5 feet from ground, 7½ inches.
3	" Peruviana -	Finest grey bark.	109	-	15	4	Close to the ground 12 inches, 5 feet from ground, 7 inches.
4	" Nitida -	Genuine grey bark.	66	-	7	10	Close to the ground 7½ inches, 4 feet from ground, 4½ inches.
5	" Condamenia	Rusty crown bark.	74	-	12	1	Close to the ground 9 inches, 5 feet from ground 5 inches.
6	Chinchona -	Name unknown	10	-	9	4	Close to the ground 6½ inches, 4 feet from ground 5 inches.
		TOTAL - -	3,552				

12. I paid a hasty visit to Peermade last month to inspect the ghaut,† a portion of the Madura road-trace, and the plantations.

† This it is hoped will be open to carts by the end of this year.

The Chichonas I thought looked remarkably well. They would bear favourable comparison with any I have seen in Wynaad or elsewhere, excepting only the best portions of the Neddiwuttam gardens.

The planters at Peermade do not appear to doubt the suitability of the climate, soil, and situation; but they are not satisfied that the cultivation will be financially remunerative to private individuals, and consequently exhibit no desire to undertake it.

13. I found on my visit that Mr. Sinclair, the superintendent of the gardens, had some 9,000 plants (from layers and cuttings) ready for planting out this season, which would only suffer by longer retention.

I found that there was no chance of sale, and therefore instructed Mr. Sinclair to give away up to 5,000 plants, if any applications were made; but, as above said, the planters did not seem to care about taking the plants even gratis.

I further instructed Mr. Sinclair, with whose intelligence and interest in his charge I was very favourably impressed, to plant out clumps of 50 to 100 well-established young Chinchonas in some of the most eligible sholas, merely clearing space for each plant, and having under growth and weed cleared once a month or so, till such time as the young trees were large enough to make their own way. Also to plant most freely, singly, or in small clumps in sufficiently-sheltered spots on grass land, along sheltered road sides, &c., all about the hills. It will thus be fairly tested in a few seasons whether the Chinchona will flourish without elaborate cultivation, and if it appears that the plant can be as it were naturalised to the country, a very great object will, I think, have been gained.

* No. 1599, dated
5th June 1869.

14. I merely submit this brief sketch of the past and present of the Peermade Chinchona plantation in reply to the call from Government.* With regard to the future of the gardens, I am about communicating with the Sirkar, and may address Government again shortly.

— No. 52. —

(No. 26.)

From the Secretary of State for India to the Government of Madras.

India Office, 11 September 1869.

I HAVE considered in Council the very interesting letter from the resident in Travancore, on the subject of Chinchona cultivation at Peerméde, which was forwarded in your Excellency's Revenue Despatch, dated July 20th (No. 42), 1869.

The coffee planters at Peerméde, doubtful of the financial result, are not disposed to undertake Chinchona cultivation at present; and the resident has, therefore, adopted the best means at his disposal, for spreading the cultivation over the Travancore hills, by ordering trees to be planted in *shalas*, on the grass lands, and on sheltered parts of the road side, Mr. Ballard, will, no doubt, take the same interest in this beneficial measure as he did when he was collector of Malabar, and, as I observe, that he intends to address your Government again on the subject of the Peerméde gardens, I shall be glad to be informed of the results of the measures he has adopted, and of the progress that is made in the Travancore hills under his auspices.

— No. 53. —

From the Government of Madras to the Secretary of State for India.

My Lord Duke,

Madras, 27 July 1869.

WITH reference to your Despatch, dated 8th December 1868, No. 48, we have the honour to forward, for Captain Maury of the State of Virginia, a packet of Chinchona seeds from the Government gardens on the Neilgherry hills, together with five copies of the notes printed last year on the cultivation of the plants.

We have, &c.

(signed) H. D. Phillips,
A. G. Arbuthnot.

— No. 54. —

From the Government of Madras to the Secretary of State for India.

Madras, 27 July 1869.

WE have the honour to forward for your Grace's information the accompanying letter from the Commissioner of the Neilgherries, and the Report from the Government Quinologist, therewith received, upon certain Chinchona barks, together with our order on these papers, dated 19th June 1869.

2. Our proceedings of 22nd September 1868, referred to in paragraph 2 (foot-note) of Mr. Broughton's Report, were forwarded to the Home Government, with our Despatch, dated 6th October, No. 49.

Enclosure in No. 54.

From *J. Broughton*, Esq., Quinologist to Government, Ootacamund; Ootacamund,
24th April 1869.

I HAVE the honour to communicate the following facts connected with the Government Chinchona plantations. The considerations suggested by these appear to me to be of importance, and I therefore make a separate communication on the subject.

2. On a previous occasion* I had the honour to mention the occurrence of a variety (or perhaps a species) of Chinchona, whose bark surpassed in quality that of any kind previously known. The number of these trees is unfortunately not great. A search over the plantations has brought to notice about a dozen of various sizes; some quite equalling in vigour the trees of *C. Officinalis*; but others decidedly smaller, and less vigorous in growth.

3. During the last six months I have naturally paid much attention to these trees, and made repeated analyses of their bark. I am led in consequence to attach even a greater value to the kind than at first. I quote the principal numerical results I have obtained, expressed in per-centages of the dry bark. To compare with these, and to avoid all chance of ascribing to the merits of the species what might possibly be due to other unperceived causes, I made analyses in each case of their nearest crown bark neighbours of about the same size. The latter are marked β .

4. I.—A good specimen, 9½ feet high, and equal in size to an average tree of *C. Officinalis* of same age:—

	New Kind.	
Total alkaloids - - - - -	11.40	8.95
† Total sulphates obtained crystallised - - - - -	10.61	3.82
Quinine - - - - -	9.75	1.55
Chinchonidine and a small amount of Cinchonine - - - - -	1.65	2.40
Quinine sulphate obtained crystallised - - - - -	10.13	1.50
Chinchonidine sulphate - - - - -	0.38	1.82

5. II.—A tree

* Proceedings of the Madras Government, Revenue Department, 22nd September 1868, No. 334, paragraphs 11—18.

† Exclusive of Chinchonine sulphate which, however, would be of very small amount.

5. II.—A tree of same age, but smaller size :—

	New Kind.	β.
Total alkaloids - - - - -	11.50	4.52
Total crystalline sulphates obtained. - - - - -	10.10	Undetermined.
Quinine - - - - -	7.00	2.42
Chinchonidine, &c. - - - - -	4.5	2.10
Quinine sulphate obtained crystallised - - - - -	6.75	Undetermined.
Chinchonidine sulphate obtained crystallised - - - - -	3.35	- ditto.

6. III.—Bark from two healthy trees about 8½ feet high :—

	New Kind.	β.
Total alkaloids - - - - -	8.10	4.45
Total sulphates obtained crystallised - - - - -	7.52	Undetermined.
Quinine - - - - -	7.25	2.03
Chinchonidine, and traces of Cinchonine - - - - -	0.85	2.42
Quinine sulphate obtained crystallised - - - - -	7.37	Undetermined.
Chinchonidine - - - - -	0.15	- ditto.

7. IV.—Bark from two small trees 5 feet in height :—

	New Kind.	β.
Total alkaloids - - - - -	5.61	1.85
Quinine - - - - -	3.26	1.05
Chinchonidine and Cinchonine - - - - -	2.35	0.80
Sulphate of quinine obtained crystallised - - - - -	3.90	Undetermined.

8. V.—Bark from several trees about 4 feet high, growing at high elevations, healthy, but not vigorous :—

	New Kind.	β.
Total alkaloids - - - - -	4.45	1.45
Quinine - - - - -	2.41	Undetermined.
Other alkaloids - - - - -	2.04	- ditto.

9. The foregoing analyses abundantly show the remarkable quality of the bark. In all cases the yield of alkaloid from the bark of trees of this lanceolate-leaved kind greatly exceeds that of the Crown barks growing under the same external conditions. Analyses I. and III. are of bark from vigorously healthy trees, and the alkaloids consist almost entirely of quinine. The amount is unprecedented, far exceeding that of any Chinchona bark hitherto known. Indeed, the yield of No. I. is three-fold that of fine Bolivian Calisaya. Even this scarcely gives an accurate idea of the value ; for the alkaloid is contained in a third of the bulk of material ; and hence, both the cost of carriage, and the labour, and proportionate cost of the process of obtaining the alkaloid in a commercial form, is practically reduced. The effective practical value of Chinchona bark really increases in a greater ratio than the yield of alkaloids. Rich bark is cheapest to manufacture quinine from.

10. The bark of the above specimens was of capital appearance, and its alkaloids yield crystalline sulphates with much ease. There being no reason to suppose that the cost of the growth of this variety will exceed that of the Crown barks, it may fairly be predicted that bark

bark of the quality of No. I. specimen, yielding a tenth of its weight of sulphate of quinine, must ultimately produce great changes both in Indian Chinchona cultivation, and in the European market.

11. I have pointed out to Mr. McIvor, superintendent of the plantations, the great importance of the variety. He is now taking steps for its rapid propagation; I feel convinced that the cultivation of this remarkable variety, if it be appropriately followed up, will greatly enhance the present success of the plantations. It would be well worth while to have a considerable plot of ground planted with these trees under "high cultivation."

12. Feeling desirous of some corroboration of my results with this bark, I forwarded a small parcel of it to my friend and correspondent, Mr. J. E. Howard, of Stratford. I am glad to learn from him that the numbers he obtained in the analyses he was kind enough to undertake, closely coincide with mine. He says that the kind appears to him to be *sui generis*, and unlike any he has in his possession. He obtained ten per cent. of crystalline sulphates, the greater part of which he found to be quinine. He hopes to be able to trace its affinities with the help of Mr. Cross, who brought over the seeds among those of the Crown barks.

13. As a matter of personal opinion, I have long felt much doubt of the expediency of the haste with which the whole amount of land that is intended to be devoted to Chinchona cultivation is being planted out. Such rapidity will, I fear, leave little scope for the improvements that must eventually follow from the systematic study of the plants, and their products. The benefit that would accrue by applying the results of a fuller experience to the future extension of the plantations will have little chance of being felt, if all the work be now done in the light of our present knowledge. The energy which has covered large tracts of land with Chinchona trees and shrubs, has placed the undertaking beyond risk; sufficient has been planted for all present use, and it appears to me to be unwise to limit the future to our present measure of success by leaving so little room for future extension.

14. The above opinion, which I have ventured to express, seems also to be corroborated by some collateral considerations. It is proposed to plant, during the forthcoming season, two lacs of plants of *C. Succirubra*. This tree possesses several advantages, is of quick growth, and produces bark of good yield; but is not by any means, nor will be, the best species possible. The million and a quarter trees we already possess should, I think, be enough of it. Moreover, *C. Succirubra* appears to succeed well in most places where it could rationally be tried. Private plantations here are filled with it. It succeeds well in Wynaad, Coorg, the Himalayas, Travancore, Ceylon, and other parts of India. Great hopes are anticipated of the success of the Jamaica plantations of red bark, and private plantations of the same are succeeding well on the slopes and crests of the Organ mountains in Brazil. It has also been introduced into Madeira and Algeria. From these facts it appears worth considering, whether it be desirable to have so large a quantity planted by Government, especially when it is recollected that there are other species which have a still higher reputation in Europe. The true *C. Calisaya*, hitherto the most esteemed of all the Chinchonas, is in our possession, and the seeds of the valuable *C. Pitayensis* have been received from South America. Both have yet to be fairly tried.* Would it not be well to see how these and other matters turn out before the whole amount of land is planted?

* Though the trees of *C. Calisaya* are small, I have been able to obtain bark for analysis, grown on the Neddivuttum plantations. The trees were two years old. The per-centages of alkaloid in the dry bark were:—

Total alkaloids	- - - - -	3.66
Quinine	- - - - -	1.38
Chinchonidine and Cinchonine	- - - - -	2.28
Total sulphates obtained crystallised	- - - - -	2.72
Sulphate of quinine obtained	- - - - -	1.22
Sulphate of Chinchonidine obtained	- - - - -	1.50

The results from so young a tree are promising; but as there appear to be very many sub-varieties of the species, it would be unsafe to generalise from a single analysis. The bark was undoubtedly that of the true *Calisaya*. In this instance there seems to be the tendency to produce Chinchonidine, which marks most of our Indian barks.

— No. 55. —

From the Secretary of State for India to the Government of Madras.

India Office, 27 September 1869.

I HAVE received and considered in Council your Excellency's Despatch, dated July 27th 1869, forwarding Mr. Broughton's report on the discovery of a very valuable variety of the Chinchona plant, raised from seeds collected in the Loxa district, which yields a larger per-centage of quinine than any other kind that has hitherto been analysed.

Mr. Broughton's very important discovery shows the great value of the services of an intelligent chemist residing on the spot, with opportunities of watching the habit of the plants, the barks of which it is his duty to analyse. I perceive that your Government concurs in Mr. Broughton's opinion that a sufficient number of acres has now been planted with the *C. succirubra*, and that the remaining area should be devoted to the careful cultivation of this precious Loxa species, and of the *C. Calisaya*, and varieties of *C. Pitayensis* recently obtained from New Granada. I presume, therefore, that immediate action will be taken in this matter, and there is no reason why the area to be planted should not be slightly increased beyond the extent already sanctioned, if such a course is found to be desirable.

It might be useful if specimens of the parts of Mr. Broughton's valuable Loxa variety were accessible in this country, and indeed it is desirable that a complete series of the different parts of all the Chinchona species grown on the Neilgherries should be preserved in this office.

I have to request, therefore, that Mr. McIvor may be directed to dry specimens of the leaves, flowers, fruit, and bark of each species and variety of Chinchona, and that the collection may be forwarded to me.

— No. 56. —

From the Madras Government to the Secretary of State for India.

Madras, 10 August 1869.

WITH reference to paragraph 5 of Sir Stafford Northcote's Despatch, dated 16th April 1867, and to paragraph 2 of our Despatch, dated 8th June 1869, we have the honour to forward, for your Grace's information, the accompanying report from the officiating conservator of forests on the cultivation of Chinchona on the Nulla Mallay Hills in the Kurnool District, together with our proceedings thereon, dated 3rd August 1869, No. 2,240.

2. It will be perceived that the experiment, after two years' trial, has proved a failure, and that, as suggested by Major Beddome, we have ordered its discontinuance.

Enclosure in No. 56.

From the Officiating Conservator of Forests to the Acting Secretary to Government,
Revenue Department, Fort St. George, Calicut, 28th June 1869.

WITH reference to the Order of Government of the 4th instant, I have the honour to report as follows:

2. At the suggestion of the collector of Kurnool, and on the recommendation of the Board of Revenue, a case containing 56 young plants of *Chinchona Succirubra* was forwarded from Ootacamund to our department at Nundyal, for trial on the Nulla Mullays. The ground previously selected was in a moist locality, with a rich deep soil, at an elevation of 3,000* feet, with a north-east exposure. Two only of the plants died during transport, but sixteen were sickly when the case was opened; the plantation was fenced in and the plants carefully watered, according to Mr. McIvor's instructions; in December of the same year 32 out of the number were well established and healthy; these grew well till the hot weather set in, but then they began to droop, and they all died before the rain commenced in June. In September 1867, at Dr. Cleghorn's suggestion, the experiment received a further trial; Mr. Sheffield, who was at Ootacamund on leave, took a case back with him containing 56 well-rooted vigorous plants. These were planted out in the same locality, 10 or 12 only being lost during transmission or when transplanted, the remainder well established themselves before the hot season, but their ultimate fate was the same as those of the previous year; they were very carefully shaded and looked after as the hot weather set in, but they soon began to droop, and eventually all died off.

3. I never expected that *Chinchona* cultivation would answer on these hills; the climate is far too dry, and they are exposed to hot winds for two or three months in the year; it is very doubtful if even with the greatest care individual plants could be saved through the hot weather without glass, so the experiment should, I think, be dropped.

4. I may here mention how admirably the plant succeeds all over Wynaad; it has been planted experimentally at Goodalore, at Manontoddy, and on many coffee estates in different parts; all the trees show splendid growth and are very healthy, and appear to require no attention.

ORDER of Madras Government, 3rd August 1869.

UNDER the circumstances brought to notice, the experimental cultivation of *Chinchona* on the Nulla Mullays should, as suggested by the Officiating Conservator of Forests, be dropped.

2. The foregoing letter with these proceedings will be communicated to the Home Government, with reference to the Despatch from that Government, marginally noted; also to the Board of Revenue, and, through the Commissioner of the Neilgherry Hills, to Mr. McIvor.

(signed) *R. A. Dalryell*,
Acting Secretary to Government.

— No. 57. —

From the Government of Madras to the Secretary of State for India.

Madras, 24 August 1869.

WE have the honour to forward, for your Grace's information, the accompanying report from Mr. McIvor on the Government *Chinchona* Plantations and botanical gardens on the Neilgherries for the year 1868-69, together with our proceedings thereon, dated 5th August 1869.

2. This report is in most respects quite as satisfactory as those which have preceded it.

* The highest peak of these hills is only 3,300.

Enclosure, in No. 57.

REPORT on the Government Chinchona Plantations and Botanical Gardens, Ootacamund, Neilgherry Hills, for the Official Year 1868-69.

IN submitting this report, it affords me much satisfaction to be able to state that during the past year considerable progress has been made. The year has been favourable for planting operations, the rains of both monsoons having been more copious than usual, and more regularly distributed; consequently we have had less than our average of failures of young plants during the dry weather.

2. The heavy preparatory works on Neddiwuttum, Dodabetta, Hooker, Wood, and Napier plantations are so far advanced as to lead me to hope I may be able, during the ensuing monsoon, to finish the whole of the land sanctioned, viz., 1,200 acres.

3. The average monthly increase by propagation throughout the year is 19,703, against 48,267, the result of last year.

4. Private planters now grow their own plants from seeds supplied gratuitously from this establishment, and consequently the sale of Chinchona plants has ceased. Our propagating operations are therefore limited to the supply of our own requirements, and the production of plants for gratuitous distribution for public purposes. On the 31st March 1868, there were 740,912 plants permanently planted out; at the same date this year, the number was 894,057, which gives 153,145, the total of plants put out during the year.

5. The first plants, planted out in August 1862, have attained heights varying from 21 feet to 24 feet, the circumference of the stems, at one foot above the ground, varying from one foot nine inches to two feet six inches. The largest plants of 1862 were cut down in 1867, and their bark sent to the European market. The Chinchonas planted in 1862, 1863, and 1864, especially the red bark species, have now fairly assumed a tree-like character, and all the species planted in these years are now producing abundance of excellent seeds, for which we have a large demand from almost every part of the world.

6. The analysis of the last bark sent to Mr. Howard shows a steady increasing yield of alkaloid, while the lanceolate-leaved variety of *C. Officinalis* has been found by Mr. Broughton, the Government quinologist, to yield the extraordinary amount of 9.75 per cent. of quinine. One of the plants of this species having this season produced seed, I am propagating this kind by both seeds and cuttings.

7. In order to facilitate reference, I have arranged the details of this report under the following heads:—

- I. Propagation.
- II. Condition and Growth of Plants.
- III. Cultivation.
- IV. Cultivation results obtained by private planters.
- V. Formation of Alkaloids.
- VI. Chinchona, New Species and Varieties introduced, remarks on.
- VII. Progress of Operations.
- VIII. Establishments.
- IX. Convict Labour.
- X. Botanical Gardens.
- XI. European Fresh-water Fish, their Introduction and Propagation.
- XII. Tea Plantation.
- XIII. Concluding Remarks.
- XIV. Appendix A., Accounts from the Commencement to 31st March 1869.
- XV. Meteorological Observations at Neddiwuttum.
- XVI. Meteorological Observations at Ootacamund.

8.—I. Propagation.—The stock of plants is maintained by seedlings, except *C. lancefolia* and the lanceolate-leaved variety of *C. Officinalis*, which are propagated by cuttings, as the seeds

seeds produced by these are insufficient for our requirements. The system adopted in rearing from seeds or cuttings is that fully described in my "Notes on the Propagation and Cultivation of the Medicinal Chinchonas." The seeds are found to germinate readily, and their management is well understood by our native gardeners. Our seed crop of this season is very large, several of the more valuable varieties of calisaya having for the first time produced seeds.

9.—II. Condition and Growth of Plants.—The growth of the red and grey barks continues to be more luxuriant than any of the other species. That of the crown barks is the next; and the calisaya, or yellow bark, may rank as third. In point of hardiness and ability to stand the violence of storms, the crown barks rank first; the red bark second; the grey barks third; and the yellow barks fourth. The *C. Succirubra* still continues to succeed best at elevations of from 5,000 to 6,000 feet, where the plant obtains the greatest vigour and luxuriance of growth. Seven thousand feet is found to be too high for this species; although the plants thrive at this elevation, the growth is too slow to be profitable. From the seeds of the three original varieties of crown bark, received in 1863, we have raised at least seven distinct varieties, and one of these, named the "lanceolate-leaved officinalis," has proved to be the most valuable of all the known species. From the seeds of the red bark, received from South America in 1862, we have raised three distinct varieties or species, one of these being apparently the *C. Orata*; thus it is apparent that the various species of Chinchonas, when raised from seeds, are liable to "sport," or not to come true to their kinds, and I fear this will prove to be the case with our valuable lanceolate-leaved officinalis; therefore, to obtain this valuable variety perfectly true, I have resolved to propagate it by cuttings to the greatest extent possible. Last season we had two storms of short duration; the plants suffered but little in consequence, even in exposed situations. The grey barks will not bear heavy storms, and they are consequently now planted only in the sheltered valleys. This remark applies also to the different varieties of yellow bark, with the exception of the species named *C. Josephinea*, which will bear exposure almost as well as any of the species of crown barks.

10.—III. Cultivation.—A further extent of grass land has been planted during the past year with *C. Officinalis* and *C. Succirubra*. About an acre of land has also been planted with *C. Lancefolia* and *C. Calisaya* at only three feet apart, in order to ascertain what effect close planting has upon the bark in consequence of the denseness of the shade produced. This season an acre of land will be planted with *C. Officinalis* at three feet apart, in order to attest the effect of this process still further. I would notice, however, that in the early part of 1867 I observed in the shaded valleys planted with red bark, that the yield of alkaloid was on an average somewhat greater than bark produced in more open places. This I subsequently pointed out to Mr. Broughton, whose observations appear to confirm the above conclusion. I believe full exposure is essential for the health of the plants, and that when planted close the strong-growing will overtop and injure the weaker; this will naturally place a limit to the amount of shade we can give to the bark by close planting. The weather during the past year has been very favourable for our operations; the rains of the monsoons have been heavier than usual, and regularly distributed throughout; consequently the plants have made very satisfactory growth. The frost was late, not setting in until December; and being less severe than usual the plants were not injured. After the plants attain a height of from two to three feet they are not liable to injury from frost, as it only freezes close to the ground.

11.—IV. Cultivation, Results Obtained by Private Planters.—Chinchona cultivation, as a private speculation, has, in common with all cultivation in this district, received a decided check. The value of estates has greatly fallen in the market; in fact, they have become almost unsaleable, and therefore operations have been limited. Among the plantations which are still maintained, may be mentioned those of Mr. Money, Colonel and Mr. James Morgan, Dr. Colvin Smith, Captain Jennings, Mr. R. F. Phillips, and Colonel Fyers. A large number of seeds have been distributed to planters here and in the Himalayas, from whom I continue to receive favourable reports.

12. A number of well-established plants and seeds were given to Captain Seaton, who conveyed them safely to Burmah, and the cultivation in that country is now progressing favourably. A number of both seeds and plants was also forwarded to the Superintendent of the Ashtagram Division of Mysore for cultivation in the more elevated tracts. In the Wynaad District the cultivation has not made such rapid strides as was anticipated.

13.—V. Formation of alkaloids.—In addition to the various experiments made by Mr. Broughton on the formation of alkaloids in our Neilgherry barks, at foot* is given, in detail, an analysis by Mr. Howard, with observations by Dr. de Vrij on the eighth remittance of bark

* REPORT of an Analysis of the Eighth Remittance of Bark from India, by Mr. J. E. Howard, F.L.S.
To the Under Secretary of State for India.

Sir,
I HAVE to report on specimens of bark collected in March of the present year, and sent to me for analysis, as follows:—
No. 1. *C. Succirubra*, being "the third harvest of renewed bark," is most interesting, as it showed more
432. D D 2 completely

1 September 1868.

bark from the Neilgherries. The result is highly interesting as showing a steady increase in the yield of alkaloids. The following shows the progressive yield of alkaloids in red bark produced on the Neilgherries; the results are those obtained by Mr. Howard from red bark: in 1863 the yield was 3.40 per cent.; in 1864, 6 per cent.; in 1865, 8 per cent.; in 1867, 9.79 per cent.; in 1868, 11.74. But the most extraordinary yield of quinine has been obtained by Mr. Broughton from the lanceolate-leaved variety of the *C. Officinalis*. The bark of this variety gave 11.40 per cent. of alkaloid; total sulphates crystallised 10.51; quinine, 9.75; chinchonidine, &c., 1.65 per cent. The yield of quinine from this species is very large, and the facility with which it is separated from the bark is peculiar to this variety.

14.—VI. New Species and Varieties of Chinchonas introduced.—The very valuable variety of *C. Calisaya*, received from Mr. J. E. Howard, brought to India by me in the autumn

completely than any sent hitherto the aspect of red bark from South America, and has, in all respects, a superior appearance. In examining it chemically I found that it presented also more exactly the counterpart of that composition which I have described as being commonly observed in the analysis of the older barks of this species. I hoped to obtain a larger produce than last time, but was disappointed in finding a smaller amount of salts of quinine, viz., 6.15 per cent. against 8.45 per cent. in the specimen of renewed bark from the same tree on which I had the honour to report in February 1867.

The above figures give the relative commercial value of the two specimens; but as I thought it desirable to obtain all the information in my power, I endeavoured, in two experiments, with a sufficient quantity of bark ($\frac{1}{2}$ lb.) in each, to arrive at the most correct results; from the first I obtained quinine as alkaloid, capable of being formed into, and equivalent to 5.33 per cent. of sulphate of quinine; from the second, by a process somewhat varied, I obtained, in crystallizations of refined oxalate, 4.80 per cent., and remaining in the liquor as more soluble (in part, perhaps, oxalate of chinchonidine) 0.60, together 5.40 per cent. oxalate of quinine. In both cases there was an inevitable loss through the product being more exactly purified; and therefore this must be borne in mind in comparing these figures with those previously given; but even at this lowest or minimum scale of production, the results are really surprisingly good, though not equal to the hopes entertained by Mr. Melvor.

The explanation of a smaller produce of sulphate of quinine appears to me to be found in the idiosyncrasy of this particular species, which I have described, to the best of my power, in my "Illustrations of the Nueva Quinologia," sub-voce *C. Succirubra*.

I am pleased to find that Mr. Broughton, in his first report, corroborates what I have said as to the difficulty of obtaining the alkaloids in a pure state from this species—a difficulty which increases in the age of the tree. On this account I must again urge the necessity of carefully ascertaining what species are likely to yield the best permanent results.

The precipitated hydrated alkaloids, in a subsequent examination of a small portion of the present bark against a re-examination of a portion remaining from the second harvest, gave me for the second harvest of renewed bark—

Alkaloids dried at the temperature of the air	-	-	-	-	10.60
Of which soluble in ether, quinine, &c.	-	-	-	-	8.70
„ insoluble in ether, chinchonine, &c.	-	-	-	-	1.90

For the third or present harvest of renewed bark—

Alkaloids dried at the temperature of the air	-	-	-	-	11.20
Of which soluble in ether, quinine, &c.	-	-	-	-	9.40
„ insoluble in ether, chinchonine, &c.	-	-	-	-	1.80

It will be seen that the proportion of alkaloid has increased; but this would be no guide to the commercial value, which is almost entirely regulated by the proportion capable of being converted into crystallised salts. More valuable commercial information consequently will be gained from the following corrected analysis:—

Quinine (as sulphate)	-	-	-	-	5.33
„ uncrystallizable	-	-	-	-	2.00
				(?)	7.33
Chinchonidine	-	-	-	-	1.14
Chinchonicine	-	-	-	-	0.53
					9.00

I have attached a (?) to the weight of the proportion of uncrystallizable quinine, which it was impossible to ascertain exactly from so small a quantity of bark. Moreover, from its great implication with resinous colouring matter, I am led to doubt the possibility of obtaining any part of it as crystallized sulphate of quinine on a large scale. This uncrystallizable portion is therefore unimportant, and not to be reckoned, from a commercial point of view, as possessing any value to the purchaser of such bark for manufacturing purposes.*

The analysis of No. 2, "root-bark from a tree of *C. Succirubra*, seven years old," presented much interest, as bearing on the question as to which of several modes of cultivation is to be preferred, since it has recently been proposed to cultivate the plant, like madder, solely for the roots.

I consequently have forwarded about half the sample of No. 2 and also No. 3 (of which a very small quantity was sent from India) to Dr. de Vrij, as it was desirable thus to arrive at a consentaneous agreement on the value of the root-bark, which I have always regarded unfavourably, judging from the root-bark of the *C. Calisaya* var. *Josephiana*, occasionally found in the market. The analysis was troublesome, although

* The weight of the crystallizable and consequently more valuable portion was ascertained by the following process:—The 6.15 per cent. (as above) having been precipitated, the precipitate was dissolved in ether, separating thus the chinchonidine and the quinine, then dried at 212° F. It must be understood that quinine thus obtained from the *C. Succirubra*, although sufficiently pure to pass the tests required in commerce, retains some chinchonidine, which can be separated by solution in acid, and subsequent treatment with iodide of potassium.

autumn of 1867, is now growing freely, and promises to be one of the most robust of the yellow barks. It has been considerably increased by propagation.

15. A few seeds of three varieties Pitayo barks (*C. Pitayoenses*) have this year been received from Mr. Cross, who is at present on the Andes; these seeds arrived in bad condition, and I regret to say have not germinated freely. I have, however, with much care raised of *C. Pitayoenses* No. 4, five plants; of *C. Pitayoenses* No. 3, four plants; of No. 2, one plant; and one of No. 1. We have now succeeded in obtaining every species of Chinchona of known value, and should we not receive any more seeds, the plants being once secured, they can be increased by cuttings to any number required.

16.—VII. Progress

although the hydrated alkaloids were obtained in a state more free than often from colouring matter. The weight of the precipitated alkaloids appeared to be 12·75 per cent.; but this hopeful amount did not yield proportionate results, probably from an amount of wax and resin being carried down with the alkaloids. I obtained with difficulty a small crystallization of sulphate of quinine, and the remaining liquor when precipitated dissolved in ether, and the solution, left to concentrate by evaporation, furnished crystals of chinchonidine adhering to the sides of the vessel, and at last uncrystallizable quinine containing a portion of quinidine. The remarkable feature was the large production of fine chinchonine, quite insoluble in ether, yielding good crystals from spirit of wine; and these, when formed into sulphate, giving the very characteristic salt. In all this, the root-bark is decidedly superior; but it will be observed, it is chinchonine and not quinine that (at all events in this species) is the product of this root-bark. I give the total as follows:—

Quinine (as sulphate)	-	-	-	-	-	1·75
„ uncrystallizable	-	-	-	-	-	4·60
					(?)	6·25
Chinchonine	-	-	-	-	-	3·00
Chinchonicine, water and gum-resin	-	-	-	-	-	3·50
						12·75

This root-bark would not be of more value than that mentioned above (of the *C. Josephiana*) unless it were wanted for the extraction of chinchonine.

- No. 3. I shall transmit the report of the analysis when I receive it from Dr. de Vrij.
- No. 4. Consists of four pieces of fine-looking crown bark, apparently not intended for chemical analysis.
- Nos. 5, 6, and 7 are interesting to me, and will, I hope, furnish some facts for a work which I am publishing, “On the Quinology of the East Indian Plantations.” They appear to be intended rather for microscopical examination than for chemical analysis. The seeds of No. 7 have been sent to Kew.

I beg, &c.
(signed) J. E. Howard.

(Supplement.)

(Copy of a Letter from Dr. De Vrij to J. E. Howard, Esq., containing Anaysis of No. 2 Root-bark.

The Hague, 30 August 1868.

The sample of No. 2, *C. Succirubra*, root-bark from a tree, seven years old, with your letter of the 21st instant, duly reached me, and immediately I have set at work to analyse this bark which was very welcome to me, particularly because now you have the opportunity to judge by yourself of the richness of the root-bark, at least of the cultivated Chinchonas.

I found in the bark 11½ per cent. of alkaloids, and 0·467 per cent. of Chinchona bitter (kinovice acid). The part of the alkaloids soluble in ether amounts to 4·31 per cent. of the bark. Although these 4·31 per cent. are soluble in ether, they do not entirely consist of quinine (crystallizable), but contain another alkaloid also soluble in ether. As you expressed your wish to obtain the results of my experiments within about 10 days, I have not been able to ascertain with certainty which is this alkaloid which accompanies the crystallizable quinine in its ethereal solution. I suspect it is the amorphus alkaloid, which I always find in the Indian barks; but am not yet quite sure of it. I obtained beautiful herapathite from the part of the alkaloids dissolved by ether, so that there is no doubt that this root-bark contains really crystallizable quinine. In treating the total amount of alkaloid with ether, I had some reason to expect to obtain also chinchonidine. In this I was, however, frustrated, for I could not find till now with certainty its presence. At this moment that I write this letter my result is that the mentioned bark is rich in alkaloids, of which the part insoluble in ether consists chiefly of chinchonine. If chinchonidine is perhaps also present, it can only be a very small quantity, not to be compared with the large quantity which I obtained from the stem bark of *C. Succirubra*.

(Copy of a Letter from Dr. De Vrij to J. E. Howard, Esq., containing Analysis of No. 3 Root-bark. •

18 September 1868.

Together with your valued letter of September 3, I received the No. 3 of root-bark from *C. Succirubra*. As the amount of the powdered bark dried at 212° F. was only 19·5 grammes, I divided this quantity into two parts, viz. one of 10 grammes. From the first I obtained 1·202 grammes, and from the second 1·088 grammes of alkaloids. The average per-centage of alkaloids in this red bark is therefore 11·743 per cent., whilst

16.—VII. Progress of Operations.—At Neddiwuttum additional hospital accomodation had to be erected, and also a cottage for the European constable in charge of the police guard. No extension of buildings has been necessary in the propagating department, nor on the Dodabetta Plantations. On the Neddiwuttum Plantations (namely, the 1st and 2nd Denison, the Wood, Hooker, and Napier), 75 acres have been planted, making total extent under cultivation 601 acres. Extension has taken place principally upon the Napier. On this plantation 150,000 pits have also been prepared for planting; the roads and drains completed, and an enclosure trenched around the greater part of the plantation. On the Wood Estate at Pycara no additional land has been planted. On the Dodabetta Plantation 60 acres have been planted, making a total on this plantation of 413 acres under cultivation. On the Malakoondah Plantation 15 acres have been planted, making the total extent of land planted 40 acres. The new road to the plantation has been traced and cut out to a bridle-path to the valley of Keerapadah, or nearly two-thirds of the entire distance; but it has not been bridged, and much yet remains to be done to render it available for the plantation. The total extent of land planted in all the plantations is as follows:

On the Dodabetta Plantation	-	-	-	-	acres	413
„ Neddiwuttum	-	-	-	-	„	601
„ Wood Estate, Pycara	-	-	-	-	„	128
„ Malakoondah	-	-	-	-	„	40
• Total						1,182

17.—VIII. Establishments.—It affords me much satisfaction to be able to report the willing co-operation and the zeal with which my assistants have carried out the operations entrusted to them. The department has lost the valuable services of Mr. Batcock, the deputy superintendent, who returned to Europe in August last year. His successor, Mr. Jamieson, arrived in December last. Mr. Charles Dawson, the assistant superintendent at Neddiwuttum, has carried out the works on this plantation, as also on the Hooker and Wood Plantations, assisted by Mr. Sherman and Mr. McDonald. Mr. DeFacien, the assistant superintendent on the Dodabetta Plantations, vacated his appointment for more remunerative employ, and has been replaced by Mr. Rowson. In the office establishment, T. Narrainsawmy Naidoo, Mr. McNair, and Mr. Bennett, have performed their duties with great credit. Mr. Burrows, the storekeeper, has also conducted himself entirely to my satisfaction.

18.—IX. Convict Labour.—The employment of convict labour on our plantation was discontinued on the 31st March, in consequence of the difficulty experienced in arranging them so as to suit the convenience of the police-guards, and at the same time perform a fair quantity of work. The convicts have done well for the plantations, and without them we could not have made the same progress at like cost. On the Dodabetta plantations the conduct of the prisoners has been excellent; they worked cheerfully and willingly. There was less sickness among the men than in any other jail in the Presidency. There was only one death during the whole time the jail was established. The conduct of the Chinese convicts was also very good. The Chinese disliked a native police-guard being placed over them, and consequently I worked these men under the care of one warder. From this jail we have never had any escape, nor an attempt to escape. At Neddiwuttum, the health of the convicts has not been so good as Dodabetta. Here also the men have worked well and cheerfully, especially the Chinese.

19.—X. Botanical Gardens.—During the past year considerable progress has been made in laying out the new botanical portion of the gardens. The ground has been trenched and prepared

whilst the amount of kinovic acid is 0.676 per cent. The combined amount of the obtained alkaloids, viz. 2.29 grammes, was dissolved in dilute acetic acid, and which treatment only an imponderable trace of dark brown resinous matter remained undissolved. As the acetic solution proved to contain no quinidine, it was shaken with caustic, soda, and ether. The following day the ethereal solution, which was lemon-coloured, was evaporated, and the residue dried at 212° F. Its amount was 0.981 grammes. This root-bark contains therefore 4.774 per cent. of alkaloid soluble in ether. I obtained from these 0.981 grammes beautiful herepathite, but found, in the meantime, that the largest part of this alkaloid soluble in ether is not quinine, but an amorphous alkaloid. The remaining alkaloids, which were not dissolved by ether, proved to be chinchonine, with only a trace of chinchonidine. In this root, like in the former, I found the chinchonine particularly fit to crystallize, and consequently I obtained beautiful sulphate of chinchonine from it.

J. E. Howard, Esq., to C. R. Martham, Esq.

For the guidance of the Indian Government I send the foregoing interesting and well-executed analysis, and add that it accords most nearly with the previous analyses by Dr. de Vrij and myself of (No. 2) root bark of larger size, but of the same parcel, and that these specimens of root-bark would command but a low price in the London market from the causes before stated. I do not think the root-bark of this species would repay cultivation.

prepared for planting out the enconomic plants, which will form the most interesting and instructive part of the garden. A few of the leading natural orders have already been planted out, and are making satisfactory growth. Of enconomic plants recently introduced, and which thrive well in this climate, may be mentioned the commercial Jalap, the Scammony, the Rice, paper plant of China, the New Zealand Flax, the true Olive; the Quinooa has also been successfully grown and proved to be in this climate one of the most productive grains on these hills; consequently a supply of seeds has been forwarded to the Commissioner for distribution among the native cultivators. From Captain Seaton, the Assistant Conservator of Forests, Burmah, I received a supply of seeds of the dry paddy grown at high elevations on the hills of that country, and a portion of these seeds were also forwarded to the Commissioner for trial in this district. We have now increased by propagation our stock of Ipecacuanah plants to thirteen; but their growth is not satisfactory, this climate being too dry and cold. The famous Cowdir pine of New Zealand continues to thrive well, as also the other species of *Damara*, and the famous *Aracarius Cryptomerins*, these forming perhaps the finest pines in the world; and our garden nurseries are at present stocked with thousands of young plants, which, when grown and planted over the plateau of the Neilgherries, will entirely alter the features of the scenery. To Colonel Denison and Major Beddome we are indebted for seeds of the famous *Wellingtonia Gigantea*. This beautiful tree promises to succeed well on these hills. From the Royal Gardens at Kew, we have received (through Major Beddome) a valuable collection of oaks, beech, ash, chesnut, &c., as well as seeds of various species of pines; and from Major Beddome a large collection of Australian and Himalayan seeds. From Mr. E. B. Thomas, the late collector of this district, seeds of several European trees and shrubs; as, the olive, hop, gooseberry, currants, filberts, walnuts, &c., &c.; and from Colonel Denison several new and rare ferns and orchids. The very valuable and handsome Japanese *Osmanthus*, the beautiful *Retinasporus Thuijopsis*, *Padocarpus*, *Arolia*s, &c., continue to do well. Among the new introductions which promise to be of great value, may be mentioned the *Fitzroya Patagonica*, a new and handsome coniferous tree, a native of Patagonia, resembling much in manner of growth and foliage the European larch. It grows best on elevated situations, and attains a height of from 50 to 80 feet, and yields a valuable timber. The *Sciadopitys Verticillata* (umbrella pine of Japan) is unquestionably the finest, most distinct and desirable of recently introduced Conifera; it grows on elevated and exposed situations, and attains the height of 60 or 80 feet. *Retinospora Obtusa* and its varieties are also very handsome new plants from Japan. The wood of *R. Obtusa* is used in that country for every purpose that timber is applied to, and from its rapidity of growth and striking appearance, it seems likely soon to become a general favourite in India. These and other new Japanese plants, such as *Acubas*, *Aralias*, &c., have been propagated extensively, and will be planted out largely this season. The following table exhibits the distribution of garden plants and seeds for 1868-69:—

				Fruit Trees.	Timber Trees.	Flowers and Shrubs.	Packets of Seeds.	Amount.		
								RS.	A.	P.
April	1868	-	-	-	-	84	133	41	7	-
May	"	-	-	4	263	362	185	227	6	-
June	"	-	-	-	132	324	195	157	5	-
July	"	-	-	72	66	100	160	122	6	-
August	"	-	-	-	-	452	178	213	12	1
September	"	-	-	-	65	331	140	166	12	6
October	"	-	-	-	3	135	189	69	2	-
November	"	-	-	56	-	69	159	89	12	-
December	"	-	-	-	-	47	80	26	1	-
January	1869	-	-	-	-	32	45	23	2	-
February	"	-	-	-	16	-	36	20	4	-
March	"	-	-	-	-	57	87	28	8	-
Total distribution				132	545	1,993	1,537	1,185	13	7

20.—XI. European Fresh-water Fish, their Introduction and Propagation.—The experiment of acclimatising and breeding European fish has now been going on in the gardens for a period of eighteen months, and with distinguished success. The trout have spawned, and we have at present from 200 to 300 fry, one to two inches in length; about the same number of young tench; three dozens young rudd; while the parent fish have grown to a large size, and will shortly spawn a second time. The value of stocking the waters of these hills with fish is fully appreciated, as affording a new supply of food both for Europeans and Natives. The tench is perhaps one of the most valuable of all the species introduced, that is, when viewed in connection with its enormous fecundity and rapid growth, together with the delicacy and richness of its flesh.*

I would suggest that a few of the fry be now distributed to such parties as are willing to make proper arrangements for their reception. The produce of next spawning, after stocking the ponds in the gardens, may be placed in the Ooty lake.

21. As this is the first time that live fish have been conveyed to such a distance, a short account of the process adopted in preparing and transporting them, may prove interesting.

22. I collected the young trout-fry in July 1867, and had them kept in an aquarium till the date of my departure for India, to accustom them to the artificial condition to which they would be subjected during the voyage. When first placed in the aquarium, a rapid flow of water was allowed to pass through it; after 10 days this flow of water was gradually diminished; but, as many of the fry died, the flow of water was again increased, and continued for about six weeks, when it was again diminished with more favourable results. On leaving England, I selected 18 of the most healthy trout-fry to be conveyed to India. The other species of fish had not this preparatory process, and I believe this was a disadvantage. On the 3rd November 1867, I left Southampton, by the P. and O. steamer, with 18 lake trout-fry, 24 tench, 12 carp, 12 gudgeon, 12 rudd, 12 silver eels, and three goldfish (one male and two females). Of those I succeeded in bringing to the Neilgherries 15 trout, 10 carp, 24 tench, 12 rudd, 12 silver eels, and three goldfish. The gudgeon were all lost by an accident in the Red Sea; two trout were subsequently lost by leaping out of the tubs in which they were placed. One female goldfish died; nine of the eels escaped into the running stream, and have not since been seen; the remaining three eels were placed in a large pond in the gardens; and the other species of fish in a house, or rather inclosure covered with wire netting, specially prepared for their reception, by forming four ponds, with a stream of clear water running through them. Previous to my departure, I had the fry of each species placed separately in tin boxes, 15 x 10 inches, fitted with a small tap, so as to allow a flow of water to pass from one box into the other, as per sketch in the margin, Fig. I. The boxes should be placed in a wooden frame, so as to stand the one above the other, as at A., and above the fish boxes is placed a cistern, 20 x 10, and 12 inches deep, to receive the water for the supply of the fish boxes below. The wooden frame should be constructed so as either to be slung or stand on the deck. It is better, however, that it should be slung so as to swing to and fro with the motion of the ship. This can be effected by passing a rope through the iron loop C., and suspending the frame in some convenient place exposed to a breeze. The same arrangement should be adopted when conveyed by land in a railway carriage, or otherwise. Fig. II. is a longitudinal section of a fish box; A. being a small flange for the lid to rest on; B. the lid, made of perforated tin or zinc, so as to allow the air to act on the water when the lid is shut. The lid should never be shut, except in very stormy weather, and when there is a danger of the fish being thrown out of the boxes. In order to prevent all the water from being drawn off, the tap C. should be placed about the centre of the box. Fig. III. is a cross section; A. the flange, B. the lid, C. the tap. The boxes are prepared for the reception of the fish, by placing about half an inch well-washed gravel at the bottom; they are then filled three parts full of water, and in this is placed a few aquatic plants to float in the water. These plants give off a small portion of oxygen, and afford shelter to the fish. During the journey, the water should be changed in the boxes, and replaced in the cistern, three times in 24 hours, or once every eight hours, if possible. It is best to throw the fresh water into the boxes by means of a syringe, as in this way it catches the oxygen of the air in its descent. In addition to this the water, prior to being used, should be thoroughly aerated by forcing air through it by means of a bellows with a piece of elastic tubing (sufficient to reach the bottom of the water) attached to the end of the pipe. The smaller the fish-fry are, the safer they can be conveyed; but fish of considerable size could be conveyed with safety by increasing the size of the boxes in proportion, and thus placing at their disposal a greater quantity of water.

23.—XII. Tea Plantation.—This has not been extended beyond the number previously planted, viz., 13,500. The plants are making satisfactory growth, and have produced a few perfect

* Soyer, in the "Modern Housewife," at page 138, says, "Tench are considered by modern epicures to be one of the best of all fresh-water fish; they should be caught, killed, cleaned, and cooked almost directly; they may be kept alive in large buckets of water a few days, as also may Carp, feeding them with a few crumbs of bread."

Fig. 1.

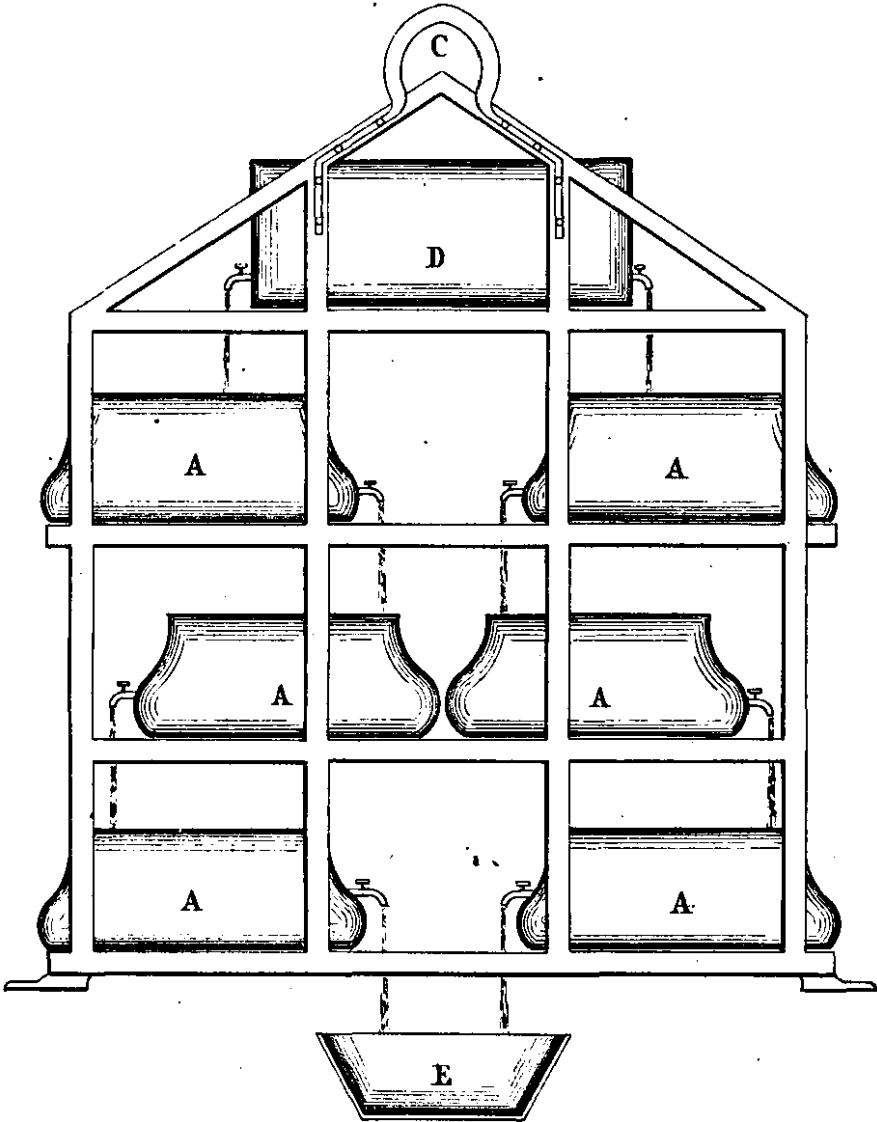


Fig. II.

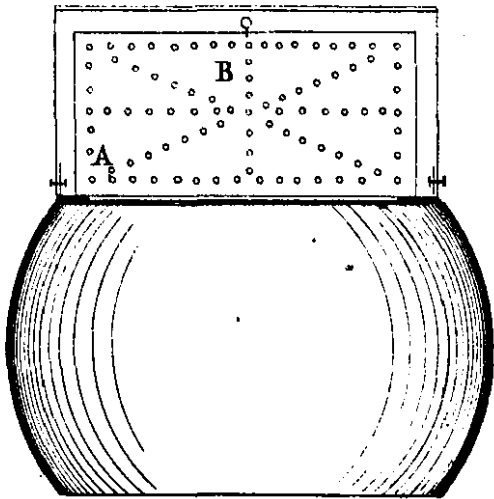
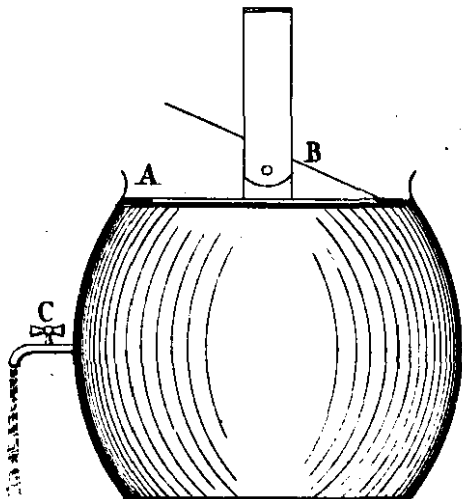


Fig. III.



perfect seeds; therefore, this year we may expect to gather our first harvest of tea seeds. During last year about 2,000 plants have been raised from cuttings from such kinds as by their habit promise to yield the greatest quantity of leaf. These cuttings are now ready for planting, and will be permanently planted out this season.

24.—XIII. Concluding Remarks.—The above details show that the progress attained in our medicinal Chinchonas has exceeded our utmost expectations. The plants continue the same luxurious growth, while the product of alkaloids has, from the commencement, been steadily increasing. The Botanical Gardens are now stocked with every plant of known value suitable to this climate.

25. In closing this report, I beg to tender my grateful acknowledgments to the Madras Government for the interest they have taken in the development of this national undertaking; to Mr. J. E. Howard for much valuable information in connection with the formation of alkaloids; and to Mr. Clements R. Markham, of the India Office, for a supply of the Pitayo bark seeds.

APPENDIX A. - - - - -

SANCTIONED ESTIMATE COST of each CHINCHONA PLANTATION

PARTICULARS.	Superintendent and Office Establishment.				Nursery Department.				Dodabettah Plantations.			
	1860 to 1866.	1866-7.	1867-8.	1868-9.	1861 to 1866.	1866-7.	1867-8.	1868-9.	1860 to 1866.	1866-7.	1867-8.	1868-9.
Establishment, including salaries, &c.	Rs. 34,378	Rs. 7,778	Rs. 8,804	Rs. 8,672	Rs. 20,234	Rs. 3,711	Rs. 4,684	Rs. 3,636	Rs. 29,418	Rs. 10,736	Rs. 8,044	Rs. 4,284
Buildings - - -	-	-	-	-	4,000	-	100	250	8,100	2,500	1,000	1,950
Tool and store-rooms -	-	-	-	-	-	-	-	-	500	200	100	50
Coolies' quarters - -	-	-	-	-	-	-	-	-	900	-	200	200
Felling - - - -	-	-	-	-	-	-	-	-	2,450	400	-	1,000
Clearing and weeding, &c.	-	-	-	-	-	-	-	-	2,330	300	1,000	3,000
Pitting - - - -	-	-	-	-	-	-	-	-	2,450	800	500	1,000
Carriage of plants - -	-	-	-	-	-	-	-	-	700	1,000	700	500
Planting and shading -	-	-	-	-	-	-	-	-	1,250	700	700	500
Trenching - - - -	-	-	-	-	-	-	-	-	2,900	308	-	100
Enclosing - - - -	-	-	-	-	756	-	-	-	6,400	500	-	150
Road making - - - -	-	-	-	-	-	-	-	-	2,825	-	-	250
Tools - - - -	-	-	-	-	-	400	200	200	2,525	1,000	200	300
Contingencies - - -	-	95	100	200	996	600	200	500	3,099	700	1,000	800
Clothing - - - -	-	-	-	100	-	100	30	50	-	150	100	100
TOTAL - - -	34,378	7,868	8,904	8,972	25,986	4,811	5,214	4,636	65,907	19,294	14,144	14,184

ACTUAL EXPENDITURE on each CHINCHONA PLANTATION

PARTICULARS.	Superintendent and Office Establishment.				Propagation and Nursery Department.				Dodabettah Plantations.			
	1860 to 1866.	1866-7.	1867-8.	1868-9.	1861 to 1866.	1866-7.	1867-8.	1868-9.	1860 to 1866.	1866-7.	1867-8.	1868-9.
Establishment, including salaries, &c.	Rs. 32,354	Rs. 7,715	Rs. 8,116	Rs. 8,499	Rs. 16,810	Rs. 6,536	Rs. 6,832	Rs. 3,152	Rs. 18,678	Rs. 6,405	Rs. 6,369	Rs. 4,355
Buildings - - -	-	-	-	-	10,725	1,504	660	280	12,615	3,023	3,209	767
Tool and store-rooms -	-	-	-	-	-	-	-	-	430	-	200	-
Coolies' quarters - -	-	-	-	-	-	-	-	-	1,058	-	350	137
Felling - - - -	-	-	-	-	-	-	-	-	3,050	257	-	361
Clearing and weeding, &c. -	-	-	-	-	-	-	-	-	3,500	78	1,160	4,300
Pitting - - - -	-	-	-	-	-	-	-	-	5,108	384	1,011	2,507
Carriage of Plants - -	-	-	-	-	-	-	-	-	1,535	250	1,330	140
Planting and shading -	-	-	-	-	-	-	-	-	4,065	621	1,163	360
Trenching - - - -	-	-	-	-	-	-	-	-	2,600	800	289	70
Enclosing - - - -	-	-	-	-	-	-	548	-	4,357	350	590	40
Road making - - - -	-	-	-	-	-	-	-	-	5,670	625	644	120
Tools - - - -	-	-	-	-	170	-	70	204	2,754	450	350	1,280
Contingencies - - -	250	-	-	222	1,150	883	170	320	3,461	616	989	280
Excavating - - - -	-	-	-	-	-	-	-	-	-	450	644	-
Clothing - - - -	-	-	-	64	-	-	54	75	-	-	120	80
Various - - - -	-	-	-	-	-	-	-	352	-	-	1,900	310
TOTAL - - -	32,604	7,715	8,116	8,785	26,855	8,423	8,334	4,383	69,781	14,309	20,329	15,167

APPENDIX A.

from Commencement of Operations to 31st March 1869.

Neddiwuttum Plantations.				Pycara Plantations.				Malkoondah Plantations.				TOTAL.
1861 to 1866.	1866-7.	1867-8.	1868-9.	1862 to 1866.	1866-7.	1867-8.	1868-9.	1863 to 1866.	1866-7.	1867-8.	1868-9.	
Rs. 57,444	Rs. 12,356	Rs. 17,120	Rs. 4,872	Rs. 17,611	Rs. 2,860	Rs. 3,036	Rs. 1,440	Rs. 8,720	Rs. 4,225	Rs. 4,376	Rs. 1,320	Rs. 280,254
11,330	3,300	2,500	2,000	3,530	-	-	400	3,250	1,075	200	400	46,545
650	-	250	100	975	-	200	100	275	400	100	50	3,950
2,700	300	200	300	1,200	100	150	100	750	200	-	70	7,370
6,900	800	-	1,500	3,150	800	500	1,500	7,050	900	300	1,000	28,250
6,900	650	1,500	4,000	3,150	500	500	3,000	900	800	100	2,000	30,630
7,900	400	500	2,000	1,900	700	500	1,000	900	800	300	1,000	22,650
2,200	1,000	1,000	500	800	200	150	500	50	300	100	200	9,900
2,350	900	1,000	500	2,000	500	150	500	-	100	100	200	11,450
6,000	-	-	200	9,950	-	-	100	1,250	542	-	50	21,400
5,250	600	-	300	1,300	200	-	200	1,325	500	-	50	17,531
3,070	-	-	356	2,150	450	-	200	2,675	433	-	50	12,450
3,182	1,200	400	400	1,782	600	180	200	1,841	600	100	100	15,410
5,634	1,300	1,600	1,000	2,896	500	800	300	1,396	500	400	200	24,316
-	200	200	150	-	50	70	50	-	50	100	50	1,550
121,510	23,506	26,270	18,178	52,394	7,460	5,736	9,990	30,382	11,425	6,176	6,740	533,665

from Commencement of Operations to 31st March 1869.

Neddiwuttum Plantations.				Pycara Plantations.				Malkoondah Plantations.				TOTAL.
1861 to 1866.	1866-67.	1867-68.	1868-69.	1862 to 1866.	1866-7.	1867-8.	1868-9.	1863 to 1866.	1866-7.	1867-8.	1868-9.	
Rs. 39,538	Rs. 16,350	Rs. 15,861	Rs. 5,993	Rs. 5,574	Rs. 1,935	Rs. 1,686	Rs. 1,132	Rs. 2,642	Rs. 3,050	Rs. 2,163	Rs. 670	Rs. 221,435
15,110	3,294	2,117	1,024	1,683	-	87	773	1,740	442	375	426	59,845
1,469	-	-	35	845	-	-	20	300	-	-	-	3,299
3,650	-	-	309	1,900	-	-	240	250	-	-	125	8,019
6,280	983	720	1,244	5,750	-	436	1,350	3,251	-	101	1,600	26,283
4,900	700	1,614	9,882	5,375	322	408	5,002	2,450	415	597	4,087	45,690
6,738	913	859	6,465	2,955	-	660	2,632	1,488	240	856	1,984	34,560
3,511	300	849	129	1,015	200	264	125	-	150	441	140	10,379
3,938	939	1,078	330	765	150	426	344	-	250	445	294	15,168
5,387	1,104	-	151	1,700	300	35	30	200	200	175	-	13,041
3,210	280	557	90	1,429	200	156	40	1,050	-	-	30	13,267
4,427	1,030	100	70	2,404	662	275	30	2,177	22	90	32	18,378
3,518	239	441	1,300	2,750	200	50	700	1,000	350	81	500	16,407
5,105	617	978	460	1,000	100	207	257	475	135	190	150	17,575
-	1,195	-	-	-	-	-	-	-	-	-	-	2,289
-	-	159	100	-	-	38	80	-	-	35	40	845
-	-	2,250	326	-	-	200	190	-	-	235	60	5,823
100,781	26,944	27,913	27,908	35,145	4,129	4,928	13,845	17,023	5,254	5,784	10,138	512,593

(signed) W. G. McIvor,
Superintendent Government Chinchona Plantations.

METEOROLOGICAL OBSERVATIONS made at the Botanical Gardens, Ootacamund. from 1st April 1868 to 31st March 1869.

MONTHS.	Dry Bulb.				Wet Bulb.				Maxi- mum in Shade.	Mini- mum in Shade.	Solar Radium.	Rainfall.			
	7 a.m.	2 p.m.	6 p.m.	Daily Mean.	7 a.m.	2 p.m.	6 p.m.	Daily Mean.				Inches.	Cents.	Days with Rain.	Days without Rain.
April - 1868	58.57	72.71	61.71	64.33	53.86	60.98	56.79	57.19	77.87	53.23	129.43	-	75	11	20
May - "	57.0	70.36	60.96	62.77	54.20	61.48	57.32	57.67	73.77	53.93	117.16	7	09	20	11
June - "	54.75	62.35	55.30	57.47	53.85	58.65	54.45	55.65	63.71	53.63	81.12	8	03	21	9
July - "	53.47	61.89	54.47	56.61	52.79	59.05	53.58	55.14	-	-	85.64	10	35	23	8
August - "	53.57	63.0	55.10	57.22	52.71	59.29	53.90	55.30	65.68	-	104.77	3	14	18	13
September "	52.54	64.27	56.31	57.71	51.46	59.88	55.04	55.46	67.40	-	105.0	7	69	18	13
October "	53.56	65.30	56.52	58.46	50.96	59.74	54.74	55.15	68.39	-	113.70	9	01	20	11
November "	51.23	66.12	55.69	57.68	45.96	56.12	50.85	50.98	69.90	-	112.97	3	25	6	24
December "	51.81	69.24	55.52	58.86	43.38	55.95	48.76	49.36	71.07	-	134.92	-	34	3	28
January 1869	51.12	68.12	55.59	58.27	43.95	57.76	50.76	50.82	71.20	-	135.73	-	44	4	27
February "	52.19	70.0	59.44	60.54	48.44	60.12	54.62	54.40	73.48	-	140.14	-	30	3	25
March "	53.52	70.67	60.31	61.50	48.29	62.29	55.33	55.30	74.04	-	131.85	2	30	11	20
TOTAL - -	-	-	-	-	-	-	-	-	-	-	-	52	59	158	208
Annual Mean -	53.61	67.0	57.24	59.28	49.99	59.72	53.84	54.37	70.59	-	116.03	-	-	-	-

Ootacamund.

(signed) W. G. McIvor,
Superintendent of Government Chinchona Plantations.

NEDDIVUTTUM WEATHER REPORT from 1st April 1868 to 31st March 1869.

MONTHS.	Hygrometer.		Maximum in Shade.	Minimum in Shade.	Rain in Inches.	Days with Rain.	Days without Rain
	Dry Bulb.	Wet Bulb.					
April 1868 - -	66	58	82	61	0.70	2	28
May " - -	68	58	82	62	5.80	8	23
June " - -	58	57	69	55	27.9	27	3
July " - -	57	56	59	52	18.97	30	1
August " - -	59	59	62	56	30.22	22	9
September " - -	59	58	67	53	9.17	22	8
October " - -	60	60	70	57	5.24	10	21
November " - -	60	57	70	56	2.20	7	23
December " - -	60	56	74	55	-	-	31
January 1869 - -	59	50	76	51	-	-	31
February " - -	58	53	73	54	0.4	1	27
March " - -	66	64	80	68	0.57	3	28

Ootacamund.

(signed) W. G. McIvor,
Superintendent of Government Chinchona Plantations.

EXTRACT from ORDER of the Madras Government, 6th August 1869.

The Superintendent's report for 1868-69 is in most respects quite as satisfactory as those which have preceded it, and the Government are disposed to augur the happiest results from the acclimatisation on the Neilgherries of nearly all the valuable species of Chinchona which have received a notable accession during the year under review, by the successful introduction of the *C. Pitayensis* variety.

The average monthly increase by propagation has fallen from 48,267 in 1867-68 to 19,703 in 1868-69. This is attributed to the cessation of demand for plants on the part of private individuals who now grow the Chinchona from seeds. The Government observe, however, that the plants which were put in the ground during the year under review only reached 153,145, or less than half the number of those planted out in 1867-68 (339,701). In his report for the latter year, Mr. McIvor stated that the plants on hand were nearly sufficient to occupy all the land granted for Chinchona cultivation; but this anticipation would appear not to have been realised. It is probable, however, that as the Government, on Mr. Broughton's recommendation, recently directed that special attention should be paid to the propagation of the "lanceolate-leaved variety of *C. Officinalis*," some delay in occupying those portions of the plantations which are still vacant may ensue.

The Government note with satisfaction that the "lanceolate-leaved variety of *C. Officinalis*" has yielded the unprecedentedly large proportion of 11.40 per cent. of alkaloids and 9.75 per cent. of quinine. The largest amount of alkaloids extracted from the bark hitherto imported into the London market is stated by Mr. Markham, in his "Travels in Peru and India," at 8.5 per cent., of which 5 per cent. was quinine. This was in the case of *C. Succirubra*. The latter variety, as grown on the Neilgherries, appears from Mr. Howard's letter to have yielded only 6.15 per cent. of quinine in 1868, against 8.15 per cent. in 1867. Mr. Howard accounts for this decline by the idiosyncrasy of the species.

The present report does not include the progress of *C. Pahudiana*. By the last account, this species, heretofore considered worthless, although grown to a large extent by the Dutch in Java, had been found to yield a small per-centage of quinine.

The Government regret to learn that the cultivation of Chinchona by planters is retrograding, and desire that both the Commissioner and Mr. McIvor will use every means in their power to further the distribution of seeds and plants to those who may intimate a desire for them.

Several valuable accessions appear to have been made to the Botanical Gardens. The Government will look with interest for the development of their utility, and desire to receive an early report on the success of the dry paddy received from Burmah, which is grown at high elevations in that State.

The Superintendent's account of the rapid propagation of the European fresh-water fish, for which the gardens are indebted to his public-spirited efforts, is very encouraging.

— No. 58. —

From the Secretary of State for India to the Government of Madras.

India Office, 30 June 1869.

LAST year Mr. Cross, the gardener who conveyed Mr. Spruce's collection of Chinchona plants to India in 1861, was commissioned by my predecessor to go to New Granada, and make a collection of seeds of the most valuable species of Chinchona which grow in that republic. He proceeded to the district of Popayan, and has since sent home packets of seeds from time to time, which, immediately on their receipt, have been forwarded direct to Mr. McIvor.

It is desirable that I should now be furnished with precise information as to the results that have been obtained by Mr. McIvor, with reference to the germination of these seeds. I therefore, inclose a tabular statement showing the dates on which seeds were despatched by Mr. Cross from Popayan, and the dates on which they were forwarded from this office to Mr. McIvor, and I desire that Mr. McIvor may be called upon to fill up the column of remarks, with a statement of the dates on which the seeds in each packet were sown, and of the results.

— No. 59. —

From the Government of Madras to the Right Honourable the Secretary of State for India.

My Lord Duke, India Office, 30 September 1869.
With reference to your public Despatch, dated 30th June 1869, we have the honour to forward the accompanying statement of the results obtained from the Chinchona seeds sent from New Granada by Mr. Cross.

We have, &c.
(signed) H. D. Phillips.
A. G. Arbuthnot.

Enclosure in No. 59.

From the Superintendent of the Government Chinchona Plantations to the Acting Secretary to Government, Revenue Department, Fort Saint George, dated Ootacamund, 1st September 1869.

With reference to the order of Government, under date 10th August 1869, I have the honour to enclose the statement of Chinchona seeds sent from New Granada by Mr. Cross, with the information required by the Secretary of State for India duly filled in.

STATEMENT of Chinchona Seeds sent from New Granada by Mr. Cross.

Dates on which Chinchona were sent from Popayan or Sylvia by Mr. Cross.	Dates on which the Seeds were forwarded to Mr. McIvor from this Office.	QUANTITY.	REMARKS.	
6 July - 1868	Next mail after 11 August 1868	2 Packets -	Sown 20th September 1868; two seeds germinated. Seeds received in bad condition.	2
22 June - "	27 " "	A few seeds -	Sown 1st November 1868; failed. Seeds damp and covered with mildew.	
2 August "	17 September "	2 Packets -	Sown 25th October 1868; failed. Seeds damp and covered with mildew.	
7 September "	16 October "	3 " -	Sown 26th November 1868; failed. Seeds damp and covered with mildew.	
3 October "	16 November "	2 Smallpackets	Sown 21st December 1868; one seed germinated. Seeds received in damp and mildewed state.	1
9 November "	11 January 1869	1 Packet -	Sown 16th February 1869; one seed germinated. Seeds received in damp and mildewed state.	1
2 " "	14 " "	4 Packets -	Sown 16th February 1869; failed. Seeds received in bad condition.	
21 December "	2 March "	2 " -	Sown 6th April 1869; 12 seeds germinated.	12
9 January 1869	2 " "	4 " -	Sown 6th April 1869; 30 " "	30
9 " "	17 " "	4 " -	" 12th " " 22 " "	22
8 February "	- " -	4 " -	" 20th May " 8 " "	8
22 " "	26 April "	6 " -	" 14th June " 10 " "	10
8 March "	26 " "	6 " -	" 14th " " failed. Seeds in bad order.	
29 " "	27 May - "	2 " -	Sown 1st August 1869; failed. Seeds in bad order.	
26 April "	15 June - "	4 " -	Sown 13th August 1869; seeds received in better order, but not yet germinated.	86

Ootacamund, }
1 September 1869. }

W. G. McIvor,
Superintendent, Government Chinchona Plantations.

— No. 60. —

From the Government of Madras to the Secretary of State for India.

My Lord Duke,

Madras, 15 November 1869.

* Despatch from
Secretary of State,
11th Sept. 1869.

WITH reference to paragraph 4 of your public Despatch, dated 29th July 1869, we have the honour to observe that the reports on the experimental cultivation of Chinchona at Peermade, in Travancore, and on the Nul-lamallay Hills, in Kurnool, have already been forwarded to your Grace: the former with our Despatch, dated 20th July 1869, to which a reply has recently* been received; the latter with our despatch, dated 10th August.

2. We have now the honour to transmit, for your Grace's information, similar reports which we have recently received from the Revenue Board, in reference to the other places mentioned in paragraphs 5 and 6 of Sir Stafford Northcote's Public Despatch of 16th April 1867, viz., Ganjam, Tinnevely, Pulney Hills, in Madura, Shervaroy Hills, in Salem, and South Canara. Our proceedings, containing the orders we have issued in respect to the experiments at these places, are also forwarded.

Ganjam.
Proceedings of Gov., 30 August 1869.
Ditto - 9 Oct. "

Tinnevely.
Proceedings of Gov., 8 Oct. 1867.
Ditto - 23 August 1869.
Ditto - 12 Oct. "
Ditto - 25 " "

Madura.
Proceedings of Gov., 9 Sept. 1869.
Ditto - 30 " "

Salem and South Canara.
Proceedings of Gov., 20 Sept. 1869.

3. It will be seen that the Chinchona plant has proved a failure in Ganjam, and that no attempts to cultivate it have been made on the Pulney Hills, in Madura, or in the South Canara district. The plant is, however, found to prosper on the Paupanassum Hills, in Tinnevely, and on the Shervaroy Hills, in Salem.

Enclosure 1, in No. 60.

From the Acting Junior Assistant Agent, Russelcondah, to the Acting Agent to the Governor in Ganjam, dated 7th July 1869.

I HAVE the honour to report that I can find no information in the records of this office regarding the experiments in Chinchona cultivation made by Mr. Goodrich, nor does any one here appear to know anything on the subject. I distinctly remember Mr. Goodrich coming once to Chetterpore, and preparing some earth in boxes for the reception of the Chinchona plants; this was in Mr. Forbes's time; but I do not remember hearing the result of the experiment. Probably Mr. Goodrich reported it demi-officially to Mr. Forbes or Mr. Carmichael. Mr. Spedding may possibly be able to give you some information; it was he who took overcharge from Mr. Grigg.

2. In some memorandum left by Mr. Goodrich for the guidance of his successor, mention is made of Sandal-wood and Pinas Maritima, but nothing is said about Chinchona. From this I would infer that the Chinchona experiment had failed before Mr. Goodrich went away.

COPY submitted to the Board of Revenue with reference to their Proceedings of the 9th ultimo.

2. ACCORDING to the accounts, a sum of 52 rupees was advanced in June and July 1866 on account of Chinchona cultivation; but, as no plants had been received, 50 rupees were recovered and credited in March 1867, the remaining 2 rupees having been spent in contingencies.

Chetterpore, 15 July 1869.

(signed) *G. Ellis,*
Acting Collector.

SUBMITTED to Government with reference to Government Order, 4th June 1869.

2. No experiments seem to have been made in Ganjam.
3. The plant would, the Board believe, succeed in the Khond and Soura Hills.
4. The Board understand that the Inspector-General of Police took up a few young plants in 1866; but they arrived at the time that disturbances broke out in the hills, and could not be carried up. They all died off in the plains.

Enclosure 2, in No. 60.

From the Collector of Tinnevely to the Secretary to the Board of Revenue dated
17th August 1867.

* Revenue Department.

1. As required in Government Proceedings,* dated 3rd May 1866, I have the honour to forward herewith the sub-collector's report on the cultivation of Chinchona in this district.

2. Though the cultivation of the Chinchona succirubra is described as a successful experiment, I may add that, from the fact of our hills being uninhabited, there is no possibility of extending Chinchona cultivation except at the cost of Government.

From the Sub-collector to the Collector of Tinnevely, dated Terukurangudi,
6th August 1867.

1. I HAVE the honour to report on the experimental cultivation of Chinchonas in this district, sanctioned by Government in Proceedings of 3rd May 1866.

2. Three plantations were made altogether, two on the General's hill at different elevations (about three and four thousand feet respectively), and one on the hills above Papanasam, at about 3,000 feet.

† On the 22nd
August 1866.

‡ 18th July 1867.

3. In the lower plantation on the General's hill (commonly called the Chinna Kulirati), Mr. MacGregor originally† planted 33 succirubra and 21 officinalis, and on the higher, that on the Periya Kulirati, nine succirubra and nine officinalis. It was found impossible to get them looked after at so great a distance, and after nine had died, I had the remainder moved down to the Chinna Kulirati in January last. When last‡ visited there were 31 of the succirubra and 15 of the officinalis alive and apparently promising. I have Captain Beddome's authority for saying that the succirubra are as flourishing as possible. The officinalis, however, do not appear to grow at all on the Chinna Kulirati, and I believe require greater elevation. I propose, therefore, to re-transplant them to the Periya Kulirati and hand them over to Mr. Honiss, who has a house there, and would look after them, either for Government or as private speculation, if Government approve. This move will at the same time give the additional room to the succirubra which they require.

§ Inspected with
Captain Beddome
on the 26th July.

4. On the Papanasam plantation § 32 of the succirubra out of 40 planted, and 75 of the officinalis out of 100, have survived the year, and both appear to prosper remarkably well, though here again the succirubra seem better suited to the climate.

|| About 15 miles.

5. The plantation, as you are aware, is at present under the care of one of the 10 hillmen who are paid to protect the jungles, and is visited from time to time by the forest peons. It is too || far from the plains to be easily inspected, but if the Tinnevely forests are handed over to the department, as proposed, I have no doubt they would be able to arrange for its regular and effective supervision.

6. As an experiment, the cultivation seems to me to have been completely successful, though it is manifest that the "succirubra" variety is far better suited to the elevation (or climate) of our hills than the other.

7. There is a very large tract of forest which was cleared by the hillmen in 1859, within a couple of miles of the plantation, and on which timber will never grow again. There could be no objection, I think, to having this planted with Coffee or Chinchonas under a regular establishment; or it might even be given up to private enterprise without any fear of further injury to the sources of irrigation, and by putting one of the establishment in charge, the preservation of the Chinchonas would be assured at no great cost to Government.

1. Submitted for the information of Government.

2. The Board consider the results of the experiment to be satisfactory as far as they go, and though they would not extend the plantation, as proposed in the concluding paragraph of the sub-collector's letter, they consider that the present plants should be carefully looked after, and periodical report submitted of their progress.

3. The sub-collector's proposal to transfer some of the plants to Mr. Honiss seems unobjectionable.

4. The collector should report upon the advisability of allowing private persons to purchase estates in the tracts referred to in paragraph 7 of Mr. Pennington's letter. He should also state how many plants were received from Ootacamund, and whether the hill people will not take some of them. It is observed that Government ordered 500 plants to be sent, but only 212 appear to have been planted.

ORDER THEREON, 8th October 1867.

1. Communicated to the Superintendent Government Chinchona Plantations, the Conservator of Forests, and the Agri-Horticultural Society.
2. The transfer of the plants on the Peria Kulirati to Mr. Honiss is approved.

(signed) *W. Hudleston,*
Secretary to Government.

Enclosure 3, in No. 60.

From the Acting Collector of Tinnevelly, to the Acting Secretary to the Board of Revenue, dated 30 June 1869.

WITH reference to the Proceedings of Government, dated 4 June 1869, communicated with Board's Proceedings of the 9 idem, I have the honour to forward copy of a letter from my acting sub-collector, reporting on the Chinchona cultivation. I accordingly support the recommendation made by Mr. Stuart in reference to retaining the services of the "*Mallai Arasans*" (hill-men) for the extension of the Chinchona garden.

(Enclosure.)

From *A. J. Stuart, Esq.*, Acting Sub-Collector, to the Acting Collector of Tinnevelly, dated Ambasamudram, 23 June 1869.

IN reply to your endorsement on Proceedings of Government, dated 4 June 1869, No. 1582, I beg to inform you that I visited the Chinchona garden in the sub-division on the 22nd instant. It is about 15 miles from Paupanassum, of which about three are of very steep ascent and two rather steep, so that the elevation must be considerable, I should guess two to three thousand feet.

2. The garden (the only one in this district), is about one-fourth of an acre in extent, and consists of a clearing in fine forest on a rather steep slope in which the trees have been planted at a distance of six or eight feet apart. The garden is well sheltered by the surrounding forest, and the trees on the whole have done well. They were planted, 130 in number, in September 1866, 32 of the broad-leaved variety, and 98 of the narrow-leaved kind; of them there now remain 30 broad-leaved trees and 70 narrow. The broad-leaved trees have grown up decidedly better than the others; on the whole a larger percentage of this kind having succeeded, and nearly all having grown equally well and being in a uniformly flourishing condition. The highest of them was about 13 feet, and the average about eight to ten feet high, well furnished with branches and leaves, and looking extremely healthy. The measurement round the base of the largest of these was about eight inches, and all of them were stouter in the trunk than the other variety.

3. The trees of the other variety had some of them shot up higher, namely, to 15 feet; but were more slender and delicate-looking, and would, if in an exposed situation, probably require support: they were also of less circumference at the root, the largest being only six inches. They have not succeeded so uniformly as the other kind, many trees being from four feet to six feet high only, and by no means so stout and healthy as the broad-leaved variety.

On the whole, it is plain that the trees will grow and grow well, the broad-leaved variety being more vigorous than the other; but I imagine it would require a good many more years before any considerable quantity of bark could be taken from them.

4. The garden has been carefully kept, and was in excellent order when I saw it; but the account of expenditure upon it shows that if it is intended to continue the experiment, it should be very greatly extended. When the trees were first planted, the little patch of forest in which they are was cleared at a cost of nine rupees. The place is in the middle of a beech forest and no doubt the only practicable plan of looking after it was adopted, namely, employing the hill-tribes. Ten men were retained at 3 rupees a-month each, and appear to have taken pains and care with their charge; but the same ten men might now be made to look after probably fifty times the area of plantation at the same rate of pay. These men live by cutting and burning the forests, and cultivating a fresh piece of forest every year or two. This cutting has been summarily put a stop to on our side of the boundary, and the hill-men are migrating to Travancore. If therefore it is decided that the plantations be extended, which must be done if it is to pay at all, I would suggest that a bargain be made for the permanent services of one whole company of these hill-men, to be paid in such a manner as will enable them to live independently of cultivation. I understand that the 10 men hitherto employed would be quite willing to accept such terms, and they

might be trusted to look after the plantation and take good care of it without any person to look after them. This is a great advantage which we shall reap from having gained the confidence of these simple and honest people.

A few experiments on a small scale seem to have been made to propagate the tree by cuttings but have all failed, and the trees have not begun to bear seed yet, so that any extension must be by importing seedlings or by sending down some one who knows how to make cuttings grow.

5. The cost up to the present time has been as below:—

	Rs.	a.	p.
Clearing the garden - - - - -	81	15	-
Pay of 10 hill-men for 29 months, at three rupees a month, is up to the end of April 1869 - - -	870	-	-
Four men paid by me up to end of June, for which sanction is now requested - - - - -	24	-	-
Do. for broken periods at beginning of work - - -	17	9	6
Cost of two mamooties - - - - -	1	4	-
Total - - -	994	12	6

From April 1869 it appears the deputy-conservator ordered that these men should be discharged, why I do not know; but as I believe some of these have since remained in charge, and as the fences must be kept up and the weeds cleared out until Government order the experiment to be abandoned, I have ventured to pay to four men their arrears for the last two months in anticipation of sanction, and request that orders may be issued for the regular monthly payment of this amount until the garden is definitely abandoned.

In this letter the collector of Tinnevely forwards a report from his sub-collector on the state of the Chinchona plantation on the Paupanassum hills.

2. Similar reports have been called for from Ganjam, Madura, Salem, and South Canara, and the results will, when received, be embodied in one statement.

3. Meanwhile, however, it is necessary to address Government on the subject of the further prosecution of the experiment.

4. From Mr. Stuart's report it appears that there are now flourishing, at an elevation of 3,000 feet, 30 *Succirubra* and 70 *Officinalis* out of 32 and 98, respectively, planted.

5. The trees were cuttings brought from the Neilgherries in Wardian cases, and when planted in September 1866, they measured from four inches to a foot.

6. The *Succirubra* are reported to average from eight to ten feet, some reaching 13 feet and to be looking extremely healthy.

7. The *Officinalis*, though more slender as is their nature, are thriving, though not so uniform in size; but the highest are 15 feet.

8. The plantations were undertaken at the instance of Dr. Cleghorn, and with the advice of Mr. Markham, in order to ascertain if the difference of latitude produced any marked variation in the growth or properties of the trees.

9. The Board would therefore suggest that the Government quinologist should be referred to for his opinion as to whether he considers it desirable now to make any experiment on the bark; and if so, to lay down instructions to guide the collector in its removal and despatch to Ootacamund.

10. Another object was to obtain the means within the district of propagating from trees, the stock of which had already been improved by culture on the Neilgherries.

11. The board would now recommend that the collector should be authorised to procure from Ootacamund, at the expense of the Jungle Conservancy Fund, the services for a few months of a man trained to propagate Chinchona from cuttings. If this were done several hundreds of young plants might be reared and planted out in extension of the present garden, and in a few years these trees would afford the means of supplying any number of cuttings that might be required.

12. From the sub-collector's report, it appears that the establishment of hill-coolies employed to take care of these plantations was entirely discontinued by the deputy-conservator of forests from the end of April, and he applies for sanction to pay arrears to four men who have since then tended the trees, and to continue them. This should be at once arranged by the collector in communication with the deputy-conservator, funds being found from the Jungle Conservancy Fund.

13. It was intended that the hill-coolies originally entertained, should be utilised for general work in guarding the forests, for which their intimate knowledge of the jungle paths, and immunity from fever admirably fits them.

14. Should

14. Should Government approve of the board's proposal, it would be necessary to direct the collector to place himself in communication with the superintendent, Government Chinchona plantations, and to instruct the latter to endeavour to obtain the services of a properly-qualified gardener. SERVANTS OF I

15. The acting third member is not a party to these proceedings.

ORDER thereon, 23 August 1869.

COMMUNICATED through the Commissioner of the Neilgherries, to the Superintendent, Government Chinchona plantations, who is requested to submit at his earliest convenience, an opinion on the measure proposed in paragraph 11 of the board's proceedings, dated 2nd August 1869, No. 5620.

2. The Government are of opinion that the establishment of hill-men at present employed on the Paupanassum plantation should not be discontinued.

3. Mr. Stuart's report does not include the condition of the plantation on the China Kulirati.

(signed) *R. A. Dalryell*,
Acting Secretary to Government.

Enclosure 4, in No. 60.

From *W. G. McIvor*, Esq., Superintendent, Government Chinchona Plantations, to the Acting Secretary to Government, Revenue Department, Fort Saint George, Ootacamund, 13 September 1869.

WITH reference to the Order of Government, dated the 23rd August 1869, and paragraph 11 of the Proceedings of the Board of Revenue therein recorded, I have the honour to state that it appears to me desirable that the cultivation of Chinchona should be continued at Paupanassum, and I shall gladly endeavour to procure the services of a man trained to the propagation of these plants, both by seeds and cuttings.

2. Perhaps it would be better to instruct the hill-men to rear seedlings, as we have now an unlimited number of seeds; this would be the most rapid and successful way of establishing nurseries.

ORDER thereon, 12 October 1869.

WITH reference to the opinion expressed by Mr. McIvor, the Government do not deem it expedient to incur the expense of sending a trained Chinchona planter from Ootacamund to Paupanassum. Mr. McIvor will therefore forward to the acting sub-collector of Tinnevely a supply of Chinchona seeds of the species best suited to an elevation of 3,000 feet, and inform that officer as to the proper method of raising them.

(signed) *R. A. Dalryell*,
Acting Secretary to Government.

Enclosure 5, in No. 60.

From *C. T. Longley*, Esq., Acting Collector of Tinnevely, to the Acting Secretary to the Board of Revenue, Courtallum, September 3rd 1869.

WITH reference to paragraph 3 of the Order of Government, dated 23rd ultimo, communicated to me by the Board on the 26th idem, I have the honour to forward, for the information of Government, copy of a letter from my acting sub-collector, reporting on the condition of the Chinchona plantation on Peria Kuluratti and Chinna Kuluratti.

Note.—I regret that through an oversight this report was not submitted to the Board earlier.

(Enclosure.)

From *A. J. Stuart*, Esq., Acting Sub-Collector of Tinnevely, to the Acting Collector of Tinnevely, dated Ambasamudram, 23rd July 1869.

REFERRING to my letter, No. 143, dated 23rd June 1869, I have the honour to state, that since I wrote it I have ascertained that there were two other small plantations of Chinchona in my division: one at Chinna Kuluratti, at an elevation of one to 2,000 feet; and one at Peria Kuluratti on the General's hills, at nearly double that elevation. I

inspected the first of them the other day, and found all the small-leaved variety had disappeared, but 17 trees of the large-leaved kind were in vigorous health. The highest of these trees were about 12 feet, and the average 8 feet. The climate evidently suits them well. These, as well as the plantation at Peria Kuluratti, were under the care of the Reverend Mr. Honnis. He informs me that the plantation at Peria Kuluratti has entirely failed, the elevation being apparently too great.

2. From Mr. Pennington's letter, No. 304, dated 29th July 1867, it will be seen that 72 plants were originally planted there in August 1866, of which there are now alive 17 of the broad-leaved kind out of 42, and none of the narrow-leaved variety out of 30. This latter grows very fairly above Paupanassum, and as the garden there is, I think, certainly higher than Chinna Kuluratti, and lower than Peria Kuluratti, in both which places this tree has failed entirely, I conclude that it requires an intermediate climate and elevation; at the same time I expect it is, in fact, a more delicate and less vigorous plant by nature than the other variety, which is certainly well adapted to these hills.

3. Near the Paupanassum garden there is an extensive Kumari clearing made years ago by the hill men, where fine jungle has been cut down and burnt, though rather exposed. I think this would be an excellent opportunity and place for putting a large plantation of these trees. The returns are too doubtful and too distant to attract private capital; I would recommend therefore that the plantation be made and cared for by Government, advantage being taken of the hill tribes. I understand the Forest Department contemplate planting on a considerable scale, both for timber and to clothe the country with trees, and should think they could not do better than take up this extensive clearing, the soil of which *must be fine*, since it once supported a forest, and re-cover it with trees by planting Chinchonas: the place is a little lower than the Paupanassum Chinchona garden, but probably higher than the one at Chinna Kuluratti; and I do not doubt the large-leaved variety would thrive well, especially if care be taken to shelter it from the strong winds, either by close planting at first, or by putting down some stronger trees with it.

Order thereon, 25th October 1869.

THE Government are glad to learn that the plantation on the Chinna Kuluratti is still in existence, although the number of trees has decreased from 42 in July 1867, to 17 in July 1869.

2. If Mr. Stuart's estimate of the height of the Chinna Kuluratti be correct, his report is particularly interesting; for it would establish the fact that the *C. Succirubra* or broad-leaved variety of Chinchona thrives vigorously at so low an elevation as from 1 to 2,000 feet. But the Government are disposed to consider that the estimate (3,000 feet) contained in Mr. Pennington's letter, dated 6th August 1867, No. 304, must be nearer the truth; for Mr. McIvor in his last annual report states that the *C. Succirubra* succeeds best at elevations of from 5,000 to 6,000 feet. For the same reason the failure of the plantation on the Peria Kuluratti, the height of which does not exceed 4,000 feet at the utmost, cannot be attributed to the cause assigned in Mr. Stuart's letter under review.

3. The Government are disposed to regard favourably the suggestion embodied in paragraph 3 of the acting sub-collector's letter relating to the planting of Chinchona by the Forest Department near Paupanassum; but it would be well for the elevation of the spot in question to be ascertained. Mr. Longley should not have submitted, without comment, a letter from his sub-collector containing a proposal of this nature.

(signed) *R. A. Dalryell*,
Acting Secretary to Government.

Enclosure 6, in No. 60.

From *J. R. Arbuthnott*, Esq., Officiating Collector of Madura, to the Acting Secretary to the Board of Revenue, dated Sembaganoor, 6th July 1869.

IN reply to the Proceedings of Government, dated 4th June 1869, communicated by the Board, under date the 9th idem, I have the honour to report that no Chinchona plants were supplied to the Collector of this district by the superintendent of Chinchona plantations, nor was a copy of the Proceedings of Government, dated 29th August 1867, communicated to this office.

2. In case, however, it is thought desirable to make an experiment now, I shall be happy to undertake and carry out the same in communication with the deputy conservator of forests.

SUBMITTED to Government, with reference to Government Order, dated 4th June 1869, No. 1,582.

2. The Board would draw the attention of Government to the proposal contained in paragraph 2 of the acting collector's letter, and suggest that measures be adopted for introducing Chinchona into the villages on the Palani hills. They understand that Mr. Levinge has been very successful with it in the European settlement at Kodukanal.

ORDER thereon, 9th September 1869.

THE superintendent of Chinchona plantations has been twice directed to supply Chinchona plants for cultivation on the Pulnis, but the orders have not been carried out. In the acting superintendent's letter, dated 26th August 1867, recorded in the Proceedings of Government, dated 29th August 1867, he promised to supply 100 well-established plants on receiving instructions from the collector respecting the dispatch and the route by which they should be taken; but the acting collector states that no copy of the Order of Government was communicated to his office. The register of the Government Office shows clearly that a copy of the Order in question was forwarded to the collector direct from this office by post.

Order, dated 9th June 1866.
Order dated 29th August 1867.

2. The Government regret that by some mistake the Chinchona cultivation on the Pulnis, ordered in June 1866, has not been yet commenced. Mr. Arbuthnott will at once apply to Mr. McIvor, through the Commissioner of the Neilgherries, for the supply of plants, and make proper arrangements for their cultivation, as originally intended.

(Signed) *R. A. Dalryell*,
Acting Secretary to Government.

Enclosure 7, in No. 60.

From the Officiating Collector of Madura, to the Acting Secretary to the Board of Revenue, 18 August 1869.

ADVERTING to paragraph 2 of the Board's Proceedings, dated 2nd instant, I have the honour to request your attention to my letter to you, dated 16th July, reporting that no Chinchona plants were supplied to this district.

2. I am of opinion that Chinchona cultivation would be successful on the Lower Pulneys, at a height of about 4,000 feet. The soil is very rich, and I think the climate too is suitable. Should the Board consider it desirable, I would gladly carry out an experiment on these hills on a large scale.

Enclosure 8, in No. 60.

From the Collector of Salem, to the Acting Secretary to the Board of Revenue, 1 July 1869.

I HAVE had the honour to receive the proceedings of Government, (Revenue Department), under date the 4th June 1868, and beg to reply as follows:—

2. In the latter part of 1866, 100 small seedlings of *Chinchona succirubra* were furnished to this district, by Mr. McIvor, from Ootacamund. These were taken up to the Shervaroys. Mr. Arbuthnott gave a few of them to Major Hunter, and planted out the remainder himself.

3. The position chosen by Mr. Arbuthnott had a southerly aspect, and the seedlings were planted on slopes in October 1866. The plants were so small that it required great care in transplanting them from the case they were sent in. The rains of November and December caused the plants to thrive, and there are some of them now upwards of 10 feet high, and look extremely healthy. There can be no doubt at all that Chinchona will grow well on the Shervaroys. Major Hunter unfortunately lit a fire for the purpose of burning the grass about his premises, and this spread all over the Shervaroyen and down the slope on the sides where the Chinchona had been planted. The consequence was that several of the growing Chinchona plants were damaged. If it had not been for this accident, I see no reason why every plant that was put down should not have succeeded. I observe that the young trees vary much in size. Some that I transplanted are six feet high, whilst again those within a few yards are only half that. Very likely the roots of the latter were somewhat injured. Four months after the plants were put down, I left some entirely to themselves, neither watering nor attending to them in any way, except clearing the weeds round about. They are now nearly as fine as the others which were watered. My reason for so acting was to see whether Chinchona with no more attention, if so much, as is required for coffee, would succeed. The plants that were given to Major Hunter are equally as fine as those planted by Mr. Arbuthnott.

Enclosure 9, in No. 60.

From *H. S. Thomas*, Esq., Acting Collector of South Canara, to the Acting Secretary to the Board of Revenue, Mangalore, 26 July 1869.

IN pursuance of the marginally quoted orders, I have the honour to report that the cultivation of Chinchona has not been attempted in this district.

2. Mr. Cadell desired to undertake it, and was directed to furnish Mr. McIvor, the superintendent of Government Chinchona plantations, with details regarding the locality where it was to be tried.

3. This his successor, Mr. Whiteside, did, and the reply of Mr. G. Batcock, the acting superintendent of Government Chinchona plantations, was received on 5th May 1867. On this letter no action was taken by Mr. Whiteside, because he left the district very shortly afterwards.

4. Finding the letter undisposed of, I took it with me on the first occasion of my visiting the Kudri Mukh, which was the spot thought of by Mr. Cadell. Mr. Batcock's opinion was, that "the most suitable locality would probably be on the upper plateau of the hill" on which he had no doubt we should "find in the jungle a fine chocolate-coloured loam * * similar to what they have on the Neilgherries," in which with an open well-drained sub-soil "he thought the Chinchona plant would thrive to perfection." I observed that the conditions of the place were the exact opposites of all Mr. Batcock's requirements. South Canara owns no plateau on the hill top; it belongs to Mysore. The soil and wood of the plateau are as dissimilar as possible from those on the Neilgherries. Such is the violence of the south-west monsoons to which this line of mountains offers the first attraction, that the vegetable-made soil is annually washed down to the plains, and the very trees are scarce worthy of the name, so poor are they both in height and girth. The desired sub-soil is also essentially rocky. Had it not been so, it also would, under the action of the annual torrents of rain, have long since found its way to the plains and to the sea. In short, the plateau is of the same nature as the upper hill sides to which objection was taken by Mr. Batcock on the ground of the soil being shallow and rocky, and the lower hill sides, where all our fine timbers grow, are far too low for Chinchona.

5. Neither does the rain-fall appear more propitious than the soil, and Mr. Batcock writes that, "it is essential to notice this, as Chinchonas require a uniform but not excessive amount of rain, especially to establish the young plants; 45 to 65 inches distributed pretty equally throughout the year is, according to experience, the quantity best suited for these plants." What we have here is from 120 to 130 inches in the year, almost the whole of which falls in from three to four months at the rate of from 3 to 5, 8 and even 10 inches in the 24 hours.

Under such forbidding circumstances, I abandoned the idea of an experiment which seemed to hold out greater promise of failure than of success.

7. The only other place in the district which I can think of as likely to be favourable, is the neighbourhood of Nagodi in the Hannar Magane, where this district owns a hill-plateau of some miles in extent intersected by a good road. But I have no means of ascertaining the altitude.

8. I venture to suggest that if such collectors as take a personal interest in these matters were provided with the means of ascertaining the altitude in different parts of their districts, they would be often in a better position to report what localities are best suited for the cultivation of exotics, and the possession of such instruments when on their tours would often prove suggestive of the introduction of different special products. In this hilly district especially such instruments might often prove useful, and even in more level districts. I have frequently wished I had the means for deciding whether water could be advantageously stored in certain places or not. I imagine the Aneroid barometer and boiling point thermometer are not so expensive that it would be an extravagance to supply one in each collectorate in which it might be desired. I shall be glad if I can be thus supplied.

9. I would also suggest the advisability of desiring the departments concerned to bear in mind the advantage of entering altitudes more generally on the maps made in all future surveys. It is to a very limited extent only that it has hitherto been done.

(Enclosure.)

From *G. Batcock*, Esq., Acting Superintendent of Government Chinchona Plantations, to the Acting Collector of South Canara, Mangalore, Ootacamund, 1 May 1867.

WITH reference to your letter of the 5th ultimo, asking for an opinion with reference to the suitability of the tract therein mentioned for Chinchona cultivation, I have the honour to observe:—

1. That

1. That the elevation and temperature of the Mukh appears to be well adapted for the cultivation of those varieties of Chinchona, namely, the "red" and "grey" barks, suited to a sub-tropical temperature. The most suitable locality would probably be on the upper plateau of the hill, avoiding the bottoms of the valleys, as there may be a danger of frost, and planting on the slopes, those having a north or north-west exposure being preferred.

2. From your description of the sides of the hill it would appear that the soil is shallow, or that they are deficient, either wholly or at protracted periods, in certain seasons, in rain-fall. It is essential to notice this, as Chinchonas require a uniform but not an excessive amount of rain, especially to establish the young plants; 45 to 65 inches distributed pretty equally throughout the year is, according to our experience, the quantity best suited for these plants.

3. The soil appears, from your remark, to be similar to what we have on the Neilgherries, and no doubt you will find in the jungle on the hill-top a fine chocolate-coloured loam, in which, with an open well-drained sub-soil, the Chinchona plant will thrive to perfection. The sites selected for their cultivation should be [entirely cleared of trees, except a few belts on distant ridges to check the violence of any prevailing winds.

4. The best time to put the plants out would probably be just after the south-west monsoon, but as no details are furnished of the different seasons and rain-fall it is difficult to give an opinion on this point.

Submitted to Government with reference to Government Order, 4 June 1869.

2. As in the case of Ganjam, reported on in Proceedings of the Board, 17th August 1869, No. 6,144, no experiments appear to have been attempted in South Canara, as Mr. Thomas considers that the locality, Kudri Mukh, a high point in the range of ghaut in which it was originally intended to make them, was unsuited to the purpose. The Board, however, consider that suitable localities may be found on the lower slopes of the ghauts, and request the collector to select one or two for this purpose. In the meantime a few plants should at once be put down in some sheltered and fertile spot within the Hannar Magane at the top of the Coloor Pass as proposed.

3. In Salem 100 plants of *Chinchona succirubra* were planted out on the Shervaroy Hills in 1866 by the Honourable Mr. Arbuthnott, the late collector, and Major Hunter, a resident. The collector reports that although a few of the trees have been injured by an accidental fire, they are generally succeeding well, and that some of them are 10 feet high. He also expresses an opinion, founded on his own experiments and observation, that this species will grow well on the Shervaroys without any extraordinary care. The climate is evidently suited to Chinchona, and the Board would recommend that the extension of its cultivation on these hills be encouraged.

— No. 61. —

From the Secretary of State for India to the Government of Madras, India Office,
28 December 1869.

I HAVE had before me in Council the Despatch from your Excellency in Council, in the Revenue Department, No. 67, dated the 15th ultimo, reporting the results of various experiments, with a view to introducing Chinchona cultivation into the hill districts of your Presidency.

The growth of the red bark species at the heights near Papanassum in the Tinnevely Hills is so satisfactory that steps should be taken for establishing Chinchona cultivation on a suitable scale in that district. It is most important, with reference to a due supply of water for the tanks and channels in Tinnevely, that the spaces that have been denuded of trees on the overhanging mountains should again be planted. The proposal to cover one of the clearings with Chinchona trees is, no doubt, an admirable suggestion, and as it appears to be favourably entertained by your Government, I trust it will be systematically undertaken by means of seeds from the Neilgherries.

Mr. Arbuthnott, when at Salem, introduced Chinchona cultivation into the Shervaroy Hills with complete success, and there can be no doubt that an equally-satisfactory result will attend the experiment which he is about to commence on the Pulney hills.

I shall be glad, from time to time, to receive reports on the progress that is made in the hill districts where Chinchona cultivation has been commenced. I conclude that these arrangements will be executed in concert with the Forest Department in which your subsequent proceedings should be reported.

From the Government of Madras to the Secretary of State for India.

My Lord Duke,

Madras, 4 April 1870.

WITH reference to your Despatch, dated 11th September 1869, we have the honour to transmit a further report from the Resident in Travancore and Cochin on the Chinchona gardens at Peermade.

2. Mr. Ballard's former report described the condition of the gardens up to June last, and since then their progress has been on the whole satisfactory. The young plants are thriving, and Mr. Ballard is evidently anxious to extend the growth of Chinchona in Travancore.

Enclosure in No. 62.

From the Resident in Travancore and Cochin, to the Acting Chief Secretary to Government, Fort Saint George, Trevandrum, 15th February 1870.

ADVERTING to Government Order, dated 12th November last, and your reminder, dated 14th ultimo, I have the honour to observe that I have little to add to my report of June last, regarding the Chinchona gardens at Peermade.

2. There was little or no extension of the regular Sirkar plantations. They continue to look generally very well, when I last saw them in December last; but the searching winds of November and December are undoubtedly very trying so near the crest of the ghauts, and several, especially violent gales in November last, had caused some damage.

3. I find the growth of individual specimens in the Malayalam year 1,044, or from August 1868 to August 1869, reported by the superintendent as under:—

Botanical Names.	Height of tallest.		Girth.	Growth in Inches in Year.
	Ft.	In.		
1. C. Succirubra - - -	21	3	{ Close to ground, 24 inches - } 5 feet from ditto 15 ditto - }	41
2. C. Micrantha - - -	18	4	{ Close to ditto 14 ditto - } 5 feet from ditto 8 ditto - }	14
3. C. Peruviana - - -	16	0	{ Close to ditto 13 ditto - } 5 feet from ditto 7 ditto - }	18
4. C. Nitida - - -	8	0	{ Close to ditto 8 ditto - } 4 feet from ditto 4½ ditto - }	14
5. C. Condaminea - - -	12	6	{ Close to ditto 16 ditto - } 5 feet from ditto 6½ ditto - }	5
6. C. ditto - - -	10	0	{ Close to ditto 8 ditto - } 4 feet from ditto 5½ ditto - }	26

4. The superintendent had not planted out well-established young plants in sholas and sheltered spots as extensively as I expected he would have done during the monsoon months. He stated that he had very great difficulty in getting labourers to work out during the rains; but so little work was really required that more than was done might have been done in this direction. Many of the plants that were disseminated were doing well, but of course time must elapse before any safe opinion can be formed of their ultimate general success.

Plants were supplied as below :—

Mr. Burrows - 100

Mr. Egan - 12

Dewan of Travancore - 320

5. Little advantage was taken by the planters about the offer of plants gratis. One reason, however, was that the offer came somewhat late for preparing for plantation last monsoon. The offers are continued, and I am in hopes that a good number of plants may be taken for putting out next monsoon.

6. I shall endeavour to have steps taken to secure the active dissemination of plants in good time during the ensuing season.

— No. 63. —

From the Government of Madras to the Secretary of State for India.

My Lord Duke,

IN continuation of our Despatch, dated 9th March 1869, we have the honour to forward, for your Grace's information, the accompanying Tabular Report on the progress and condition of the Chinchona Plantations on the Neilgherries, for the half-year ending 31st July 1869.

Madras, 7 March 1870.

Enclosure in No. 63.

REPORT on the Number, Distribution, and Condition of Chinchona Plants on the Neilgherries, for the half-year ending 31 July 1869.

Species.	Botanical Names.	Commercial Names.	No. of Plants.	Value per Lb. of Dry Bark in the London Market.
				s. d. s. d.
1	C. Succirubra - - - -	Red bark - -	1,215,963	2 6 to 8 9
2	„ Calisaya - - - -	Yellow bark - -	40,895	2 10 to 7 -
	„ „ Frutex - - - -			
	„ „ Vera - - - -			
3	„ Officinalis - - - -	Original loxa bark -	1,183,159	2 10 to 7 -
	„ Var. Condaminea - - -			
	„ „ Bonplandiana - - -	Select crown bark -	87,509	2 10 to 7 -
	„ „ Crispa - - - -	Fine crown bark -	4,355	2 10 to 6 -
4	„ Lanceifolia - - - -	Pitayo bark - -	279	1 8 to 2 10
5	„ Nitida - - - -	Genuine grey bark -	2,786	1 8 to 2 10
6	„ Species without name - -	Fine grey bark -	8,500	1 8 to 2 10
7	„ Micrantha - - - -	Grey bark - -	46,730	1 8 to 2 9
8	„ Peruviana - - - -	Finest grey bark -	3,889	1 8 to 2 10
9	„ Pahudiana - - - -	Unknown - -	425	Unknown.
10	„ Lanceolata, leaved variety of Officinalis.	- - - -	701	- ditto.
11	„ Pitayo, from the seeds sent by Mr. Cross.	- - - -	86	- ditto.
	Total number of plants - -	- - - -	2,594,277	

TABLE showing the Growth of the Different Species of Plants Planted out in the Plantations for the half-year ending 31 July 1869.

No. of Plants.	Species.	Where Planted.	When Planted.	Maximum Growth.	Average Growth.	Height of the tallest Tree.	Birth near the Ground.
12	C. Succirubra .	Neddiwuttum	30th Aug. 1862	in. 28	in. 10½	feet. 24	in. 29
12	C. Micrantha -	- ditto -	- - -	19	9	22½	24
12	C. Officinalis -	Dodabetta -	30th Sept. 1863	13	11	14½	12

TABLE showing the Propagation, Distribution, &c., of Plants and Seeds during the half-year ending 31 July 1869.

DATE.	Total Number of Plants Propagated.	Total Number Permanently Planted out.	Total Number of Plants Distributed to Private Individuals.	Total Quantity of Seeds Distributed.
February 1869 - - -	12,600	- -	- -	ozs. 2½
March " - - -	5,440	- -	- -	3
April " - - -	2,480	- -	- -	6
May " - - -	1,200	- -	2,700	1
June " - - -	701	121,020	4,800	7
July " - - -	86	128,767	- -	14
	22,507	249,787	7,500	33½
Previously - - -	2,571,770	894,057	170,850	206½
Grand Total - -	2,594,277	1,143,844	178,350	240

REMARKS.—The number of plants permanently planted out in the plantations is 249,787, making the total 1,143,844.
All the species of Chinchona still maintain their usual luxuriance; the older plants of Chinchona Succirubra, Micrantha, and Officinalis, have this year again produced a large quantity of good seeds.
The increase by propagation is 22,507, the monthly average being 3,751, making the total 2,594,277.
The number of plants distributed to the public is 7,500, giving the total distribution of 178,350. Thirty-three and a-half ounces of seeds have also been gratuitously distributed, making the total 240 ounces.

Ootacamund,
23rd August 1869.

(signed) W. G. McIvor,
Supt., Govt. Chinchona Plantations.

— No. 64. —

From the Government of Madras to the Secretary of State for India.

My Lord Duke,

IN continuation of our Despatch, dated 7th instant, we have the honour to forward, for your Grace's information, the accompanying Tabular Report on the progress and condition of the Chinchona Plantations on the Neilgherries for the half-year ending 31st January 1870.

Madras, 21 March 1870.

Enclosure in No. 64.

REPORT on the Number, Distribution, and Condition of Chinchona Plants on the Neilgherries, for the half-year ending 31 January 1870.

Species.	Botanical Names.	Commercial Names.	Number of Plants.	Value per Lb. of Dry Bark in the London Market.
1	C. Succirubra - - - -	Red bark - - -	1,215,068	s. d. s. d. 2 6 to 8 9
2	C. Calisaya - - - - Frutex - - - - Vera - - - -	Yellow bark - - -	40,895	2 10 to 7 -
3	C. officinalis: Var. Condaminea - - - Bonplandiana - - - Crispa - - - -	Original loxa bark - - - Select crown bark - - - Fine crown bark - - -	1,183,159 87,509 4,355	2 10 to 7 - 2 10 to 7 - 2 10 to 6 -
4	C. Lancifolia - - - -	Pitayo bark - - -	279	1 8 to 2 10
5	C. Nitida - - - -	Genuine grey bark - - -	2,786	1 8 to 2 9
6	C. Species without name - - -	Fine grey bark - - -	8,500	1 8 to 2 10
7	C. Micrantha - - - -	Grey bark - - -	46,730	1 8 to 2 9
8	C. Peruviana - - - -	Finest grey bark - - -	3,389	1 8 to 2 10
9	C. Pahudiana - - - -	Unknown - - -	425	- unknown.
10	C. Lanceolate leaved variety of C. Officinalis.	- - - -	1,563	- ditto.
11	C. Pitayo, from the seeds sent by Mr. Cross.	- - - -	123	- ditto.
TOTAL Number of Plants - - -			2,595,176	

TABLE showing the Growth of the Different Species of Plants Planted out in the Plantations, for the half-year ending 31 January 1870.

Number of Plants.	Species.	Where Planted.	When Planted.	Maximum Growth.	Average Growth.	Height of the Tallest Tree.	Girth near the Ground.
12	C. Succirubra - - - -	Neddiwuttum -	30th September 1862.	in. 25	in. 15½	ft. 24½	in. 32
12	C. Micrantha - - - -	- ditto - - -	30th September 1862.	19	9½	23½	25
12	C. Officinalis - - - -	Dodabetta -	30th September 1863.	18	10½	18½	13½

TABLE showing the Propagation, Distribution, &c., of Plants and Seeds during the half-year ending 31 January 1870.

Date.	Total Number of Plants Propagated.	Total Number Permanently Planted Out.	Total Number of Plants Distributed to Private Individuals.	Total Quantity of Seeds Distributed.
August 1869 - - - - -	350	4,580	- - -	ozs. 10
September 1869 - - - - -	- - -	- - -	- - -	28
October 1869 - - - - -	- - -	- - -	105	10
November 1869 - - - - -	420	- - -	100	2
December 1869 - - - - -	- - -	- - -	- - -	5
January 1870 - - - - -	129	- - -	50	—
Previously - - - - -	899	4,580	255	55
	2,594,277	1,143,844	178,360	240
Grand Total - - -	2,595,176	1,148,424	178,605	295

REMARKS.—The number of plants permanently planted out in the plantations is 4,580, making the total 1,148,424. This increase by propagation is 899, the monthly average being 150, making the total 2,595,176. The number of plants distributed to the public is 255, giving the total distribution of 178,605. Fifty-five ounces seeds have also been gratuitously distributed, making the total 295 ounces.

Ootacamund,
28 February 1870.

(signed) W. G. M'Ivor,
Superintendent, Government Chinchona Plantations.

— No. 65. —

From the Government of Madras to the Secretary of State for India.

My Lord Duke,

Madras, 21 March 1870.

WE have the honour to forward, for your Grace's information, the accompanying satisfactory report from the Government quinologist, respecting his examinations of the Chinchona barks, &c., together with our proceedings thereon, dated 22nd February 1870.

2. Our proceedings of the 22nd September 1868 and 19th June 1869, referred to in Mr. Broughton's report (paragraphs 3, 5, and 10) were forwarded to the Home Government with our despatches, dated respectively 6th October 1868, and 27th July 1869.

Enclosure in No. 65.

From J. Broughton, Esq., Quinologist to Government, Ootacamund, to the Acting Secretary to Government, Revenue Department, Fort St. George, Ootacamund, 9th December 1869.

THE present condition of the Neilgherry Chinchona Plantations, both absolutely and with reference to the changes that have taken place during the past year, may be aptly discussed in the beginning of this report.

Red bark has increased in yield of alkaloid, 1868-69.

Annual increments are decreasing in amount.

2. Constant examinations of the bark of the oldest part of the plantations of *C. Succirubra* have demonstrated that the amount of alkaloids therein contained has increased during the past year. The amount of this increase has necessarily been determined by the comparative examination of a part only of the plantations conducted at different seasons, and hence a certain error may be committed by applying the definite number thus obtained to the plantation generally. I therefore content myself with stating that the increase in the amount of alkaloids, contained in the trunk-bark of the oldest trees from May 1868 to May 1869, has not been less than 0·5 per cent.

3. In a report, dated 17th August 1868 (Proceedings of Madras Government, Revenue Department, 22nd September 1868, No. 334), I had the honour of stating the *à priori* probability of the annual increment of alkaloid therein mentioned decreasing in amount, till an equilibrium is established between formation and internal consumption. The respective numbers representing this annual increment for the last two years coincide with this view, being 0·75 and 0·5 respectively.

4. The

4. The mean per-centage of quinine has, on the other hand, diminished during the past year among the red barks, as was the case during the previous year. This diminution will be considered below. Analyses, which are believed to fairly represent the mean yield of the bark of the oldest trees, may be stated thus in per-centages of the dried bark.

Quinine has not increased in red bark.

	May 1868.	May 1869.	Mean present yield of red bark.
Total alkaloids - - - - -	6.74	7.43	
„ sulphates obtained crystallised *	6.06	6.48	
Quinine - - - - -	2.40	1.72	
Chinchonidine and Chinchonine - - -	4.34	5.71	
Crystallised quinine sulphate obtained - -	2.21	1.51	
„ Chinchonidine sulphate obtained -	3.85	4.92	

* The numbers express the pure and not the commercial salts. From the crystalline sulphates that of chinchonine is excluded. These observations apply to all analytical statements in this Report.

5. During the past year I have paid much attention to the varieties of *C. Officinalis*, which constitute the "Crown-barks." The varieties we possess of these are far more numerous than are usually recognised by the botanists who have studied Chinchonæ in Europe. With the exception of the very distinct kind (provisionally called *Lanceolata*), whose great excellence I have pointed out on former occasions (Proceedings of Madras Government, Revenue Department, 22nd September 1868, No. 334, paragraphs 12 and 13, and 19th June 1869, No. 422) I can discover no invariable connection between the external appearance and the chemical constitution; while the varieties themselves merge into one another by slight gradations.

C. Officina is.

6. But, on the other hand, the yield of alkaloids varies greatly according to the vigour of growth, size of tree, and consequently with character of soil. The most vigorous and quickly-grown trees yield a far richer bark than the more stunted ones of the same age; while, at the same time, they of course yield more bark. This circumstance strongly indicates the advantage of high cultivation: thus an acre of land planted with trees growing at a doubled rate will yield more alkaloid than two acres of trees growing at the ordinary rate. It is a singular circumstance that the alkaloids should be the constituents most affected by the tree's vigour; as it would seem far more likely *à priori* that all the constituents would be affected in equal proportion. I have some reason for thinking this circumstance is closely connected with the amount of nitrogenous constituents in the soil.

Vigorous trees contain most alkaloid.

7. This variation in the amount of alkaloid, with the size and vigour of the tree (age being constant), renders any numerical estimate of the annual mean increase in the percentage of alkaloids exceeding difficult to obtain. I believe the increase during the past year has been considerable, but feel hardly justified in stating a definite number that would apply to the whole plantation. The diminution in the amount of quinine with age, perceptible in *C. Succirubra*, certainly does not obtain in *C. Officinalis*. To illustrate the great difference in the yield connected with the vigour of the trees, I quote the following results obtained from trees of same age (five years old), each analysis being the mean of several trees:—

Increase during past year.

Analyses showing difference of yield according to vigour.

	Bark from fine Vigorous Trees.	Bark from fine Vigorous Trees.	Bark from Trees of Mean Growth.	Bark from Trees of Stunted Growth.
Total alkaloids - - -	6.76	6.94	4.34	2.40
„ sulphates crystallised -	5.39	5.59	3.60	1.65
Quinine - - - - -	3.76	3.80	2.18	0.90
Chinchonidine and Chinchonine.	3.00	3.14	2.16	1.50
Quinine sulphate obtained crystallised.	3.45	3.55	2.00	undetermined.
Chinchonidine sulphate obtained crystallised.	1.94	2.04	1.60	- ditto.

13. The circumstance of the occurrence of the several alkaloids in the leaves in so definite a manner is one of considerable interest, but as a source of supply it obviously is of no practical value. The state of their occurrence is different to that in which they are found in the bark, and it is laborious and difficult to obtain them in a pure state. The quantity is very small in amount, and certainly gives no support to the impression so often stated as a fact (on slight grounds) that the leaves are an effective febrifuge. According to the above it would take many pounds of leaves to be equal to a dose of quinine.

Leaves of no practical use as source of alkaloid.

14. The leaves contain quinovin, to which they owe their bitter taste. The therapeutic effects of quinovin are under trial by the medical department.

Quinine in leaves

15. In the original instructions I had the honour of receiving from the Home Government, I am directed to investigate the blossoms of chinchona for alkaloids, &c. This has been done. The beautiful and scented blossoms contain no alkaloid, but a considerable amount of quinovin. The act of flowering does not appear to have any direct influence on the amount of alkaloid in the bark—a point on which I have made a careful inquiry—though it is by no means unlikely that blossoming has an indirect effect on the seasonal changes which I discuss below.

Blossoms of Chinchona.

16. In fulfilment of G. O., Revenue Department, 16th January 1869, paragraph 2, I have continued the examination of the wood for alkaloids. I find the wood of *Officinalis*, when dried, to contain 0·0101 per cent. of total alkaloids, of which 0·004 was quinine. This wood does not appear to be of any account as a source of alkaloid; it contains not a tenth of the amount found in the wood of *C. Succirubra*. The wood of *Officinalis*, unlike that of *C. Succirubra*, is very hard and dense, and may hereafter be found of value.

Wood of *C. Officinalis*.

17. Several remarkable kinds, which are now engaging my attention, have appeared on the plantation. I have many reasons for thinking they are really *hybrids*. None of them which I have examined appear to yield bark of special excellence, but the subject is nevertheless one of great importance, and merits a thorough study.

Occurrence of hybrids.

18. As the age of the various barks increases they lose less weight on drying. Hence, the fresh bark is more productive than it was, from another cause besides the increased percentage of alkaloid in the dried bark.

Amount of moisture in barks decreases with age.

19. In 1867 the oldest red bark contained 73 per cent. of water, and the crown barks 69 per cent. They now contain an average of 68 and 64 per cent., respectively. This progressive alteration is what might be expected, and will doubtless continue to take place for many years to come.

20. I have had many opportunities of examining barks grown in the various parts of India on private and Government plantations. In almost every case the quality has been satisfactory. The *C. Succirubra* appears to flourish almost everywhere, and to produce a bark containing abundance of febrifuge alkaloids. Generally speaking, I find the barks somewhat thinner than those of a similar age on the Government Neilgherry plantations, and yielding rather less quinine and more colouring matter and resin, qualities doubtless resulting from the less elevated sites of their growth. The crown barks appear to enjoy less favour with cultivators; but the few specimens I have received have always been of good quality.

Good quality of India Chinchona barks generally.

21. The satisfactory quality of the bark of *C. Succirubra* in all South India localities, where the tree will grow at all, appears to be certain; and this statement may in all probability be still further generalised.

MODE of Drying the BARKS.

22. The greater part of the inquiries given in this and foregoing reports have been concerned with the chinchona barks in the fresh green state. I have already in other reports adverted to the advantages that are experienced by dealing with the bark in its natural state. The labour of drying and powdering, preparatory to the extraction of the alkaloids, is avoided; and in addition to this, from the softness of the tissues, the alkaloids are obtained in a state of solution with greater ease and less expenditure of acid. I estimate the saving from the latter cause at rather more than one-fourth.

The fresh bark is preferable to the dried.

23. The best means of drying the bark so as to preserve, as far as is consistent with economy, the contained alkaloids from alteration, is one of the points which I was directed by the Home Government to investigate. I have therefore, during the past two years, at various times conducted experiments with this end, both with the red and crown barks. It would be tedious if I were to quote the whole of the numerical results on which I base the conclusions; but in the Appendix to this report I cite certain of them which indicate sufficiently the influence of the various modes of drying upon the subsequent yield of alkaloids, as determined by analysis (Appendix A.).

Experiments made to determine best mode of drying.

24. The modes of drying that I have studied are (1), spontaneous drying in vacuo; (2), drying in a stream of air at about 36°—45° C;* (3), direct exposure to sunshine; (4),

Principal possible methods drying

* These methods were necessarily examined for the sake of comparison.

drying at a steam-heat, which at Ootacamund is about 96° C. The results were compared with those obtained with the fresh bark.

Effects.

25. The results show that the fresh bark gives a larger yield of crystalline sulphates than that artificially dried, though the difference is usually but slight. If the drying be quickly conducted at ordinary temperatures, as *in vacuo* over lime or sulphuric acid, the effect on the barks is not prejudicial. This is also the case with drying in a stream of warm air. The former conditions are not readily obtainable in practice, and from the cost can in no case be applied. It would, however, not be difficult to devise a system whereby the bark could be dried by a current of artificially warmed air; but the trouble and cost would, I think, under present circumstances, render it unadvisable to adopt such a process if it can be avoided.

Proportion of quinine not altered by drying the bark.

26. The processes of drying were each carefully tried also, in order to ascertain whether the proportional amounts of quinine and chinchonidine were affected by the methods employed. They were found not to be appreciably altered; and hence, in subsequent trials, the amount of total crystalline sulphates obtained was employed as the standard of comparison of the various modes.

General conditions to be fulfilled in drying.

27. The general conditions to be fulfilled in drying the bark, as indicated by the results, are, to dry it at a low temperature, as quickly as possible, and without prolonged exposure.

A steam-heat frequently injurious to the bark.

28. A high temperature, or even merely a steam-heat, is generally prejudicial to the bark from a remarkable reason. The alkaloids are associated in the bark with a peculiar tannin, the so-called quino-tannic acid. This, under moderate heat, absorbs oxygen, and unites with the alkaloid to form a compound, which frequently is decomposed with great difficulty by acids. Hence, when such bark undergoes the ordinary manufacturing process, a part of the alkaloid does not get into solution; and thus a practical loss takes place from the imperfect exhaustion of the bark. This effect of heat occurs in different degrees, being sometimes very marked, and at other times in but small amount. It is singularly apparent in those crown barks which abound in colouring matter, especially in var. *crispa*, and was a source of much confusion until the cause was ascertained. Thus a sample, which when green yielded 3.52 per cent. of alkaloid, after two days' exposure to a steam-heat, gave but 1.92 per cent. The loss appears to affect all the alkaloids equally. That the above explanation is really the true one has been demonstrated by special experiment. Again, if bark be exposed to a temperature much exceeding 100° C., the alkaloids become altered, and lose their property of crystallisation, so that the bark becomes worthless. The foregoing reasons, therefore, exclude artificial heat as a general method for drying the bark.

A high temperature alters the alkaloids.

Sunshine also injurious to Chinchona bark.

29. M. Pasteur has stated on deductive grounds that the drying of chinchona bark in the sun is injurious. I have abundantly corroborated the general truth of this statement.* But to render the change clearly apparent it requires a certain exaggeration in the conditions, such as prolonged insolation, or else exposing the bark in a divided state in order to have an increased surface of action. If this be done a decrease of a half per cent. in the amount of crystalline sulphates obtainable from the bark takes place. If the bark be exposed to sunlight, and at the same time evaporation is checked (as in a box covered with glass), the decrease becomes very marked. If shred bark be allowed to remain a fortnight exposed to the sun in the Neilgherries, the decrease amounts to one per cent.

Bark may with care be dried in the sun.

30. But as the injurious action of sunlight is comparatively slow, and as bark dries rapidly under the fierce sun and dry rarefied air of the Neilgherries, it is not difficult to manage so that, while the action of the light is reduced to a minimum, the conditions of short exposure and moderate temperature may be fulfilled.

Cannot be dried during the south-west monsoon.

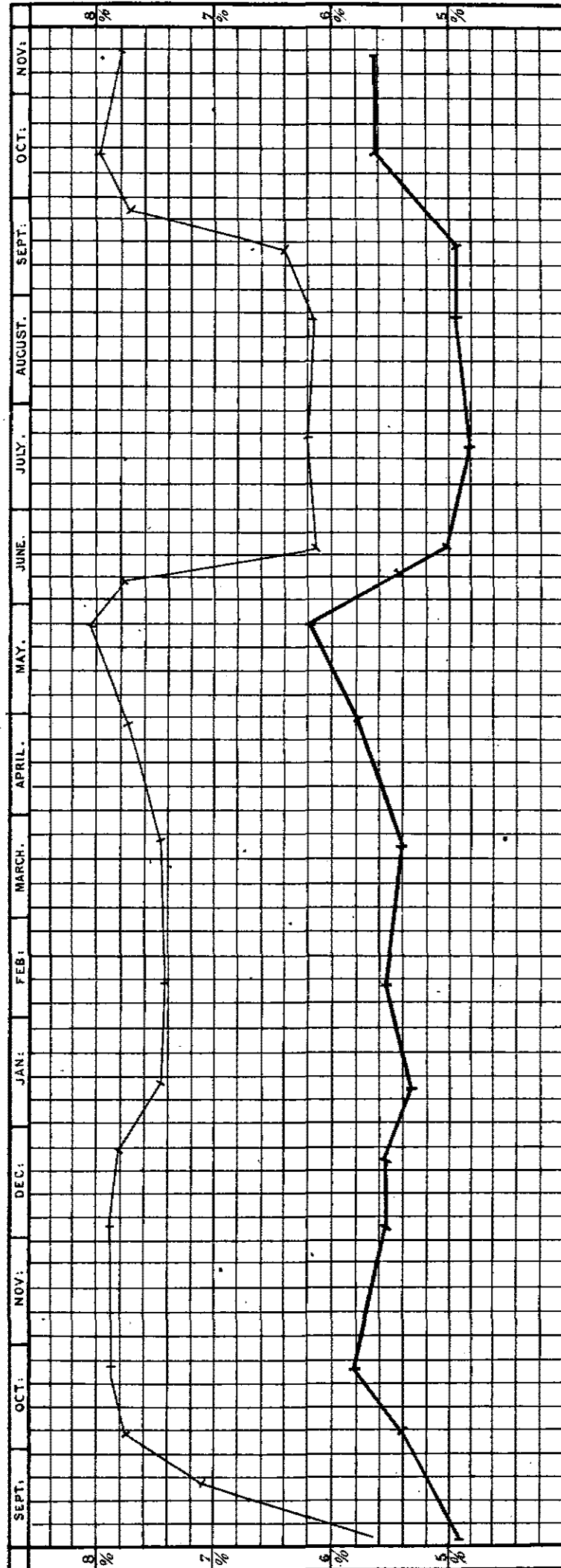
31. If recourse be not made to artificial heat it is scarcely possible to dry bark during the south-west monsoon on these hills. But the quality of the bark (as I shall show hereafter) will render any extensive harvesting of bark during that season unadvisable. I feel therefore justified on all grounds in recommending that the bark of the Government plantations should be dried by natural means only.

Precautions.

32. I have repeatedly satisfied myself that if due care be exercised, the bark may be dried and prepared for export without appreciably deteriorating from the quality it possessed in its fresh state. The precautions to be taken are simple; the bark must be in as large pieces as possible (in order to expose a proportionally small surface), frequently turned, and so managed as to be as short a time exposed as possible. From January to the end of March, when the atmosphere is very dry, bark could be dried on stages one above the other, so as almost entirely to avoid exposure to sunlight, in which case no deterioration of quality is possible. Under other circumstances, unless the exposure to sunlight be carelessly prolonged, the alteration in quality is practically imperceptible.

33. Long

* I have been requested to analyse bark which I found subsequently to have been baked in order to dry it. It was of course entirely spoilt.



33. Long keeping of the bark in an undried or partially dried state impairs its appearance when subsequently dried. But under such circumstances the quality of the bark is affected to a much less degree than is generally supposed, provided it be not exposed to sunshine. I find by direct trial that bark may be kept more than three weeks without in any degree yielding an inferior amount of alkaloids on analysis. If it be kept six weeks and become mouldy, a deterioration becomes apparent; but it is slight, amounting in my trials to about 0.40 per cent. The alkaloids appear in such circumstances to be very permanent substances, and remain almost unaltered; while other constituents, such as quino-tannic acid, chinchona red, etc., are greatly changed. Even after three months' keeping in a moist place, during which time fermentation, accompanied with spontaneous heating, took place, I found that at least two-thirds of the original amount of alkaloid was to be obtained from the mouldering mass. In very singular contrast to this is the fact that quinine and chinchonidine are not to be found in the bark of trees that have been dead a short time.

Permanence of the alkaloids.

34. The above facts show that, with ordinary management, there is but little risk of deterioration during the harvesting of the bark, provided the simple principles indicated above are kept in mind.

35. Bark carefully dried, kept in a dry state, and analysed at the expiration of six and nine months, respectively, has given me no indications of any deterioration or change whatever. Hence, bark can be exported without loss of quality.

Bark does not perceptibly alter when dry.

36. The above facts appear to furnish answers to the questions which are likely to arise regarding the preparation of bark for exportation. When the drying of bark is carried on with large quantities, it will of course be useful to ascertain the exact effect of the above principles under the special circumstances.

INFLUENCE OF THE SEASONS.

37. The influence of the seasons on the amounts of alkaloid in the bark of the living Chinchona trees is a subject which merited a full inquiry for several reasons. The best time of the year for collecting bark depends on the time of maximum yield. The knowledge of the variations in the amount of the alkaloids under the influence of external circumstances tends to throw light on those conditions of their occurrence on which the possibility of controlling their formation depends. As soon therefore as I possessed means for the investigation of this question, I commenced a series of inquiries. But the subject was found one of considerable difficulty. After nine months' continuance of a series of periodic analyses, I felt some reason to doubt whether my plan of investigation was calculated to exclude disturbing circumstances, some of which might be unknown. I therefore felt it necessary to begin the inquiry afresh; which was accordingly done, with the advantage of knowing the general direction to which the more precise results might be expected to lead.

Importance of inquiry.

Difficulties.

38. A set of six trees was selected from the oldest part of the plantation. A narrow strip of bark was taken from each, and the mean average sample thus obtained was analysed. This was done periodically throughout the year. The strip being but a very small portion of the whole trunk, its loss would not affect the natural changes which take place in the whole. Except at the latter end of the dry season the bark rapidly renewed itself. As a means of safety and control another set of six trees was selected whose bark had the average quality of the first six. From these at various times bark was also taken in order to verify and to complete the results obtained.

Method adopted.

The changes in composition observed agreed satisfactorily with other observations, and corroborated those which the former inquiry had shown to take place. The means of checking employed preclude the idea of any other cause seriously influencing the results. I therefore report them, with the conviction that they express with fair accuracy the variations in yield of the bark according to the seasons of the year. As a criterion I place most stress upon the amount of total crystallized sulphates, since that upon the whole is the truest standard of the commercial and practical value of the bark.

39. In order to render the bearing of the results more obvious to the eye, they may be conveniently given in a graphical form. The diagram* in which the ordinates of the respective curves represent per-centage amounts, and the abscissæ the times, expresses the seasonal changes, and render apparent the numbers which may be obtained by interpolation.

Curve best expresses results.

* See Lithograph opposite.

The thin line expresses the total alkaloids.

The thick line expresses the total crystallized sulphates.

The unit of measurement of the abscissæ is one week.

40. The curves show two "singular points" which are periods of maximum yield. One occurs in October, and the other in May, or nearly at the opposite seasons, or shortly before the beginning, and shortly after the cessation of the south-west monsoon. The ascent and descent of the sap are less marked in Chinchona than in the trees of more temperate climates; but there is a connection

Discussion of diagram.

tion between the maxima and the latter processes. The period at which the bark is richest in alkaloids that yield the largest amount of crystalline sulphates is during the month of May.

Consequences. 41. The above curve shows a very marked decrease in the amount of alkaloid during the monsoon months, so that it is during the dry season that the operations of cropping, &c., must be conducted. During that time not only is the bark better in quality than during the monsoon, but it is more conveniently dealt with. The exact periods of maximum yield do not indeed occur at the most convenient seasons; but the amount of alkaloids during the greater part of the winter (if it can be so called) does not greatly differ from the maximum yield. There appears to be no practical reason why a compromise should not be made between slightly opposing grounds of quality and convenience, and why the wide period between November and May should not be that of bark harvest. It is, however, probable that this period must be shortened on other grounds, since the bark at the latter end of the dry season separates with difficulty from the wood. It will always be a loss to collect bark in any quantity during the monsoon.

Time of harvesting.

Branch bark. 42. The branch bark appears to share in the progressive changes that are undergone by that of the trunk.

Seasonal changes in C. Officinalis. 43. Circumstances have scarcely permitted a similar investigation being conducted with the crown-bark trees. The few observations I have made appear to show that those grown at Neddiwuttum vary in yield in a similar manner to their red bark neighbours. The crown-barks of the Dodabet Plantations certainly show a less marked diminution in their yield during the rainy season than the red barks at Neddiwuttum. This is probably a consequence of the climate being not so sharply divided into a very rainy and very dry season as it is at the latter place.

Variations tend to a minimum. 44. I have considerable reason for believing that the variations in the amount of alkaloids in the bark at various seasons become less marked as the trees grow older. During the first year of my acquaintance with the plantations I found somewhat greater differences in yield between the barks collected during the dry and rainy seasons than the above diagram indicates. This is what might be expected, since the older tissues take a less active share in the vital processes of the plant, than those more recently formed. With increasing age and thickening bark it follows that there is more and more tissue which remains comparatively quiescent, and thus prevents the variations in the younger portions from affecting the gross yield to so great an extent.

CONDITIONS upon which Depend the Amount of QUININE in the CHINCHONA BARKS.

Order in which alkaloids are formed. 45. The alkaloid, which first appears in the bark, is one which has all the properties of quinine, except that of yielding crystalline salts. It is found in very young plants, and in considerable quantity in the freshly formed bark which replaces the loss of strips of original bark, when the latter is removed without injury to the cambium. It forms, indeed, nearly the whole of the alkaloid that is to be found in renewing bark. As time goes on the alkaloid acquires the property of crystallization, and is then quinine. Chinchonidine does not appear in any quantity till a later stage. This is no hypothesis, but the conclusion from many concurrent observations. For example, I may cite the following series of analyses of bark of C. succirubra for the first 17 months of its natural renovation, without any artificial protective :—

	I.	II.	III.	IV.	V.
	Four Months.	Six Months.	Ten Months.	Fifteen Months.	Seventeen Months.
Total alkaloids - - - -	4.30	5.3	5.03	6.00	5.47
Quinine - - - - -	4.20	4.4	4.02	3.03	3.65
Chinchonidine and Chinchonine -	0.10	0.9	1.01	2.97	—
Sulphate of quinine obtained -	0.25	1.56	2.20	2.30	3.12
Sulphate of Chinchonidine obtained -	none -	- - -	- -	1.13	1.24

46. These results leave no doubt that quinine is the alkaloid first produced. The gradual acquirement of the property of crystallization with the increase in the amount of chinchonidine is also clearly shown. The order in which the alkaloids are formed in the cells of new and rapidly forming tissue are, uncrystallizable quinine, ordinary quinine, and chinchonidine. Chinchonidine is also formed at a late stage. Quinine first formed.

47. It is thus scarcely possible to resist the conclusion, that it is in this order they are actually formed in the plant. Since the amounts of the first-formed alkaloids diminish, and are replaced by others as age increases, an actual conversion of one into the other is at least a legitimate hypothesis. Actual conversion probable.

48. Though I have never yet succeeded in converting quinine into chinchonidine or *vice versa* by artificial means, the intimate relationship and close resemblance of the two substances taken in connection with appearance of the latter in increasing amounts with the increasing age of the bark, lead me to consider it in the highest degree probable that chinchonidine is formed in the tree by the progressive alteration of quinine, and not as an independently formed substance. There are further corroborations of this view on quite other grounds. Chinchonidine due to alteration of quinine.

49. It is remarkable among the crown barks that the most rapidly growing trees are richest in quinine, and contain but a comparatively small amount of chinchonidine. If there be trees which, while quite healthy, are stunted in their growth, and in a quiescent state, such trees are almost sure to be poor in quinine and rich in chinchonidine. Rapid growth favourable to the occurrence of quinine.

50. All the Chinchona alkaloids are altered in composition by long exposure to light, but in different degrees. The salts of quinine are particularly sensitive. It is well known that samples of sulphate have to be kept in a shaded or dark place, or else they become discoloured.* Sunlight inimical to quinine.

51. I am by no means justified, by direct evidence, in stating that quinine is converted in the living tree into Chinchonidine by the action of light; but it seems certain that such conversion is greatly expedited by that agency. Trees, whose bark has been long exposed to sunshine, and whose growth has been sluggish, always contain the largest proportion of the latter alkaloid. Sunlight appears to encourage formation of Chinchonidine.

52. The above observations apply to *C. succirubra* and *C. officinalis* and their varieties. I am strongly inclined to believe that the chemical changes, connected with the occurrence of alkaloids, are identical in the various species, and differ only in degree.

FORM in which the ALKALOIDS Occur in the LIVING BARK.

53. The state of combination in which the alkaloids occur in the living bark has not hitherto been known with certainty. As this is a point of great importance, from its bearing on the chemistry of the formation and functions of the alkaloids, I have endeavoured to ascertain it as completely as possible. As this is scarcely the place in which to detail the methods employed in the investigation, I merely state the results. State of combination in which the alkaloids occur.

54. In the bark of *C. succirubra* four-fifths of the whole amount of the alkaloids are contained in the *solid* state within the tissues (most probably, almost exclusively in the parenchymatous cells) of the bark in combination with quino-tannic acid. These alkaloid tannates are but slightly soluble in cold water, more soluble in hot, but are quite insoluble in the surrounding plant juices. They thus cannot be very active constituents. They are, in all probability, the stored alkaloids of the bark, of which only a small portion at the most shares in the changes incident to growth. When freshly taken from the plant the substance has a grey colour; but rapidly absorbs oxygen from the air, and becomes of a dirty red tint. This substance has all the appearance of the artificially prepared quino tannate, and is, as mentioned above, liable when dried at 96° C. to pass into a state in which the alkaloid is separated with great difficulty. The remaining one-fifth of the alkaloid is in solution in the juice of the bark. It is there associated with quino-tannic acid, quinic acid, and probably also another acid, which exists in small quantity. As the tannic acid present in the juice is simply sufficient to form a tannate with the whole alkaloid present, it seems probable that the juice contains the alkaloids also in form of tannate, held in solution by the free acids. As determined by immediate experiment.

55. Quinovin is a less abundant constituent than the alkaloids. It is to be detected in the clear juice in very small quantity, but is mainly to be found in the solid cell-contents. As the combination of quinovin with the alkaloid is so readily destroyed by acids, it appears almost certain that the quinovin is in the free state. Occurrence of Quinovin.

56. A speculative opinion has been long held concerning the functions of the vegeto-alkaloids in the plants producing them, whose importance is so great that its practical verification Current notions concerning the functions of the alkaloids.

* A slight admixture of chinchonidine sulphate renders it far less easily affected. A specimen of quinine sulphate containing five per cent. of chinchonidine salt retains its whiteness, while a pure specimen becomes brown when exposed to the same circumstances.

verification or contradiction is almost necessary to the scientific cultivation of those plants. This hypothesis is mainly due to Liebig, and dates as far back as 1840, and since that time has continued to rest on little else than speculative grounds.

Application of Liebig's "Mineral Theory."

57. It is believed that the alkaloids are the substitutes for the mineral bases which are the constituents of all plants, and which constitute the larger portion of the ash obtained when the plants are burnt. The alkaloids possess the same general properties as these mineral bases; they completely neutralise acids; and comporting themselves in so chemically similar a manner, it is thought that their functions were identical, and that certain tribes of plants were enabled to produce actual substitutes for these necessary bases, which are frequently meagrely furnished by the soils in which they grow.

Applied to the Neilgherry Chinchona.

58. The simplicity and beauty of this hypothesis has always rendered it, in the absence of more precise information, a favourite one. On my first acquaintance with the living Chinchonas (*par excellence* the alkaloid-producing plant) there were several circumstances which seemed to show its truth. Among these were the exceptionally large yield of alkaloids in the Neilgherry Chinchonas, combined with singular poverty of the soil of the Neilgherries in lime—a base which is the main constituent of the ash of most plants. These circumstances led me to institute a series of experiments in which the amount of organic bases was compared with the amount of ash yielded by the same bark. This has been carried on with all the species of Chinchonas, and under all the diversity of conditions I could devise. During the last two-and-a-half years upwards of seventy determinations have been made with this object.

Experimental evidence adverse to the above hypothesis.

59. The results have convinced me that the relations of the organic to the mineral bases is by no means so simple as the hypothesis assumes. The contradictions are numerous. Trees growing under similar circumstances may have the same amount of mineral constituents, while the organic bases are as 1 : 2. The general distribution of the mineral bases is quite similar in Chinchona to that which obtains in other trees yielding no alkaloids; and, what is still more important, I find that trees grown for two years in a soil made artificially calcareous have not shown any difference, either in their yield of alkaloid or amount of ash.

The substitution for mineral bases, either untrue or very partial.

60. But there are several cases in which the amount of organic bases do really show a tendency to appear in the inverse amounts, which would result from a mutual substitution. These cases occur, however, in an incoherent manner, and can frequently be explained satisfactorily on quite other grounds. I am therefore compelled to believe that the physiological equivalence of function attributed to the organic and inorganic bases, is either untrue or much more partial than is assumed to be the case in this application of the "mineral theory." I do not, however, propose to abandon the subject, since collateral points remain which require thorough investigation. During these inquiries I have received valuable help from Mr. C. Dawson, the Assistant Superintendent of the Neddiwuttum Plantations, which are the most advanced. I therefore take this opportunity of acknowledging my obligations to his knowledge of the details of the present and past operations under his charge, and for the active and intelligent assistance I have constantly received.

APPENDIX A.

THE following results form a portion of the grounds upon which the conclusions in the Report are based, and are here quoted for the sake of illustration. A quantity of the bark finely shred was submitted to the various methods of drying. The various amounts of alkaloid and crystalline sulphates are given in the following table; A. being the amounts yielded by the fresh bark:—

Red Bark.

	A.	Dried at 17°C. in vacuo.	Dried at steam-heat.	Dried in current of air at 35°-45°C.	Dried in sunshine.	Dried in sunshine slowly.
Total alkaloids - - - -	6.89	6.67	5.92	6.64	5.90	5.85
Crystalline sulphates obtained - -	6.12	5.96	5.31	5.89	5.28	4.78
Comparative amounts of acid required to neutralise the alkaloids - -	13.2	13.1	11.8	13.1	12.0	11.6

Mixed Crown-barks.

	A.	Dried at 17°C. in vacuo.	Dried at steam-heat.	Dried in current of air at 35°-45°C.	Dried in sunshine.	Dried in sunshine slowly.
Total alkaloids - - - -	3.93	3.92	3.52	3.65	3.63	3.04
Crystalline sulphates obtained - -	3.67	3.52	3.01	3.50	3.11	2.88
Comparative amounts of acid required	7.2	7.0	6.6	6.6	6.7	5.9

The amounts of crystalline sulphates obtained were adopted as the most accurate numerical standard of comparison.

APPENDIX B.

THE remarkable effect produced in some barks by exposure to a temperature of boiling water with access of air is shown by the following analyses of the same bark. In A. analysed while fresh; in B. after three days' exposure to a steam-heat:

	A.	B.
Total alkaloids - - - - -	3.62	1.93
Quinine - - - - -	2.48	1.03
Chinchonine and Chinchonidine - -	1.04	0.90
Quinine sulphate obtained - - -	2.46	0.88
Chinchonidine sulphate obtained - -	0.66	0.56

The peculiar insoluble compound which gives rise to the above apparent loss of alkaloid is decomposed by the action of alkalis, and the missing alkaloid can thus, in great part, be recovered. Nearly all acid extracts of Chinchona barks, if evaporated to dryness at a steam-heat, undergo a similar change. Certain methods occasionally employed in the analysis of Chinchona barks (such as that known as Wöhler's) yield inaccurate results from this cause.

(signed) Kristniengar.

— No. 66. —

From the Secretary of State for India to the Government of Madras.

My Lord,

India Office, 19 May 1870.

Para. 1. I have received and considered in Council your Excellency's Despatches in the Revenue Department, dated 7th March and 21st (Nos. 5, 7, and 8) of 1870, transmitting two reports of the progress and condition of the Chinchona plantations on the Neilgherry Hills, and Mr. Broughton's report on his examination of Chinchona barks.

2. Mr. Broughton, by a series of careful and judicious analyses which are most creditable to him as a scientific chemist, appears to have arrived at practical results respecting the more important questions relating to Chinchona cultivation, namely, the best conditions of growth, the time for harvesting, and the mode of drying the bark.

3. Upwards of a million plants are now permanently planted out in the Government plantations, some of which are 25 feet high and 32 inches in girth. The time, therefore, seems to have arrived for your Government to adopt some systematic course with reference to utilizing the very large quantity of febrifuge alkaloids which is now stored in the bark of these trees. I am of opinion that this subject should receive consideration from your Government at an early date, and that, in consultation with Mr. Broughton and Mr. M'Ivor, a regular system of procuring and utilizing an annual harvest of bark should be commenced and developed as further experience is acquired in future years.

4. The plantations will require thinning from time to time, and strict injunctions should be given that no bark, not even that of the smallest twigs, should be wasted. The bark which is useless for the extraction of quinine is valuable as a febrifuge for the use of coolies, in the form of a decoction or infusion. But a certain number of larger trees must now be annually in a sufficiently advanced stage of growth to yield bark suitable for the extraction of alkaloids. It will be a point for your decision whether this bark should be used in the manufactory at Ootacamund for the supply of hospitals in India, or be sent to the London market, or whether a portion should be sent home, and a portion worked up on the spot.

5. In considering the course to be adopted with reference to the Government plantations, the question will arise whether they should remain permanently in the hands of the Government for the supply of quinine in the hospitals, and the distribution of seeds and plants throughout India, or whether they should eventually be disposed of, as in the case of the Government tea plantations. If the latter course appears preferable, it will be necessary to decide at what stage of its development the connection of Government with the enterprise should cease.

6. In considering this important subject, many other points will arise, which I am not in a position to specify, but I trust that the whole question, in all its bearings, will receive full consideration from your Government, and that your conclusions may be communicated to me in time to allow of a regular system being adopted for the ensuing year.

I have, &c.
(signed) *Argyll.*

— No. 67. —

From the Government of Madras to the Secretary of State for India.

My Lord Duke,

Ootacamund, 25 July 1870.

ADVERTING to your Despatch, dated 9th December 1869, we have the honour to transmit herewith a report from the Government Quinologist on the properties of the forest-tree "*Hymenodictyon excelsum*."

2. Mr. Broughton's experiment shows that the bitter principle inherent in the bark of this tree is identical with "*æsculin*," which is also obtained from the horse-chesnut tree, but is of little or no therapeutic value where the alkaloids of Chinchona are procurable.

We have, &c.
(signed) *C. Napier,*
W. A. McCleverty.
A. J. Arbuthnot.
J. D. Sim.

Enclosure in No. 67.

From *J. Broughton*, Esq., Government Quinologist, Ootacamund, to the Acting Secretary to Government, Revenue Department, Fort Saint George, 6th June 1870:—

CERTAIN chemical researches which I have made on an indigenous febrifuge have just been completed. I herewith beg to communicate the broad results of the inquiry according to G. O., No. 241, of 22nd January 1870.

2. The large forest-tree "*Hymenodictyon excelsum*" is a native febrifuge of considerable interest, not so much from its proved efficacy in medicine as from its history and botanical relations. It belongs to the same natural order as the true Chinchona, and it so greatly resembles them in appearance that it was named for many years *Chinchona excelsa*. Being thus considered a Chinchona indigenous to India, very considerable expectations were entertained that it would be found at least a most valuable febrifuge, if not an actual source of quinine.

3. Writers on Indian *Materia Medica* allude in doubtful terms to the bark of this tree.

4. Ainslie, speaking of the various substitutes that had been recommended for Peruvian bark, mentions the bark of *Chinchona excelsa* as having been ascertained to possess powerful tonic and antifebrile virtues.

5. O'Shaughnessy* speaks of the bark as follows:—

"The two inner leaves of the bark possess great bitterness and astringency; the bark is used by tanners, and also as a medicine among the Hindoos in cases requiring astringents.

"We have analysed the bark of *Chinchona excelsa* from the Botanic Gardens of Calcutta, but could not detect any alkaline ingredient: nevertheless, the trees of hilly regions may furnish the valuable desideratum. The stamina being contained within the tube affords much ground for expecting the discovery of a febrifuge alkaline in this species.†"

The writers of the New Indian Pharmacopœia mention the bark as follows:—

"Considering the natural order to which the tree belongs, and the sensible properties of its bark, it is not improbable that it may prove a valuable remedy. In all future inquiries into the subject of Indian anti-periodics, this bark should be one of the first to which attention should be directed."

6. These circumstances, therefore, led me to make a full investigation of the chemical constituents of the bark, in the hope that I might be fortunate enough to discover a proximate principle, whose constitution might perhaps throw light on that of the true Chinchona alkaloids.

7. By the kindness of Lieutenant Colonel Morgan, Deputy Conservator of Forests, I obtained a supply of the fresh bark from the neighbourhood of Mudumullay in Wynaad. The bark possesses the remarkable property of being bitter when quite fresh, but of this bitterness diminishing on keeping, so that after a few days it has so decreased that the bark becomes nearly tasteless.

8. After much labour I was enabled to obtain the bitter principle in a pure crystalline state. A full examination and analysis of this substance showed me that it was identical with æsculin, the fluorescent and crystalline principle of horse-chesnut bark discovered by Frischmomm, and subsequently analysed by Fromsdorff in 1835. The chemical details of the investigation and the data for this conclusion are scarcely suitable for detail here. They are to be found in the "*Pharm. Journal*," vol. ix., p. 418.

9. It is a somewhat singular circumstance that the bitter principle of this Indian tree should be the same as that of the horse-chesnut. It is also remarkable that the bark of the latter has obtained a certain reputation of being like the *Hymenodictyon* in India, a
good

* "*Bengal Dispensatory*," 1842, pp. 394, 395.

† I may mention that this structure of the flower does not appear to be coincident with any special excellence in the bark of the Chinchonas of the Neilgherry Plantations.

good substitute for Chinchona bark. Lindley and other authors mention that it has been recommended as a valuable febrifuge in intermittents.

10. The very general impression that this Indian false Chinchona contained quinine receives explanation from the properties of æsculin. The solutions of this substance, like those of quinine, are fluorescent, and are even more beautifully so. An observer, who did not examine the other very dissimilar re-actions of the two substances, might thus be misled by the coincidence of so peculiar a property.

11. The loss of bitterness undergone by the bark on keeping is now also readily explained, since æsculin in contact with decaying organic substances is decomposed, and produces a comparatively insoluble substance, *æsculetin*, which has but a slight bitter taste.

12. Being informed that there were certain differences in the *Hymenodictyon* of South India, and that of the mountain ranges of Bengal, I was desirous of testing the latter before communicating my results as being perfectly general. By the kindness of Mr. C. B. Clarke, I was supplied with some bark of the original *Hymenodictyon* bark of Roxburgh from the Calcutta Botanic Gardens. This enabled me to prove that there was no essential chemical difference in the bark of the Bengal tree and that from South India.

13. The bark of *Hymenodictyon excelsum* thus differs entirely in its chemical character and products from Chinchona bark. Containing no trace of quinine or related alkaloid, the expectations once entertained of its medicinal value appear to have little support in fact.

14. As æsculin will eventually be both a dearer and less plentiful product in this country than the alkaloids of Chinchona, and is certainly of inferior therapeutic value, it appears to me to be scarcely necessary to make any medical trials with it. Should it, however, be thought desirable to do so, I shall of course be ready to supply the necessary material in a pure state.

ORDER of the Madras Government, 30th June 1870.

Mr. Broughton's experiment shows that the bitter principle inherent in the bark of the tree "*Hymenodictyon excelsum*" is identical with "æsculin," which is also obtainable from the horse-chesnut tree, but is of little therapeutic value where the alkaloids of chinchona are procurable.

2. The report of the Government Quinologist will be communicated to the Supreme Government and to the Inspector General, Indian Medical Department, and a copy of it will be transmitted to the Secretary of State.

— II. —

CHINCHONA CULTIVATION AT DARJEELING AND IN BRITISH BURMAH.

— No. 1. —

From the Government of India to the Secretary of State for India.

My Lord,

Simla, 31 May 1866.

THE committee appointed by our resolution of the 24th March 1866 (copy enclosed) for the analysis of Chinchona alkaloids, as desired by Sir Charles Wood (in his Despatch of the 30th September 1865), have reported that the quantities of the alkaloids received from England "are quite insufficient for the purpose of a full investigation of their properties in all the important stations of this Presidency"; and suggest "that a further supply of not less than 24 pounds of each alkaloid (sulphate) be indented for from England."

Letter from Secretary to the Commission, No. 5, dated 11th May.

2. We shall feel obliged by your directing early compliance with the committee's suggestion.

We have, &c.

(signed) *John Lawrence,*
H. S. Maine,
W. Grey,
G. N. Taylor,
W. N. Massey,
H. M. Durand.

— No. 2. —

From the Secretary of State for India to the Government of India.

India Office, 17 October 1866.

WITH reference to your Despatch, dated May 31st, 1866, reporting that a committee has been appointed for testing the relative efficacy of the Chinchona alkaloids other than quinine, and requesting that 24 lbs. of the sulphates of each of these alkaloids may be supplied, I have to inform you that the quantity specified has been ordered from Mr. Howard, and that it will be shipped from Calcutta as soon as it is received at the stores department of this office.

2. I herewith transmit 20 copies of a pamphlet by Dr. Gustave Planchon on Peruvian barks, which has been translated from the French. Copies should be supplied to Dr. Anderson and Major Nassau Lees, as well as to the members of the committee on Chinchona alkaloids, and to any other persons who may be interested in Chinchona cultivation.

His Excellency the Right Honourable the
Governor General of India in Council.

— No. 3. —

From the Government of India to the Secretary of State for India.

My Lord,

Simla, 10 October 1866.

From Government
of Bengal, No. 4108,
dated 25th September
1866, and Enclo-
sure.

IN continuation of our letter No. 58, dated the 26th July 1865, we have the honour to transmit the accompanying report by the superintendent of the Botanic Gardens on the cultivation of Chinchona at Darjeeling, from the 1st April 1865 to the 31st March 1866.

We have, &c.

(signed) *John Lawrence,*
W. H. Mansfield,
H. S. Maine,
W. Grey,
W. N. Massey,
H. M. Durand.

Enclosure in No. 3.

REPORT on the Cultivation of Chinchona at Darjeeling, from the 1st April 1865, to 31st March 1866, by *T. Anderson, Esq., M.D.*, Superintendent of the Royal Botanical Gardens, Calcutta.

I AM glad to be able to report that the cultivation of Chinchona at Darjeeling has, during the past year, been attended with the greatest success. The experience gained since the cultivation has been carried on, on the site where the plants are to grow permanently, has enabled me to fix confidently the elevation between which the species can be grown.

The meteorological observations made since January 1865 have afforded valuable information when taken in connection with the condition of the Chinchona plants growing at the five different elevations at which the observations have been made.

The rapid extension of the open air plantation has been secured by separating a large number of plants of each species as the stock from which the plants to form the plantation are procured. The cuttings of *C. succirubra* and *C. officinalis* now obtained, are grown solely for the purpose of planting in the open ground, and no cuttings are made from them. Thus as healthy and vigorous plants are obtained as can ever be yielded by artificial propagation.

The progress of the cultivation and the advances made during the year, will be understood by an account of the stages through which the plants pass before they are finally disposed of by planting in the permanent open air plantations. From the stock plants of each species which are planted in the soil in low glazed wooden frames, a crop of cuttings is obtained monthly during the cold and dry periods of the year and twice a month, from May till October. These cuttings, prepared by an European gardener assisted by trained natives, are planted in shallow, well-drained wooden boxes in coarse sand, 100 cuttings are placed in each box. These boxes fit closely into a wooden frame with glazed lights, in every respect like a cucumber frame; while in these frames, the cuttings are carefully sheltered by thin cloth nailed tightly over the glazed sashes, and also by mats which are placed over the sashes during the day. Great attention is given to the watering of the cuttings during the first month, as the slightest excess of moisture causes them to decay. Water is given sparingly, and only by means of a garden syringe provided with a very finely pierced rose. In two or three days the drooping cuttings begin to look fresh and living, and by the end of three weeks most of them have become provided with one or two delicate roots, and in three weeks more at the furthest the process of hardening the young plants commences. This is effected by removing the boxes, with the cuttings still undisturbed, to other glazed frames (principally old cutting frames whose sashes from use and exposure do not fit tightly) into which air is admitted more and more daily, while the use of mats as protection against the sun is dispensed with. After a fortnight of this treatment, the cuttings, now two months since they were taken from their parent plants, are placed, still undisturbed, in the boxes on terraced beds, protected from the sun and rain by a low roofing of mats or tarpaulin. Twenty days' exposure to air and light in these sheds is generally sufficient to bring the plants into such a state that they can be planted in beds where they will obtain the size and condition of plants suited for permanent plantations. These beds are merely terraces formed on the slope of the hill, and in which the soil has been carefully freed from weeds. The plants are placed at a distance of six inches from each other, and for the first 20 days after planting they are protected by mats. These are dispensed with as soon as possible, as the object all along aimed at is the inuring of the plants to all kinds of weather. In these beds, little care is bestowed on the plants, they require to be periodically cleared from weeds, and in the dry weather they

they receive a little water; but this is only given when it is absolutely required to save the plants from injury.

The plants remain in these beds for at least two months, but in the cold season of 1865-66 all the cuttings planted in this manner from 1st November were kept in them until April, when the permanent planting operations commenced. The soil is nearly of the same nature as the slopes of Rungbee, and in it the young plants develop large healthy roots, and more than double themselves in height. At present there are in the nursery beds plants sufficient to extend over more than 25 acres of land, while, by the end of October about 70 or 100 acres will be the extent of ground planted. The ground for the plantations has been prepared by being cleared in the cold weather from all trees and vegetation, which were burned. In this land, pits 18 inches deep have been dug at five feet apart for *C. officinalis*, and six feet apart for *C. succirubra*.

The different stages described above are rendered necessary to overcome the high state of vegetable excitability, in which it is necessary to keep the stock plants. Cutting taken from such plants, excited as they constantly are by the strongest stimulants of vegetable life, a high temperature and abundant moisture, take root rapidly, but are when self-existing, quite unable to withstand the vicissitudes of the weather; their delicate foliage and watery stems require to be thickened and hardened before the plants can be restored to a hardy condition. When this state is attained, the growth in the open air follows the course of vegetation which prevails in Sikhim; the plants continue at rest during the cold weather, and on the return of spring, which varies according to the height above the sea, the Chinchonas again begin to grow. In May and June, depending on the date of the setting in of the periodical rains, and aided by the considerable rise in temperature which accompanies them, the plants shoot with an astonishing vigour, growing at the rate of a foot a month for nearly four months.

This process may seem a long one, but by following it plants suitable for open air plantation are obtained sooner than if they were raised from seeds. For example, seeds that were sown in last January cannot be planted out until the end of June, whereas cuttings made in February will be planted in the end of May.

Propagation.—The rate of increase of all the species except *C. officinalis* has greatly exceeded the rate attained in any previous year. *C. officinalis* was most successfully increased during the year 1864-65, and the falling off in the ratio of increase this year is merely the result of forming the propagation beds late in the season, so that the plants grew very slowly during the winter. The large number of cuttings yielded by this species in February and March, shows that only a temporary check has occurred, and that with the return of spring the plants have commenced to grow. During April, May, and June 1866, the rate has steadily increased, and again far exceeding that of the other species.

It is necessary to note that now cuttings are in the case of *C. succirubra* and *C. officinalis* made only from the 10,000 plants of each grown for the special purpose of yielding cuttings.

The limits of stock plants of *C. Calisaya* and *C. micrantha* not having been reached, cuttings of these species are taken whenever they are noticed on any of the plants.

The increase of all the species from 1st April 1865 to 1st April 1866, is shown in this Table:—

TABLE showing the Number of Chinchona Plants at Darjeeling on the 1st April 1865, and 1st April 1866.

Name of Species.					Number on 1st April 1865.	Number on 1st April 1866.
C. Succirubra	-	-	-	-	7,030	78,096
C. Calisaya	-	-	-	-	37	177
C. Officinalis	-	-	-	-	23,929	89,827
C. Micrantha	-	-	-	-	1,294	5,555
C. Pahudiana	-	-	-	-	5,092	5,092
TOTAL					37,382	1,78,741

In January and March I received a small quantity of seed of *C. officinalis* from Mr. Thwaites, Director of the Botanical Garden, Peradenia, Ceylon, and who has charge of the Chinchona plantations in that island. The seed was of excellent quality and germinated freely, about 8,000 seedlings have been counted from these two sowings, but this number has not been entered in the table given above, as the young plants are too small to be quite beyond the danger of damping off or other accident.

The Growth and Condition of the Plants.—The stock plants of all the species are in the finest condition, and the 37,000 plants of *C. succirubra* and *officinalis* intended for the permanent plantations to be commenced in April, are strong and healthy. The greater part of these plants have been growing for several months in open-air beds without any protection.

The plants in the small experimental plantations vary considerably in amount of growth according to elevation.

Thus at the highest plantation, 5,321 feet above the sea, 100 plants of *C. officinalis* have made very little growth, but they have received no injury from the cold of last winter. The only other species planted at this height is *C. Pahudiana*; the plants have grown very slowly but have not suffered from frost.

The second plantation, 5,000 feet above the sea, also consists of 100 plants of *C. officinalis* and a few of *C. Pahudiuna*. The plants of *C. officinalis* are strong and healthy, and nearly all are of a uniform size. For *C. Pahudiana* this elevation is also too cold, although one or two plants are in very good health, their growth is very slow.

At plantation No. 3, 4,410 feet above the sea, 400 plants of *C. officinalis* have been planted; these plants are all in a most healthy state and are growing rapidly. *C. Pahudiana* succeeds well at this altitude during the rainy season, but the plants suffer from the dryness of the air during the cold season. *C. succirubra* and *C. micrantha* do not succeed at this plantation, it is too high for the first and too dry in the winter for the latter species.

The fourth plantation, 3,332 feet above the sea, around which all the propagation and process of hardening are carried on, is well suited to the growth of all the species, but the most luxuriant and healthy plants belong to *C. officinalis* and *C. Pahudiana*. Most of the plants of *C. officinalis* planted on the 15th October 1864, being then from three to six inches high, are above three feet in height, and a few are almost five feet. One of them is about to blossom, flower buds having been noticed in the points of some of its branches. *C. Pahudiana* seems to have found every condition it requires at this altitude. For *C. succirubra* and *C. micrantha* the elevation is somewhat too high, the plants of these species are very healthy, but they do not grow so luxuriantly as at the still lower plantation No. 5.

At No. 5, the lowest of all the Rungbee plantations, *C. succirubra* is found in the most perfect state of health. The plantation contains 400 plants, most of which were planted in October 1864, the plants being then six inches in height. The height of the tallest plant (not one of those whose measurement is recorded monthly) was above six feet on the 31st March.

The temperature of the air at this plantation is too high for *C. officinalis*, although the species is represented here by plants that are taller than at any of the other plantations; the plants of this species look drawn up and less robust than the shrubby plants growing at the higher plantations.

Beyond this plantation, three other gardens, containing each 100 plants of *C. succirubra*, have been planted near the river Teesta. I am unable to state accurately the altitude of these plantations, the two lowest are probably about 700 feet above the sea, and the highest 1,500 feet.

The driest climate in British Sikhim occurs in the valley of the Teesta. These plantations are so recent that no opinion can yet be formed about their success; as yet none of the plants have suffered.

Meteorological Observations.—Since 1st February 1865, Meteorological observations have been made with more or less regularity at the different plantations. Reliance may be placed on the correctness of these observations; the instruments, maximum and minimum self-registering and wet and dry bulb thermometers, are the best that could be procured from the Government Mathematical Instrument Department in Calcutta, and most of the thermometers have been compared with the Calcutta standard. I have had the instruments placed carefully, and the records have been made with care by a European gardener in charge of the cultivation at Rungbee.

I have given the general abstract of the observations from their commencement until the end of March 1866, as an Appendix to this Report.

The observations have not been conducted long enough at the two upper plantations to allow of the mean annual temperature being given, but the abstract of the observations for six months will be found in the Appendix.

At the third plantation, 4,410 feet above the sea, the mean temperature for the twelve months ending 31st January 1866, is 61.12.

At the fourth plantation for the same period the mean maximum temperature was 76.10, the mean minimum 58.03, and the mean temperature 67.06.

The observations at the lowest plantation are not complete enough to allow of the annual means being calculated. The monthly means for a great part of the year will be found in the abstract at the end of the Report.

At the fourth plantation the rain-fall from the 1st January 1865 to 31st December was 153.18 inches.

The growth of the different species at various altitudes when compared with the temperatures of these elevations, proves that the cold of the three winter months, December, January, and February is the sole reason why lower elevations must be sought for the growth of Chinchona in the Himalaya than is necessary in the much more equable climates of Java, the Neilgherries and Ceylon. I do not think it will be possible to cultivate above 5,000 feet with success any of the species of Chinchona I now possess, although *C. officinalis* will probably exist uninjured by frost as high as 6,000 feet. The 30 or 40 acres which will be planted with *C. officinalis* during the approaching rainy season have been selected between the fourth plantation, 3,332 feet above the sea, and the second plantation at 5,000 feet. The range most favourable for this species may therefore be considered

dered as the 2,000 feet between 3,000 and 5,000 feet elevation. I am unfortunately unable to give the mean annual temperature of this region, but the mean maximum temperature of the hottest month (July) at 4,410 feet is 77·35, and the highest temperature recorded during the year is 89, the mean minimum of the coldest months, January and February, 41·7, and the lowest temperature during the year 35° in February, at the upper limit of this region the highest reading of the thermometer was 80° on the 14th June, and the lowest 31° on the 13th February. Three hundred feet above the lower limit, the mean annual temperature of the year is 67°·06, the mean maximum of the hottest month, July, is 87·10, the highest temperature during the year, 95, on the 2nd July; the mean minimum of the coldest month, December, 46·87 and the lowest temperature of the year 41°.

C. succirubra requires a very different climate from that in which *C. officinalis* delights. Sixty or 70 acres to be planted with this species during the ensuing year have therefore been chosen at an elevation below 3,000 feet, and principally at an elevation about 2,000 feet above the sea. I think that the cultivation of this valuable species can be carried as low as the Terai at the foot of the hills, 500 feet above the sea. Three plants of this species were planted on the Selim Tea Estate at the foot of the hills last September, and their rapid growth and healthy appearance are so encouraging, that I have directed a piece of ground to be cleared for 100 plants. The place is about 350 feet above the level of the sea. Should the soil and climate of the Terai be favourable to the growth of *C. succirubra*, a great benefit will be conferred on the inhabitants of that fever-stricken district by affording them a cheap and abundant supply of bark. It is needless to dwell on the experience gained by the cultivation of the commercially unknown species, *C. Pahudiana*. I have still too few plants of *P. micrantha* and *C. Calisaya* to risk a large number of them in the open air, and I am therefore not able to give a decided opinion about the altitude at which they should be grown in Sikhim.

Distribution of Chinchonas.—A sale by auction of 1,000 plants of *C. officinalis* was held on the 2nd October, all the plants sold at the upset price of four annas each. During January, February, and March, 1,158 plants were sold privately, or sent to the Government Botanical Garden at Saharunpore and to Chittagong. The total number of plants distributed during the year is 2,158; 200 plants of *C. succirubra* were sent to Chittagong in the end of March under charge of Mr. John Scott, of the Botanical Gardens, Calcutta, who was directed, when distributing the plants among the tea planters of the district, to afford them every information concerning the requirements of the plants.

The plants distributed in Darjeeling were purchased chiefly by tea planters and others, as stock plants from which it is intended to propagate. The cultivation of Chinchona is carried on by a company, the Darjeeling Chinchona Association, and by two tea companies. The late Mr. E. Fitzgerald had also a small Chinchona garden which, I understand, is still carried on.

The Chinchona Association possesses a large number of Chinchonas, principally belonging to *C. succirubra* and *C. officinalis*, and they have commenced to form permanent plantations of *C. succirubra*. Their manager is a trained gardener. At Tukdah, the garden of the Darjeeling Tea Company, *C. succirubra* is most successfully cultivated, and last year I saw on this estate about 100 large and healthy plants of *C. succirubra*, which had been in the ground since May 1864.

Mr. Fitzgerald's nursery is near the one at Tukdah; it contains both *C. succirubra* and *C. officinalis*, the stock of the latter having been purchased at the sale held at Darjeeling in October 1865.

The Tukvar Tea Company have also commenced the cultivation of Chinchona about 18 months ago, and it has, I understand, been very successfully conducted by the European gardener. All the individuals engaged in growing Chinchonas in the district, visit the Government plantations from time to time, and my subordinates have orders to give every one facilities for observing the progress that is made, as well as the method of propagation and cultivation that is followed at Rungbee.

Roads and Buildings.—The second dwelling-house and the propagating pit at Rungy-roong have been completed. At Rungbee the mat huts in which the two gardeners and the overseer lived, have been replaced by two small dwelling-houses, in which two rooms have been provided for each person. A substantial wooden bridge, with strong stone parapets, was built across the Runghee, about 200 yards above its junction with the Rungio.

From this bridge a road has been opened out through the entire length of the Rishap Valley, the most populous valley in British Sikhim. This path, after crossing the large stream the Ryeng by a hanging bridge passable by ponies, joins the forest road in the Teesta Valley, thus opening up an unbroken communication from Darjeeling through the Chinchona plantations to the plains. Maize, potatoes, murma, and mats, the produce of the rich valley of Rishap, are now carried along these roads to Darjeeling in one day. The small quantity of these products occasionally taken to Darjeeling before the valley was opened up by these roads was never less than three days in transit along difficult and steep mountain paths.

(signed) T. Anderson, M.D.,
Superintendent of the Royal Botanical Gardens,
and in charge of Chinchona cultivation in Bengal.

ABSTRACT of METEOROLOGICAL OBSERVATIONS at RUNGHEE for 1865-66.

MONTHS.		FIRST PLANTATION ALTITUDE, 5,321 FEET.					SECOND PLANTATION ALTITUDE, 5,000 FEET.					THIRD PLANTATION ALTITUDE, 4,410 FEET.					FOURTH PLANTATION ALTITUDE, 3,332 FEET.					FIFTH PLANTATION ALTITUDE, 2,556 FEET.					Rain fall at Fourth Plantation in Inches.		
		Mean Temperature.	Maximum Temperature.	Mean Maximum.	Minimum Temperature.	Mean Minimum.	Mean Temperature.	Maximum Temperature.	Mean Maximum.	Minimum Temperature.	Mean Minimum.	Mean Temperature.	Maximum Temperature.	Mean Maximum.	Minimum Temperature.	Mean Minimum.	Mean Temperature.	Maximum Temperature.	Mean Maximum.	Minimum Temperature.	Mean Minimum.	Mean Temperature.	Maximum Temperature.	Mean Maximum.	Minimum Temperature.	Mean Minimum.			
1865.																													
February	-	No observations					No observations					-	50.87	68	59.55	39	43.22	57.05	70	66.18	44	47.93	59.05	75	69.90	43	48.30	0.00	
March	-	ditto					ditto					-	54.50	78	64.83	45	48.68	64.11	89	74.68	46	53.55	66.22	90	79.85	49	54.91	0.00	
April	-	ditto					ditto					-	57.0.	78	67.90	43	51.45	68.50	88	74.50	54	60.0	73.60	90	85.40	60	62.30	11.18	
May	-	ditto					ditto					-	-	82	70.33	54	57.90	71.70	89	80.0	54	62.40	70.60	93	83.08	58	63.20	14.50	
June	-	ditto					ditto					-	-	-	62	64.42	75.58	94	82.60	66	68.50	-	-	-	71	71.77	25.50		
July	-	ditto					ditto					-	-	-	64	65.0	77.54	95	87.10	64	67.19	-	-	-	71	71.57	44.40		
August	-	ditto					ditto					-	-	-	60	62.16	76.16	92	85.54	65	66.70	-	-	-	70	71.90	41.0		
September	-	ditto					ditto					-	No observations					-	74.91	92	84.65	63	65.40	-	-	-	67	69.40	15.0
October	-	60.13	74	70.33	46	50.33	65.0	79	75.0	53	55.0	-	-	-	ditto	-	69.62	92	80.06	50	59.19	70.0	84	80.0	54	61.33	1.50		
November	-	51.25	69	60.50	40	42.0	54.12	68	65.0	43	43.25	61.08	80	74.42	43	48	64.91	88	77.63	44	52.20	No observations					-	0.00	
December	-	47.25	61	56.75	35	37.75	50.25	63	59.62	37	40.72	53.43	65	61.75	41	45.12	55.27	67	63.64	41	46.87	ditto					-	0.10	
1866.																													
January	-	44.10	56	52.60	34	35.60	46.0	60	54.60	34	37.40	48.95	64	56.20	37	41.70	53.90	64	59.40	41	48.40	56.50	73	65.50	44	47.50	2.20		
Means	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	67.06	85°	76.10	52.83	58.03	-	-	-	-	-	-		
1866.																													
February	-	43.40	59	51.50	30	35.37	46.36	65	56.30	31	36.70	52.0	71	62.3	35	41.70	55.20	71	61.60	42	49.20	57.80	75	67.73	40	48.12	3.50		
March	-	57.43	75	67.50	41	47.37	59.94	75	70.23	46	49.65	66.40	81	77.0	40	55.81	67.90	80	75.25	56	60.67	71.70	89.50	82.85	55	59.3	0.00		

T. Anderson, M. D., Superintendent
Botanical Gardens.

-- No. 4. --

From the Secretary of State for India to the Government of India.

India Office, 15 December 1866.

I HAVE considered in Council your Despatch, dated the 10th October last (No. 69), forwarding papers relating to Chinchona cultivation in British Sikhim. Dr. Anderson's report for 1865-66 gives a very satisfactory account of the progress and development of this important experiment.

2. I am glad to perceive that several companies and individual planters are purchasing plants from the Darjeeling nurseries, and thereby disseminating the growth of quinine-yielding trees over a large area of country. I request that you will keep me informed of the progress made in Chinchona cultivation by private enterprise.

3. I trust that if the soil and climate of the Terai prove favourable for the growth of *C. succirubra*, the poorer inhabitants will largely avail themselves of the remedy which will then be within their reach in that fever-stricken district.

-- No. 5. --

From the Government of India to the Secretary of State for India.

Sir,

WE have the honour to forward the special narrative of the proceedings of the Government of Bengal, noted in the margin,* forwarding samples of bark of *Chinchona succirubra*, with a view to their being analysed by Mr. Howard.

* No. 3, dated 20 Dec. 1866.

We have, &c.

(signed) *John Lawrence.*
H. S. Maine.
W. Grey.
G. N. Taylor.
W. N. Massey.
H. M. Durand.

Fort William, 5 January 1867.

Enclosure in No. 5.

Government of Bengal.—General.

SPECIAL NARRATIVE.

HEREWITH is forwarded to the Right Honourable the Secretary of State for India a copy of a letter, No. 26, dated the 17th instant, from the Superintendent of the Botanical Gardens, and in charge of Chinchona cultivation in Bengal, together with the packet therein referred to, containing two samples of bark of *Chinchona succirubra* from the Government plantations at Darjeeling. The Lieutenant Governor solicits that his Lordship will cause the necessary instructions to be issued, with a view to these samples being analysed by Mr. Howard, as requested by Dr. Anderson.

Forwarding two samples of bark of *Chinchona succirubra* for the purpose of being analysed by Mr. Howard.

By Order of the Lieutenant Governor of Bengal,

Fort William,
 20 December 1866.

(signed) *S. C. Bayley,*
 Junior Secretary to the Government of Bengal.

From *T. Anderson, Esq.*, Superintendent Botanical Gardens, and in charge of Chinchona Cultivation in Bengal, to the Secretary to the Government of Bengal; No. 26, dated the 17th December 1866.

Sir,

I HAVE the honour to forward to you, for dispatch to the Right Honourable the Secretary of State for India, a packet containing two small packets of bark of *Chinchona succirubra* from the Government plantations at Darjeeling, with the view of these samples being analysed by Mr. Howard.

The parcel contains two samples: No. 1 contains four ounces of dry bark of *Chinchona succirubra* taken from a two-year-old plant. This plant had two stems springing from the root, the smaller of which was broken, 3 feet above the ground, in a gale of wind on the 8th November 1866. The bark in this parcel was taken from the lowest part of the broken stem; i. e., 3 feet to 4½ feet from the ground. No. 2 contains 1·17 ounces of dry bark of *Chinchona succirubra*. The bark in this parcel was taken from the same broken stem as the bark in parcel No. 1, but from that part of the stem above 4½ feet from the ground. The plant from which the bark was taken is growing in the fifth plantation, at an elevation of 2,556 feet above the sea.

I hope soon to send a well-selected sample of bark of *Chinchona succirubra*, which I shall procure in the beginning of February next, by cutting down two average-sized plants, which were planted on the 15th October 1864.

— No. 6. —

From the Secretary of State for India to the Government of India.

India Office, 25 April 1867.

WITH reference to your Excellency's Despatch, dated January 5, 1867, transmitting specimens of Chinchona bark grown on the Government plantations at Darjeeling for analysis, I now transmit 50 copies of Mr. Howard's report on these specimens.

You will perceive that the result of Mr. Howard's analysis has been very satisfactory, and that the bark of the trees of this species grown at Darjeeling, when two years old, contains 3½ per cent of febrifuge alkaloids. Mr. Howard expresses an opinion that the varieties of *C. officinalis* held out the best prospect of successful and profitable cultivation in the climate of Darjeeling.

— No. 7. —

From the Government of India to the Secretary of State for India.

Sir,

Simla, 14 May 1867.

WE have the honour to forward the special narrative of the proceedings of the Government of Bengal, and of its Enclosure, forwarding samples of Chinchona bark, with a view to their being analysed by Mr. Howard.

We have, &c.
(signed) *John Lawrence,*
W. Mansfield,
H. S. Maine,
G. N. Taylor,
W. N. Massey.
H. M. Durand.

Enclosure in No. 7.

Government of Bengal.—General.

SPECIAL NARRATIVE.

Fort William, 17 April 1867.

HEREWITH is forwarded to the Right Honourable the Secretary of State for India a copy of a letter, No. 3, dated 6th instant, and of its enclosure, from the superintendent of the Botanical Gardens and in charge of Chinchona Cultivation in Bengal, together with the box therein referred to, containing samples of bark of *Chinchona succirubra* and *Chinchona officinalis* from the Government plantations at Darjeeling. The Lieutenant Governor solicits that the Secretary of State will cause the necessary instructions to be issued with a view to these samples being analysed by Mr. Howard, as requested by Dr. Anderson.

Forwarding samples of bark of *Chinchona succirubra* and *C. officinalis* for the purpose of being analysed by Mr. Howard.

(signed) H. L. Harrison,
Junior Secretary to the Government of Bengal.

From T. Anderson, Esq., M.D., Superintendent Botanical Gardens, and in charge of Chinchona Cultivation in Bengal, to the Secretary to the Government of Bengal; dated the 6th April 1867.

Sir,

I HAVE the honour to forward a box containing specimens of Chinchona bark taken from trees growing in the plantations at Darjeeling, and I have to request that these specimens may be sent through the Right Honourable the Secretary of State to Mr. Howard for chemical analysis.

The two trees of *C. succirubra*, which yielded the specimens of red bark, were planted, one on the 29th July, and the other on the 15th October 1864, when they were about 10 inches in height. They were cut down on the 13th February 1867, 31 and 28 months respectively after planting. The plants grew in the 5th plantation 2,556 feet above the sea.

The bark of *C. officinalis* was taken from two plants of the narrow-leaved variety of this species, which were planted on the 15th October, 1864, in the fourth plantation, 3,332 feet above the sea. They were also cut down 28 months after they were planted.

None of the plants whose bark is now sent have been destroyed, as although their stems were sown across close to the ground, the crown of the root and the roots themselves have been left undisturbed in hopes that shoots will be sent up from the "stool."

I append a detailed statement of the contents of each parcel in the box, in case Mr. Howard may wish to make a separate analysis of each parcel of bark.

C. Succirubra.

No. 1.—Contains the oldest bark taken from a tree which divided into two almost equal branches at 1½ feet above the ground. The girth of the trunk at the surface of the ground was 14 inches; the height of the tree was 8 feet 5 inches.

No. 2.—This parcel consists of the young bark taken from the stem and branches of the plant whose old bark is in No. 1.

No. 3.—This parcel consists of the old bark taken from a tree which, close to the surface of the ground, divided into two stems of nearly equal size. The largest of these stems was cut down for bark at 3 inches above the ground. The girth of this stem at its base was 8 inches, and its height 8 feet.

No. 4.—Contains the young bark from the branches of the stem from which the old bark in No. 3 was taken.

C. Officinalis.

No. 5.—The bark in this parcel was taken from the largest plant of *C. officinalis*, var. *Bonplandiana* (C. Chahuaguera, How), its height on the 18th February when it was cut was 5 feet 2 inches.

No. 6.—Contains all the bark of a smaller plant of *C. officinalis*, var. *Bonplandiana*, than that whose bark composes the 5th parcel; the height of this plant was 4 feet 4 inches on the 15th February.

— No. 8. —

From the Government of India to the Secretary of State for India.

Sir,

Simla, 27 July 1867.

WE have the honour to forward the special narrative of the proceedings of the Government of Bengal, and of its enclosure, forwarding samples of Chinchona bark, with a view to their being analysed by Mr. Howard and their market value ascertained in London.

We have, &c.

(signed) John Lawrence,
W. Mansfield,
H. S. Maine,
G. N. Taylor,
W. N. Massey,
H. M. Durand,
G. U. Yule.

Enclosure in No. 8.

Government of Bengal.—General.

SPECIAL NARRATIVE.

Forwarding two specimens of the bark of "*Chinchona Pahudiana*" for analysis, and with a view to ascertaining its market value in London.

HEREWITH is forwarded to the Right Honourable the Secretary of State for India the accompanying copy of a letter, No. 40, dated 3rd instant, from Dr. Anderson, superintendent, Botanical Gardens, and in charge of Chinchona cultivation in Bengal, and of its enclosure from Mr. Munro, manager of the Darjeeling Chinchona Association; the two packets therein specified, containing the bark of "*Chinchona Pahudiana*", alluded to, are also forwarded. The Lieutenant Governor begs to draw attention to the suggestion made by Dr. Anderson for analysing these specimens of Chinchonas, and ascertaining their value in the Home market.

Fort William, 16th July 1867.

(signed) H. L. Harrison,
Junior Secretary to the Government
of Bengal.

From T. Anderson, Esq., M.D., Superintendent of the Royal Botanical Gardens, Calcutta, and in charge of Chinchona Cultivation in Bengal, to H. L. Dampier, Esq., Officiating Secretary to the Government of Bengal; Darjeeling, 3rd July 1867.

Sir,

I HAVE the honour to forward, in original, a letter I received from Mr. Munro, manager of the Darjeeling Chinchona Association, in which he requests me to procure an analysis of two specimens of bark of *Chinchona Pahudiana* grown by him. The bark has been forwarded to you by Banghy Dawk. I have the honour to request that these specimens of bark, along with a copy of Mr. Munro's letter and also of mine to your address, may be dispatched to the Right Honourable the Secretary of State for India. It would be highly satisfactory to me to know the value of such bark in the London market. The trees of this specie of Chinchona in the Government plantations are now producing seed, and if the bark is found to be comparatively worthless these seeds will not be sown.

From J. Munro, Esq., Manager of the Darjeeling Chinchona Association, to T. Anderson, Esq., M.D., Superintendent of the Botanical Gardens, Calcutta, and in charge of Chinchona Cultivation in Bengal; dated the 22nd June 1867.

Sir,

I HAVE the honour to solicit, on behalf of the Darjeeling Chinchona Association, the favour of your having the goodness to forward to London for analysis the two packets of *Chinchona Pahudiana* bark which I send herewith. It was taken from four plants of an average size, the bark of one year's growth being in the one packet, and the bark of two years' growth in the other, as per details given below. The plants were raised from seed got from Java in the latter end of the year 1863, but owing to the association having removed to a new locality in 1864, they were not planted out until the 22nd of June 1865. Consequently, they are two years old to-day, from date of planting to date of cutting.

Packet No. 1.—One year's bark. | Packet No. 2.—Two years' bark.

— No. 9. —

From the Secretary of State for India to the Governor General of India in Council.

Sir,

India Office, 8 November 1867.

Para. 1. I HAVE received and considered in Council your Despatches, dated 14th May (No. 84), and 27th July (No. 134), 1867, on the subject of Chinchona cultivation at Darjeeling.

2. I herewith transmit 40 copies of Mr. Howard's report of an analysis of bark grown at Darjeeling, which appears to be very satisfactory, the Himalayan bark not being inferior to that grown on the Neilgherries, and the difference of climate not appearing to have much effect on the yield of alkaloids.

Dated 2 Oct. 1867.

3. With reference to the bark of *C. Pahudiana*, I have to draw your Excellency's attention to a Despatch from Sir Charles Wood to Lord Elgin, dated 24th January 1863, in which an opinion was expressed that it was not advisable that any further expense should be incurred in the cultivation of this species at Darjeeling. I regret to find that this expression of opinion did not receive due attention; for this species, which was introduced by mistake into Java, is well known to be so inferior to the commercial species as not to be worth the expense of cultivation. The bark has, however, been transmitted to Mr. Howard.

4. As there is now a very able quinologist employed by the Madras Government on the Neilgherries, it will save time, and be more convenient, if the Darjeeling barks are in future sent to him for analysis, instead of being forwarded to England. But I shall be glad to receive copies of the reports which Mr. Broughton may submit, after analysing the specimens of bark that may be sent to him from Darjeeling.

5. The report on Chinchona cultivation at Darjeeling appears to be very satisfactory, and I perceive that a private association has been formed there for the cultivation of this important product.

I have, &c.
(signed) *Stafford H. Northcote.*

Enclosure in No. 9.

ANALYSIS OF DARJEELING CHINCHONA BARK.

From *T. Anderson, Esq., M.D.*, Superintendent, Botanical Gardens, and in charge of Chinchona Cultivation in Bengal, to the Secretary to the Government of Bengal.

Sir,

6 April 1867.

I HAVE the honour to forward a box containing specimens of Chinchona bark taken from trees growing in the plantations at Darjeeling, and I have to request that these specimens may be sent through the Right honourable the Secretary of State to Mr. Howard for chemical analysis.

The two trees of *C. succirubra* which yielded the specimens of red bark were planted, one on the 29th July and the other on the 15th October 1864, when they were about 10 inches in height. They were cut down on the 13th February 1867, 31 and 28 months respectively after planting. The plants grew in the fifth plantation 2,556 feet above the sea.

The bark of *C. officinalis* was taken from two plants of the narrow-leaved variety of this species, which were planted on the 15th October 1864, in the fourth plantation, 3,332 feet above the sea. They were also cut down 28 months after they were planted.

None of the plants whose bark is now sent have been destroyed, as, although their stems were sawn across close to the ground, the crown of the root and the roots themselves have been left undisturbed, in hopes that shoots will be sent up from the "stool."

I append a detailed statement of the contents of each parcel in the box in case Mr. Howard may wish to make a separate analysis of each parcel of bark.

C. Succirubra.

- No. 1. Contains the oldest bark taken from a tree which divided into two almost equal branches at 1½ feet above the ground. The girth of the trunk at the surface of the ground was 14 inches; the height of the tree was 8 feet 5 inches.
- No. 2. This parcel consists of the young bark taken from the stem and branches of the plant whose old bark is in No. 1.
- No. 3. This parcel consists of the old bark taken from a tree which, close to the surface of the ground, divided into two stems of nearly equal size. The largest of these stems was cut down for bark at three inches above the ground. The girth of this stem at its base was eight inches, and its height eight feet.
- No. 4. Contains the young bark from the branches of the stem from which the old bark in No. 3 was taken.

C. Officinalis.

- No. 5. The bark in this parcel was taken from the largest plant of *C. officinalis* var. *Bonplandiana* (*C. Chahuarguera, How*), its height on the 18th February, when it was cut was five feet two inches.
- No. 6. Contains all the bark of a smaller plant of *C. officinalis*, var. *Bonplandiana*, than that whose bark composes the fifth parcel; the height of this plant was four feet four inches on the 15th February.

Report by J. E. Howard, F.L.S., to the Under Secretary of State for India, of an Analysis of the Seventh Remittance of Bark from India.

Sir, 2 October 1867.

I HAVE to report on specimens of Chinchona bark taken from trees in the plantations at Darjeeling, and, in the first place, must remark that these did not reach me in such good condition as has been the case with those sent from Ootacamund.

The bark appears to have been packed before it was thoroughly dry, producing what is called in commerce "country damage." This must be guarded against in future.

The appearance of the bark (at least of the No. 1) is good, but very thin, not more than one-twentieth of an inch in thickness. I presume that this is to be ascribed to the youth of the trees, which, in other respects, must have developed well.

The bark when cut across is of a light yellow hue, contrasting with the rich brown of the inner surface. This latter is an indication, not without some value, of the bark having been cut at a favourable season.

The pale colour of the fracture indicates a peculiar state of the tannin, which, with re-agents, indicates less oxidation than in the ordinary red bark of commerce. This feature is probably connected with the difficulty of separating the combined colouring matter found in No. 1.

The results are quite encouraging, when compared with a trial of the same species grown at Ootacamund, and of about the same age (as reported, Blue Book, 18th June 1866, p. 49).

No. 1. Oldest bark from a tree cut down 31 months after planting at Darjeeling.

For comparison, bark from the thickest part of the two lower branches of a plant of *C. succirubra*, two years and five months old, removed from the plants 24th February 1864.*

The total weight of the precipitated alkaloids in No. 1 was 7.30, but of this 1.00 per cent. was a substance which is the residuum of an altered state, either of the tannin or other matters accompanying the chlorophyll with which it seems to be associated in the younger barks. When separated from the precipitate, and dissolved in alcohol, it appears like a resin, but attracts oxygen, and undergoes a change. This resinous substance unites with quinine, even in the face of an excess of acid, and modifies the crystallisation and the precipitated alkaloid, so that this latter cannot be entirely separated in an unchanged state from

• No. 1. Darjeeling.		Ootacamund.	
Quinine, crystallising freely as oxalate - - - - -	3.20	Quinine (specimen of the white sulphate sent) - - - - -	3.14
Chinchonidine and a little quinine - - - - -	2.27	- - - - -	2.06
Chinchonine - - - - -	0.61	- - - - -	0.80
TOTAL - - - - -	6.10	TOTAL of purified alkaloid - - - - -	6.00

from the above *quasi* combination. It follows, of course, that the less prevalent this element is in the bark, the better for those who have to extract quinine from it, and in young barks (more especially those of *C. succirubra*) it is unpleasantly abundant. The 0·20 per cent. required to make up the total 7·30 must be set down as water and loss.

No. 2 gave total alkaloids 4·10 per cent.

No. 3, total alkaloids 3·79 per cent.

No. 4, very immature young branches, total alkaloids, 1·14 per cent.

Nos. 5 and 6 (same bark), total alkaloids, 3·20 per cent.

I have not completed the examination of these latter specimens, as it would not probably add any points of much interest; and I would suggest, that if such

accomplished in India.

The conclusion I should draw from the present analysis is, that there is no reason to think the Darjeeling barks at all inferior to those grown at Ootacamund; the difference of climate does not appear to have much effect on the alkaloids therein contained.

I have, &c.
(signed) John Eliot Howard.

— No. 10. —

From the Government of India to the Secretary of State for India.

Sir,

Dated Fort William, 25 November 1867.

We have the honour to forward the special narrative of the proceedings of the Government of Bengal, and of its enclosure, forwarding samples of Chinchona bark, with a view to their being analysed by Mr. Howard, and their market value ascertained in London.

(signed) John Lawrence.
G. N. Taylor.
W. N. Massey.
H. M. Durand.
G. U. Yule.

Enclosure in No. 10.

Government of Bengal—General.

SPECIAL NARRATIVE.

HEREWITH is forwarded, for submission to the Right Honourable the Secretary of State for India, a copy of a letter, No. 68, dated 29th ultimo, and its enclosure, from the Superintendent of the Botanical Gardens, and in charge of Chinchona cultivation in Bengal, together with the box therein referred to, containing samples of bark of *Chinchona succirubra* and *Chinchona officinalis* from the Government plantation at Darjeeling. The Lieutenant Governor solicits the attention of the Secretary of State to the recommendations contained in the 2nd paragraph of Dr. Anderson's letter regarding the analysis of these specimens, and the appraisalment of their commercial value.

Forwarding samples of the bark of *Chinchona succirubra* and *Chinchona officinalis* for the purpose of being analysed by Mr. Howard.

By order of the Lieutenant Governor of Bengal.

(signed) Thomas Jones,
Assistant Secretary to the Government of Bengal.

Fort William, 9 November 1867.

From T. Anderson, Esq., M.D., Superintendent of the Botanical Gardens, and in charge of Chinchona Cultivation in Bengal, to the Officiating Secretary to the Government of Bengal (No. 68, dated Botanical Gardens, the 29th October 1867).

Sir,

I HAVE the honour to forward, for dispatch to the Right Honourable the Secretary of State for India, a box containing specimens of Chinchona bark from the Government plantations under my charge at Darjeeling. A description of the nine packets of bark contained in this box is appended to this letter.

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2. Mr.

2. Mr. Howard will, I suppose, be requested to undertake the chemical analysis of these specimens. I beg leave, however, strongly to recommend that, in addition to the chemical analysis, the opinion of a broker should be obtained concerning the commercial value of the specimens contained at least in the packets Nos. 3, 4, 5, and 8. The question I recommend should be asked of the broker, is the price that such barks could be sold for in the London market.

3. This is the third transmission of bark from the Government plantations at Darjeeling. These barks were all gathered on the 13th October 1867 from trees planted on the 15th October 1864.

DESCRIPTION of the Specimens comprising the Third Transmission of Chinchona Bark from the Darjeeling Plantations.

Chinchona Succirubra.

No. 1.—Three-years-old bark from the lowest part of the stem of the broken plant whose bark was analysed by Mr. Howard in March 1867. Cut down on the 13th October 1867, when the plant had been three years in the ground. The main stem of this plant, 14 feet high, was left untouched.

No. 2.—The young bark from the side branches of No. 1. Age of bark one year.

No. 3.—Three years old bark cut in strips from the main stems, the wound being mossed after removal of the bark. Also the entire old bark from certain double-stemmed plants, one stem being removed.

No. 4.—Young bark from the double-stemmed plants, whose old bark is contained in No. 3.

No. 5.—Bark from prunings of small branches.

C. Officinalis. Var. Bonplandiana.

No. 6.—Three-years-old bark mossed on 13th February 1867, and tree cut down 10th October 1867.

No. 7.—The young unmossed bark of the plant which yielded the bark in No. 6.

No. 8.—Strips of three-years-old bark removed from the stems of plants on the 13th October 1867; the wounds were mossed on the removal of this bark.

Doubtful Species of Chinchona.

Two-years-old bark from a species of Chinchona brought by me from Java in 1861 flowers almost white, sweet smelling. Probably *C. lanceolata*. (Photograph D., No. 6.)

— No. 11. —

From the Secretary of State for India to the Government of India.

India Office, 9 July 1868.

WITH reference to the Despatch of your Excellency in Council, dated 25th November 1867, No. 201, forwarding samples of Chinchona bark with a view to their being analysed, and their market value ascertained in London, I herewith transmit a copy of a letter, dated 6th April, which has been received from Mr. Howard on the subject.

You will perceive that Mr. Howard declines pursuing the analysis of the Darjeeling barks, on the ground that their examination would require more time and labour than he is prepared to give to the subject. He has, however, submitted the samples of bark to the inspection of the brokers, and reports their opinion, which is not very satisfactory.

Under these circumstances it is advisable, in future, that the samples of bark grown in the Darjeeling plantations should be forwarded, from time to time, to Mr. Broughton, the Government quinologist at Ootacamund, whose special duty it is to perform these analyses. Copies of Mr. Broughton's reports should be forwarded to this office.

Enclosure in No. 11.

From Mr. Howard to the Under Secretary of State for India.

Sir,

Stratford, 6th April 1868.

I HAVE to acknowledge receipt of a copy of correspondence received from the Government of India, together with a box containing samples of bark from Darjeeling. I find these in good condition this time, without the damage I had to notice in the last remittance.

I have submitted these samples to the inspection of Messrs. Jenkin and Phillips (the brokers before consulted), Mr. Phillips values specimen No. 3, at 1 s. 6 d. to 1 s. 8 d. per pound. He has carefully examined the samples numbered 4 and 5, and considers them to be quite unsaleable, as they appear to have been gathered from very young trees, and would not be recognised as Indian red bark. Regarding No. 8, the Mossed bark, and No. 9, the Twiggy, Mr. Phillips feels it impossible to offer an opinion, especially as nothing is stated as to their richness in alkaloids or otherwise.

With reference to the request of the Secretary of State that I should undertake the analysis of this remittance, I beg respectfully to refer to what I stated in my last examination of Darjeeling bark, and to decline pursuing the analysis of these barks.

I have been happy to render my services gratuitously in the examination of the specimens from Ootacamund, and thus to further, as far as lay in my power, a great and beneficent national undertaking; but the examination of the Darjeeling barks would require more time and labour than I am prepared to give to the subject. I consequently return herewith the box of specimens, and think that the Government will have no difficulty in finding persons ready to undertake an analysis of the same for a pecuniary consideration. I have retained only part of number 3 (of which abundance remains for further analysis), and of No. 6, which does not, from some cause, show so well nourished an appearance as the mossed bark from Ootacamund, requiring further specimens and experiments in order to ascertain whether this is the effect of the climate.

I am, &c.
(signed) John Eliot Howard, F.L.S.

Herman Merivale, Esq.

— No. 12. —

From the Government of India to the Secretary of State for India.

Sir,

Simla, 26 August 1868.

WE have the honour to transmit, for your information, the accompanying report of the superintendent of the Botanical Gardens on the cultivation of Chinchona in the Lower Provinces, from the 1st April 1867 to the 31st March 1868.

Letter from Government of Bengal, No. 3630, dated 23 July 1868, and enclosure.

We have, &c.
(signed) John Lawrence,
W. R. Mansfield,
G. N. Taylor,
H. S. Maine,
John Strachey,
R. Temple.

Enclosure in No. 12.

From Thomas Anderson, Esq., M.D., Superintendent, Botanical Gardens, and in Charge of Chinchona Cultivation in Bengal, to the Secretary to the Government of Bengal (No. 17, dated Botanical Gardens, the 30th June 1868).

Sir,

I HAVE the honour to forward my Annual Report on the Cultivation of Chinchona in Bengal, from 1st April 1867 to 31st March 1868.

REPORT on the Cultivation of Chinchona in Bengal for the year 1867-68.

THE cultivation of Chinchonas has been most successfully carried on during the year. The number of plants propagated has far exceeded the amount added to the Chinchonas during any previous year. The open-air cultivation has been greatly extended, and now consists of four times the amount of plants reported last year. Good seed, from which young plants have been reared, was procured from *C. succirubra* and the varieties of *C. officinalis*. A very satisfactory analysis has been made in London, by Mr. Howard, of the bark of *C. succirubra* and *C. officinalis* grown at Darjeeling. I shall follow the arrangement of the report of last year, and shall consider the plants in their different stages of growth.

Stock Plants.—These plants, which are all grown under glass panes, are in excellent condition, and notwithstanding the vast amount of cuttings they have yielded, their vigour has increased during the year, as shown by the table of the monthly number of cuttings made during the year.

The stock plants of *C. succirubra* were increased to 20,000 in August 1867. In May, the number of stock plants of *C. micrantha* was reduced from 6,000 to 1,000, and the space obtained by the reduction was devoted to the extension of the stock plants of *C. Calisaya*.

The stock plants of *C. Calisaya* were increased from 624, the number at the end of March 1867, to 4,168, this increase being attained in November 1867. The stock plants of the varieties of *C. officinalis* have had no additions made to them, as many of the plants of this species planted in the end of 1864 are again in flower, and large quantities of seed will be secured this year.

Cuttings.—As in previous years the increase of all the species has been effected principally by cuttings made from the stock plants. The number of cuttings made during 1867-68 is much above the number of any previous year.

The largest number of cuttings made in one month was 87,500 in August 1867, and the smallest number 24,500 in January 1868. The maximum and minimum numbers of the previous report were 74,550 in September 1866, and 12,000 in January 1867. The total number of cuttings made and rooted in 1867-68 was 6,86,470 against 5,60,611 in 1866-67. The number of cuttings made in each month is as follows:—

						Cuttings.
April	-	1867	-	-	-	36,200
May	-	"	-	-	-	59,200
June	-	"	-	-	-	85,000
July	-	"	-	-	-	85,000
August	-	"	-	-	-	87,500
September	-	"	-	-	-	81,000
October	-	"	-	-	-	85,000
November	-	"	-	-	-	27,120
December	-	"	-	-	-	63,500
January	-	1868	-	-	-	24,500
February	-	"	-	-	-	51,000
March	-	"	-	-	-	31,450
Total						6,86,470

Seedlings.—A quantity of excellent seedlings of *C. officinalis* and a very few of *C. succirubra* were reared from seed yielded by the plants planted at Rungbee in October 1864. Besides these, I received during the year several packets of seed of *C. officinalis* and of *C. succirubra* from Mr. Thwaites, the director of the Botanical Gardens, Ceylon. The number of seedlings raised during the year amounted to 1,01,750. The number of seedlings obtained during the previous year was 38,500.

Nursery Beds.—Large additions were made to the nursery beds, as I always endeavour to plant as many rooted cuttings and seedlings in these beds during the winter as possible, in order that a great number of well-hardened plants may be ready for permanent planting at the commencement of the rains. The new nursery beds were prepared on the slopes of the Rishap spur adjoining Rungbee, where land has been cleared for the extension of the plantations. Most of the plants in these beds remained unprotected throughout the winter. The number of plants in the nursery beds on the 31st March 1868 was 5,18,821; they belonged in nearly equal proportions to *C. succirubra* and *C. officinalis*, with the exception of 8,260 plants of *C. micrantha* and 160 of *C. Calisaya*. The number of plants in nursery beds at the corresponding period of the previous year was 2,59,210.

Permanent

Permanent Plantations.—The formation of the open-air plantations and the tending of the plants in them are the simplest parts of the cultivation of Chinchona as practised at Darjeeling. As the process of planting followed by me at Darjeeling has not yet been fully stated in any of my previous reports, the time has now arrived for narrating the various stages of the open-air cultivation, from the clearance of the forest-covered land until the end of the second year of the growth of the plants. Hitherto, the land selected has consisted of ground on which Lepchas had previously carried on the cultivation of maize, millets, and rice (a peculiar variety, which is grown without being irrigated), in the manner known as joom* cultivation, with patches of virgin forest occurring every here and there among the partially-cleared spaces.

Nepalese coolies with their kookeries (short heavy curved knives) and Lepchas with their long straight sword-like knives are sent to fell the jungle as close to the ground as possible.

The scrub, and even young trees as thick as a man's body, fall rapidly before the knives of these clearers. Where patches of virgin forest are met with, the axe must be used, but here every tree is not felled, as the smaller ones, being notched near the ground, are borne down by the fall of the full-grown trees. In preparing ground for Chinchona planting at Darjeeling, the practice has always been to clear the land entirely of all vegetation, not a tree of even the smallest size ever being spared. In these hills, forest should not be felled before the middle or the end of November; if the land is cleared earlier, the grasses and underwood spring up among the branches of the fallen trees, and thus their burning is prevented. Felling may be continued until the middle of March. After two or three months' exposure to the bright sunshine and dry air of the cold season, the felled trees are in a fit state to burn. By the end of March, therefore, fires may be lit in the afternoon, when the sun has thoroughly dried up the heavy dew, at the bottom of the slope covered with felled and dry jungle. The fire rapidly consumes the whole of the brushwood and the branches of the trees, leaving only the large branches and trunks to smoulder for weeks.

Wherever virgin forest or bamboo jungle has existed, it has been necessary, after burning the lighter vegetation, to cut up the trunks of the trees and the bamboos into short pieces, and either to pile them into heaps for burning, or to roll them into the steep ravines which are too stony for planting Chinchonas. The land thus cleared by fire is ready for laying out the ground for planting and for marking the bridle-paths required to give easy access to all parts of it. These paths are made about four or five feet wide, and are connected with the principal roads of the plantation. The sites for the plants are fixed by means of a cord about 100 feet in length, on which marks are tied at intervals of six feet for *C. succirubra* and at shorter distance for *C. officinalis*. This marked cord is stretched along the ground, and at each mark on it a stick, about two and a-half feet in length, is thrust into the ground, thus indicating the place where a Chinchona is to be planted. In order to secure uniformity in the plantation, each line is continued to the full extent of the ground to be planted before another line is commenced; the lines in properly-laid-out plantations will thus be parallel.

In the plantations of *C. succirubra*, the lines are fixed at six feet from each other, and as the plants are six feet apart in the lines, a uniform distance of six feet between the plants is maintained.

At first, *C. officinalis* was planted with an interval of five feet between the plants, but I have lately altered this plan for a system of close planting in lines, the lines being four feet apart.

After the ground has been "staked out," the next preparation for planting consists of digging the soil to the depth of a foot, removing the roots at the same time in a circle about one foot in diameter, of which the stake is the centre. The planting of the ground thus prepared is performed in dull cloudy weather when showers are frequent, but when the ground is not saturated by long continued heavy rain. The thoroughly-hardened plants are brought from the adjoining nursery beds in shallow boxes, which the men carry on their heads. The plants are given to the coolie engaged in planting, who with his hands makes a hole in the loose soil sufficiently large to admit the roots of the plant, and the soil is gently pressed around the roots to prevent the plant being beaten down by heavy rain. The plants when taken from the nursery bed should not be less than four inches, and should not exceed a foot in height, but plants varying from six to ten inches in height are of the best size.

After the plants have been planted for three weeks, it is necessary to cut down the weeds which have sprung up around them, as in a few weeks more the young Chinchonas would soon be smothered in a jungle five or six feet high. This luxuriant growth of weeds springs from the creeping roots and deeply-buried tubers of gigantic grasses, ferns, *dioscorea*, *araceæ*, *cucurbitaceæ*, *convolvulaceæ*, etc., which, protected by their underground position, escaped destruction when the jungle was burned. The seeds too of some of the most noxious weeds, such as *bidens*, *ageratum*, *chenopodium*, *polygonum*, seem to have the power of not being injured

* Joom cultivation is the term used to designate the rude cultivation practised by most of the hill tribes of India. It consists of felling and burning virgin forest (leaving the stumps of the trees standing) for the growth of sub-tropical grains. After two or three crops have been obtained, the ground is abandoned for a freshly-cleared patch of forest. The piece abandoned soon becomes covered with a dense vegetation of shrubs, gigantic grasses, and young trees.

injured by a considerable amount of heat, as after the first showers in May the ground becomes covered by such annual species, two months after a fierce fire has apparently destroyed all vegetation. Many of these weeds could be eradicated by deeply trenching the soil before planting, but from the steepness of the slopes and the excessive rain-fall this cannot be attempted in Sikkim. It is followed by the washing away of the best soil and even by extensive landslips. These weeds require to be cut down once a month from May until the end of October; they are laid in lines following the slope of the hill, and the slightly-raised ridges soon disappear as they are decomposed by the heavy rain and high temperature. During the same period of the year, it is necessary to weed every six weeks the prepared circles in which the Chinchonas are growing, and at the same time to loosen the soil round the plants by lightly hoeing with a kodali or furroah. In November the entire surface of the plantations is thoroughly hoed, and by this means the weeds receive a great check by being exposed to the drying sunshine of the cold season after having been uprooted. After hoeing, the plantation requires no attention until the end of April, when a light covering of weeds having sprung up again, the circles round the plants should be lightly hoed and somewhat enlarged. From May again, until the end of October, the periodical cutting of the weeds must be continued, but not so frequently as in the previous season, as many of the strongest-growing weeds by this time have succumbed to the hoeing in November. The growth of the plants is greatly favoured by a hoeing of the ground in November again, after the second growing season is over, and if this is done in the following year, their third growing season, the plants are tall and strong enough to outgrow the jungle which then begins in its turn to be smothered under the dense foliage, at least of *C. succirubra*.

The number of plants of *C. succirubra* added to the permanent plantation during the year amounts to 2,28,773 and of *C. officinalis* to 1,28,559. The area of ground planted with Chinchonas on the 31st March measured about 350 acres. The small number of plants of *C. succirubra* planted in October 1864 were, on the 31st March 1867, from 6 to 14 feet 4 inches high, and a few plants of *C. officinalis* planted at the same time were from 5 to 8½ feet high. The girth of the stems of these plants of *C. succirubra* at 6 inches above the ground varied from 7 to 12½ inches.

The plants of *C. succirubra* referred to in my last annual report as having been placed in the Terai have succeeded only on the gentle slopes which occur close to the base of the hills, those (about 50) planted on flat but well-drained land, distant two miles from the hills, have completely failed.

The Selim Tea Association purchased 10,000 plants of *C. succirubra* in July 1867, and all of these which were planted on the steep slopes of the Himalaya immediately above the Terai, are inferior in condition and promise to only the splendid plants of Chinchona in the Government plantation at Rishap, close to Rungbee. I fear it is hopeless to attempt the cultivation of any species of Chinchona in the proper Terai district; in that district the cultivation will succeed only on the forest-clad slopes which are intermediate between the flats of the Terai and the declivities of the Himalaya.

Chemical Analysis of the Bark.—The bark of *C. succirubra* and *C. officinalis* referred to in the last annual report as having been sent to London for analysis, was analysed by Mr. Howard. The analysis was most satisfactory, one specimen of *C. succirubra*, 31 months old, yielding no less than 7.30 per cent. of precipitated alkaloids, of which 3.20 was quinine and 2.27 Chinchonidine mixed with a little quinine, a larger percentage of alkaloids than has been found in any other bark of the same age. The bark of *C. officinalis* taken from plants 28 months old gave 3.20 of alkaloids. The conclusion drawn by Mr. Howard from this analysis is "that there is no reason to think the Darjeeling barks at all inferior to those grown at Ootacamund; the difference of climate does not appear to have much effect on the alkaloids therein contained."

Flowering and Seeding.—A small number of (270) plants of the varieties of *C. officinalis* planted in October 1864 have again produced a profusion of flowers, and already many of them are covered with most promising panicles of seed vessels. A considerable amount of good seed was obtained from several of these plants in August and September 1867. Out of 389 plants of *C. succirubra* planted in October 1864, only two plants produced flowers and seed last year, and a few seedlings were raised from their seed. These plants which were in an unhealthy state at the time of flowering, soon after became healthy and vigorous, and this year they have not flowered. Another plant of *C. succirubra*, from whose stem a large piece of bark was taken, has put forth a few flowers from one or two of the branches. With these exceptions none of the *C. succirubra* plants have flowered at Darjeeling, although many of the oldest plants are above 12 feet in height.

Distribution of Chinchonas.—11,390 plants of *C. succirubra* were distributed during the year. Of these 10,290 were sold to planters in the district of Darjeeling, 1,000 plants were dispatched to Chittagong for distribution among the tea planters, and 100 were sent to the Deputy Commissioner of Hazara in the Punjab.

Private Cultivation of Chinchona in Darjeeling.—100 acres were planted with *Chinchona succirubra* during the year, by the Darjeeling Chinchona Association. The area on this estate planted with Chinchona is now 120 acres. I have not been informed of the number of plants this company possesses, but as 200 acres of land have been prepared for planting during the approaching rainy season, the number of plants probably amounts to 500,000.

At Coombe Banks, the Chinchona estate of Major Fitzgerald, 25 acres have been planted

planted, and the total number of plants of *C. succirubra*, the only species cultivated, is about 80,000.

The Darjeeling Tea Company possesses some fine plants of *C. succirubra* planted in May 1864. This company is also forming plantations of red bark on land well adapted to the cultivation of Chinchona.

Mr. Robson, the superintendent of the Chinchona plantations of the Tuckvar Tea Company, has made large additions to the plantations of *C. officinalis* and *C. succirubra*. Some of the older plants of *C. officinalis* on this estate are now in flower.

The Selim Tea Association, whose lands extend almost into the Terai, possesses 10,000 plants of *C. succirubra*, which were purchased from the government plantations in July 1867. They have been planted among the tea plants in lines along the roads of the estate, the plants being placed about 10 feet apart, so as to form avenues of Chinchona.

I regret that I am not able to state the exact number of Chinchona plants possessed by private companies and individuals in this district, but I estimate the number at nearly 600,000. The area planted is probably 170 acres.

1,000 plants of *C. succirubra* were sent to Chittagong in February 1868, and most of them arrived in good order. The accounts I have received of the state of the plants formerly sent to Chittagong are very meagre, but so far as they extend they show that the climate is suitable for *C. succirubra*. 1,800 plants of red bark have been distributed in the Chittagong District since March 1866.

Khasia Hills.—The establishment of a small nursery at the Khasia Hills was sanctioned by Government early in 1867. The nursery was intended only for raising plants of Chinchona for distribution among the planters in Assam; one of the European gardeners from the Darjeeling plantation was sent, in February 1867, in charge of the plants from Darjeeling, with which the cultivation was to be commenced. He reached Shillong in the Khasia Hills in the end of March, and early in May the cultivation was commenced on land near the Dāk Bungalow of Nunklow, on the Gowhaty and Khasia Hill road, on the northern slopes of the hills.

The plants had been increased from 650, the original number sent from Darjeeling, to 6,778 on the 31st March 1868. The distribution was begun in March 1868 by the sale of 100 plants, and other applications had been registered. The species in these nurseries is *C. Succirubra*, the only species that will probably succeed in Assam.

Meteorological records taken at the different elevations at Darjeeling during 1867 are appended.

NUMBER and Distribution of Chinchona Plants in the Government Plantations at Darjeeling, on the 31st March 1868.

Names of Species of Chinchona.	Number in Permanent Plantations.	Number of Stock Plants for Propagation.	Number of Seedlings or Rooted Cuttings in Nursery Beds for Permanent Plantations.	Number of Rooted Plants in Cutting Beds.	Number of Cuttings made during March.	Total Number of Plants, Cuttings, and Seedlings.
C. Succirubra - - -	2,72,923	20,000	2,51,585	1,88,849	29,000	7,62,357
C. Calisaya - - -	220	4,158	160	6,366	1,450	12,354
C. Micrantha - - -	5,558	1,000	8,220	15,889	- none -	30,667
C. Officinalis and varieties -	1,45,399	10,000	2,58,856	3,33,153	1,000	7,48,408
C. Pahudiana - - -	5,092	- none -	- none -	- none -	- none -	5,092
TOTALS - - -	4,29,192	35,158	5,16,821	5,44,257	31,450	15,58,878

Thos. Anderson, M.D., Superintendent, Botanical Gardens, and in Charge of Chinchona Cultivation in Bengal.

ABSTRACT of METEOROLOGICAL OBSERVATIONS at RUMBEE for 1867.

MONTHS.	Second Plantation, Altitude 5,000 feet.					Third Plantation, Altitude 4,410 feet.					Fourth Plantation, Altitude 3,332 feet.					Fifth Plantation, Altitude 2,556 feet.					Rainfall at Second Plantation in inches.
	Mean Temperature.	Maximum Temperature.	Mean Maximum.	Minimum Temperature.	Mean Minimum.	Mean Temperature.	Maximum Temperature.	Mean Maximum.	Minimum Temperature.	Mean Minimum.	Mean Temperature.	Maximum Temperature.	Mean Maximum.	Minimum Temperature.	Mean Minimum.	Mean Temperature.	Maximum Temperature.	Mean Maximum.	Minimum Temperature.	Mean Minimum.	
January - - - -	46.43	58	52.56	36	39.3	48.3	58	53.2	39	43.4	51.9	68.5	58.84	40	44.96	57.4	71	68.1	42	46.7	1.45
February - - - -	46.3	59	52.96	33	39.64	48.58	62	54.44	38	42.72	56.68	69	62.34	40	50.82	59.69	78	70.46	41	48.92	1.0
March - - - -	51.9	66	60.51	38	43.29	55.2	68	61.36	41	49.04	65.9	79	69.42	52	62.38	69.15	81	75	56	63.30	4.1
April - - - -	57.3	73	62.5	47	52.1	59.2	75	65	48	53.4	68	80	71.6	59	64.4	69.4	80	80	51	58.8	7.9
May - - - -	62.11	74	67.62	54	56.6	63.5	75	69.37	56	57.63	67.83	81	76.17	55	59.5	75.3	91	86.9	61	63.8	10.5
June - - - -	65.2	76	69.6	56	60.8	67.2	77	72.3	57	62.1	70.5	81	77.9	58	63.2	78.9	94	89.5	63	68.3	27.0
July - - - -	65.5	74	67.56	61.5	63.45	67.0	78	71.0	62	64.3	72.16	82	78.66	64	65.66	79.3	92	88.3	62	70.3	60.0
August - - - -	64.83	72	67.32	60.5	62.35	67.23	75	70.73	62	63.73	72.52	83	78.57	62	66.48	78.12	90	87.15	68	69.1	33.1
September - - - -	65.8	70	69.4	58	62.3	68.2	78	72.4	62	64.1	72.9	88	81.8	60	64.1	78.5	94	88.0	66	69.1	29.7
October - - - -	59.4	69	64.9	47	54.0	62.1	72	68.9	50	55.3	66.1	81	76.7	49	65.5	72.0	88	84.87	53	59.13	6.05
November - - - -	52.7	66	58.6	43	46.8	53.74	62	60.26	46	47.22	59.0	75	69.9	44	48.1	66.06	84.5	79.25	50	52.88	9.65
December - - - -	47.1	60	53.2	38.5	41.1	49.5	62	55.7	40.5	43.3	55.3	68	65.4	42	45.2	-	-	-	-	-	9.05
Means - - - -	57.04	68.8	62.31	47.7	51.81	59.19	70.17	64.50	56.13	53.85	64.89	77.96	72.28	52.08	57.53	71.26	86.59	81.59	56.36	60.94	182.4 inches.

— No. 13. —

From the Secretary of State for India to the Government of India.

India Office, 28 October 1868.

I HAVE received your Excellency's Despatch, dated 26th August 1868, transmitting Dr. Anderson's interesting report on the cultivation of Chinchona plants in the Lower Provinces for the year 1867-68.

Considerable progress has been made on the Government plantations at Darjeeling, and it is particularly satisfactory to find that so many companies, as well as private speculators, are seriously engaging in this important cultivation.

— No. 14. —

From the Secretary of State for India to the Government of India.

My Lord,

India Office, 4 March 1869.

Para. 1. I HAVE had before me, in council, the Despatch of your Excellency's predecessor, dated 31st December 1868, forwarding the report of the committee of medical officers appointed to examine the febrifuge properties of Chinchona alkaloids other than quinine.

2. Similar reports have been received from the medical officers of the Madras and Bombay Presidencies, and it is satisfactory to find that there is almost an unanimous opinion that these alkaloids may be used with great benefit, in India, in cases of fever. One very important conclusion which has been arrived at by one of the medical officers who has reported on the subject is, that in certain peculiar cases where quinine cannot be borne, the other alkaloids will be found good substitutes.

3. Quinine, though one of the most indispensable medicines that is used in India, is also one of the most expensive, and it is very desirable that the results of these inquiries should bear fruit. The other alkaloids, especially chinchonine, are very much cheaper than quinine, and this should not be lost sight of in the preparation of indents for medicines. The Chinchona febrifuge alkaloids should now be made available in India to a much larger extent than has hitherto been practicable, and thus save, to a considerable extent, the expense of quinine.

I have, &c.
(signed) *Argyll.*

— No. 15. —

From the Government of India to the Secretary of State for India.

My Lord Duke,

Simla, 28 April 1869.

In continuation of our Despatch, No. 92, dated the 4th July 1868, and with reference to Sir Stafford Northcote's Despatch in the Public Works Department, No. 21, dated the 7th October last, we have the honour to transmit a copy of the further correspondence, noted on the margin, regarding the experimental introduction of Chinchona into British Burmah.

We have, &c.
(signed) *Mayo.*
W. R. Mansfield.
H. M. Durand.
H. S. Maine.
John Strachey.
B. H. Ellis.

From Public Works
Department, No.
98 F, dated 22 Feb.
1869, and enclosures.
Ditto, No. 169 F,
dated 10 April 1869,
and enclosures.

Enclosure 1, in No. 15.

CAPTAIN SEATON'S REPORT upon the CHINCHONA PLANTATIONS in the MADRAS PRESIDENCY.

From *W. B. Macrone*, Esq., Assistant Secretary to the Chief Commissioner of British Burmah, Public Works Department, to Colonel *C. H. Dickens*, R.A., Secretary to the Government of India, Public Works Department, No. 1150-7 P., dated Rangoon, the 1st February 1869.

I AM directed by the Chief Commissioner, British Burmah, to submit a report by Captain Seaton upon the Chinchona plantations in the Madras Presidency, prepared after his return to Rangoon. The Government of India will remember that his deputation was approved in Home Department, No. 2785, dated 30th June 1868. The Chief Commissioner has no remarks to offer on the report, beyond stating that he thinks it has been carefully prepared.

2. Captain Seaton is now engaged on the planting out of the seedlings brought over with him, and on his return his report will be submitted for orders.

From Captain *W. J. Seaton*, Conservator of Forests, British Burmah, to the Secretary to the Chief Commissioner of British Burmah, Public Works Department, No. 55 A., dated Rangoon, the 24th November 1868.

I HAVE the honour to submit the following report of my late visit to the Chinchona plantations in the Madras Presidency, undertaken in accordance with Proceedings No. 66 of the 24th July 1868, and No. 2785 of the Government of India, dated 30th June 1868.

2. As has been already reported in this office, letter No. 28 A., dated 14th September 1868, I left Rangoon on the 18th August, and took with me two Karen lads for a 12 months' course of training in the cultivation of Chinchona.

I reached Madras on the 26th August, and after a short stay there proceeded by rail 301 miles to Coimbatore, and thence 32 miles by bullock transit to Mettapollium and Kullar, at the foot of the Neilgherry Hills, on the south-east side.

Thence to Coonoor at the top of the Ghaut of that name, which is a distance of 10 miles. By the new road, made at a gradient suitable for conveyances, it is considerably more.

3. The elevation of Coonoor is about 6,000 feet above the level of the sea, or about 1,000 to 1,500 feet below that of Ootacamund. Its mean temperature in the early part of September was about 68° Faht., or 8° higher than that of Ootacamund. The climate also being much milder, Coonoor is resorted to by many visitors on their arrival on the hills, to acclimatise themselves before venturing into the lower temperature of Ootacamund.

4. After a week's residence at Coonoor, I proceeded on to Ootacamund, distant 12 miles, on the 10th September, and on the following day made over the Karen lads to the care of Mr. McIvor, Superintendent of the Government Chinchona Plantations.

5. At Ootacamund I applied myself to a study of the system of Chinchona cultivation, which has answered so admirably, and reflects so much credit on Mr. McIvor's able management.

It may be thus briefly described under the following heads:—

- I. Propagation.
- II. Selection of Sites.
- III. Cultivation.

I. Propagation.—The propagation of the plant is by seeds, cuttings, and buds. It is usually carried on in glass houses, by which means the failures are reduced to a minimum compared with what would be the result if the plants were exposed to variations of temperature in the open air.

The seed is sown in pots 2½ inches deep, prepared in the following way:—

A piece of tile is first placed over the drain hole, then a layer of brick dust, and over that a mixture of sand and fine leaf mould, but chiefly the former, the surface being kept half an inch below the edge of the pot to allow of water, when poured on slowly, percolating through the soil below.

The pots are watered two or three times a day, as may be necessary.

With the temperature kept at a uniform level of 65° to 70° Faht., germination usually takes place within two or three weeks.

When

When the seedlings get two or more leaves they are put out about an inch apart into similar pots filled with mould and brick dust. In this operation great care is taken not to bruise the roots. To effect this a small flat stick, with a niche at one end, is used for lifting the plants, and the earth is so opened with a round stick that they can be lowered into the holes prepared for them without risk of pressure from the hand. They are then watered carefully and the mildew scraped off the surface of the pots daily to prevent the plants damping off, fresh sand being sprinkled on from time to time, as that on the surface comes off in the above operation.

When an inch or two high the seedlings are put out into hardening beds, under glass frames or thatched *pandals*, and gradually exposed to the air and sun, until sufficiently hardy to admit of removal to the nurseries, which is generally when they have four to six leaves. In the nurseries they are placed in rows four inches apart, and three inches within the rows in soil similar to that of the main plantation for which they are destined, watered daily, if necessary, and sheltered by tatties, thatched with ferns, placed upon a raised framework, five feet high on one side, and three feet on the other, the tatties being lifted more and more until the plants are well established and able to bear exposure to the sun.

The treatment of cuttings and buds is similar to that of seedlings as regards hardening and preparation for removal to the main plantations. When first taken from the parent trees they are placed in fine brick dust over a layer of leaf mould, and generally take root within a month to six weeks. If planted out in the open air, partially shaded, cuttings form roots within three or more months.

II. *Selection of Sites*.—The sites are selected with reference to aspect, shelter from the prevailing winds, soil, drainage, and elevation.

A northerly aspect is preferred, but at Ootacamund the various plantations have different aspects as well as degrees of exposure, which cannot be avoided as the plantations cover a large area.

For the brown and yellow bark species from 7,000 to 8,000 feet elevation is selected. For the red and grey bark 5,000 to 6,000 feet elevation is deemed the best, but they will grow at a much lower elevation, 3,000 feet, and as low as 2,500.

Some plants, *Succirubras*, two years old, are doing well in a coffee plantation on the Carcoor Ghaut, at 2,500 feet elevation, where the climate is particularly moist, the rainfall being upwards of 200 inches. As that of Ootacamund is only 40 to 50 inches, it may be assumed that a heavy rain-fall compensates for elevation, and is essential to success at low elevations.

The most suitable localities on the hills for the Chinchona plant appear to be the re-entering angles between the bends and spurs where the ground was originally occupied by "*sholas*," or patches of evergreen forest, and the soil consists of a dark rich vegetable loam. In such localities the red and grey bark thrive best, while the other varieties will grow on open grass land and peaty soils. All require good superficial drainage, as well as on open sub-soil below.

III. *Cultivation*.—In the early part of the dry season the trees, brushwood, &c., on the site selected are felled and prepared for burning in every way, similar to the system known in this province as "*toungya*" cultivation. After the whole has been well burnt at the close of the dry season, the ground is marked off into lines for the plants, pathways made, and catch drains cut here and there to carry off the surface water during heavy rains. Pits two feet square and two deep (seven feet apart for the red and grey barks) are then prepared and filled with the best surface soil and burnt earth.

The ground being now ready for the reception of the plants from the nurseries, a wet showery day is selected for the work of transplanting. In this operation, to avoid touching the roots, the plants are held by the leaves; care also is taken not to imbed the plant deeper than the collar or head of the roots. Immediately they are planted out, the plants have to be shaded either with a circular basket, open at both ends, or with a few pieces of wood placed erect and covered with ferns. During the hot season the earth is heaped up around the billets of wood in the shape of a circular bund, but this is removed on the first fall of the rains.

In the event of the weaker plants requiring water during the hot months, this is done by watering the ground a foot or two on the slope above them, a hole being prepared for the water to penetrate readily into the soil. As they grow and require support against the wind they have to be secured above the stem with grass rope between two stakes. Beyond an occasional weeding nothing more is done to the plants, which, when fairly established, can be left to themselves.

6. At Neddivattum, 18 miles north-west of Ootacamund, is the largest and oldest plantation of the red and grey bark varieties. I visited it on the 26th September, when *en route* to Nellamboor.

7. The general appearance of the red bark indicated vigorous growth, especially on the more sheltered slopes, while the reverse was the case on the more exposed parts.

8. The red barks have obtained a considerable size; the oldest, now six years of age, being 15 to 25 inches in girth, and from 10 to 20 feet in height. The grey barks of the same age are a little less in girth, but quite equal to the red barks in height. Notwithstanding the existence of catch-drains, it would appear that trees are occasionally injured by the action of the surface water; in one instance the earth seemed to have accumulated only an inch or two above the collar or union of the stem and roots, and yet the tree was dying; the results are said to be the same if the soil is washed away and the head of the roots exposed.

9. All the older red and grey barks now bear seed, and as a proof of the hardiness of these species, I may add that numerous seedlings are obtained under the trees. This fact, together with the successful cultivation of these species in the Wynaud, and at as low an elevation as 2,500 and 3,000 feet, specially recommend them for introduction into this province, where, although only moderate elevations are obtainable, a good rainfall can be counted on. There can also be no doubt that the propagation of the plant will be attended with less difficulty at low elevations than at the higher ones, where the frosts prove so injurious. We may further entertain the hope that when seed is obtainable from the plants recently supplied by Mr. McIvor, and now about to be planted out, it will be possible to cultivate these species on other hill ranges of lower elevation, such as the hills between the Irrawaddy and Sittang Rivers, on the sources of the Pegu River, and those in the Martaban and Tenasserim Provinces.

10. With regard to the period required for the Chinchona tree to produce bark, Mr. McIvor has definitely fixed it at four to six years, the trees on the Neilgherry plantations having commenced to yield a small harvest of bark at that age, the quality of which was found to equal that of the finest Peruvian bark.

Mr. McIvor's plan, in opposition to that of felling the trees, is to obtain constant supplies of bark by a system of mossing. About half the bark is taken off in alternate strips of two or three inches in width, and the parts thus laid bare are covered with a layer of green moss about three inches thick.

In the course of 18 months to two years new bark will have formed under the moss, and another supply of bark can be had by taking off the alternate strips remaining between those of the renewed bark, the moss over which is placed over the new places laid bare.

According to this process every alternate year a small crop of bark is obtainable from the tree.

From analysis made by Mr. Broughton, quinologist to Government, the renewed bark has been found to yield a greatly increased amount of alkaloid, but it would appear that the system of mossing needs to be tried on a large scale, so that the increase of bark and alkaloid can be definitely determined, and its cost compared with that of the Coppice system.

11. Having now briefly sketched the outlines of the system of Chinchona cultivation, it only remains for me to add that I brought my visit to the hills to a close on the 21st October, and took with me 200 strong plants of the *Succirubra* variety, carefully selected by Mr. McIvor, and packed in Wardian cases, as well as a supply of seed of the red and grey bark species.

12. Besides the seed of the red and grey barks, and 200 strong plants of the red bark variety, as reported in my letter, No. 51 A., dated 16th November 1868, I have also to acknowledge the receipt from Mr. McIvor of seed of the following varieties of Australian trees which have been introduced with so much success into the Hill Districts of India:—

Acacia robusta.	Eucalyptus robusta.
„ Len Comæfolia.	„ Stringy bark.
„ Stricta.	

The *Eucalypti* rank foremost among timber trees for rapidity of growth, durability of timber, and the huge proportions they attain.

The successful cultivation of these species at as low elevations as 3,000 and 4,000 feet fully warrant an experiment on a small scale being tried with them in this province.

13. The following measurements taken by me at Ootacamund exhibit the extraordinary rapid growth of these trees:—

1. Eucalyptus globulus, age 18 years.	9 feet in girth.
1. „ gumifera „ 2½ „	2 feet 6¾ inches in girth.
1. „ robusta „ 8 „	4 feet 2 „ „

14. In conclusion, I take this opportunity of stating that I received every assistance from Mr. McIvor, and obtained from him all the information I needed regarding the cultivation of Chinchona.

No. 98F, dated the 22nd February 1869.

COPY of the above forwarded to the Home Department, in continuation of Public Works Department, No. 195F., dated 12th June, and No. 417F, dated 30th November 1868.

By Order,
E. C. S. Williams, Major, R.E.,
 Under Secretary to the Government of India, P. W. Department.

No Present Orders.

Enclosure 2, in No. 15.

No. 169 F., dated Simla, the 10th April 1869.

COPY of the following, forwarded to the Home Department, in continuation of Public Works Department, No. 98 F., dated 22nd February 1869.

(signed) *E. C. S. Williams*, Major, R.E.,
 Under Secretary to the Government of India,
 Public Works Department.

No. 1263-7 F., dated Rangoon, the 11th March 1869.

From Lieutenant-Colonel *A. Fraser*, R.E., Secretary to Chief Commissioner, British Burmah, to the Secretary to the Government of India, Public Works Department.

IN continuation of the letter from this office, No. 1150-7 F., dated 1st February 1869, I am directed by the Chief Commissioner, British Burmah, to submit copy of a report by the Conservator of Forests, British Burmah, regarding the measures taken by him for the formation of Chinchona plantations at Plumadoe in the hills to the north-east of Tounghoo.

2. The Chief Commissioner considers the report a most interesting one, and reflects much credit upon Captain Seaton for the care and interest he evinces in the successful introduction of Chinchona into this province.

3. The Chief Commissioner has ordered the publication of the report in the supplement of the "British Burmah Gazette."

No. 83 A., dated Rangoon, the 5th March 1869.

From Captain *W. J. Seaton*, Conservator of Forests, British Burmah, to the Secretary to the Chief Commissioner, British Burmah, Public Works Department.

FOR the information of the Chief Commissioner, I have the honour to submit the following report regarding the Chinchona plants of the *Succirubra* variety, which were brought over by me in November last from Madras, as has been duly reported in letter, No. 55 A., of 24th November 1868, and regarding the measures adopted for the propagation of the plant by seed.

2. I also beg to append two inspection reports of the Deputy Conservator of Forests, Tounghoo, dated respectively the 15th and 16th February 1869, on the condition of the plants at Plumadoe at that time.

3. *Failures among the Plants.*—Out of the 200 plants which reached this in safety on the 14th November 1868, 188 survived the boat and land journey to Tounghoo and Plumadoe. The failures, numbering 12, or 6 per cent., were confined either to the smaller plants which were overtopped by the others, or to those in proximity to the sides of the cases.

4. *Treatment of the Plants.*—While at Rangoon from the 14th November to 11th December, as well as during the boat journey from the 11th to the 20th December to Tounghoo, the glass frames were kept constantly open to harden the plants (the cases being under shade). The surface of the soil was watered once or twice a week sufficient to keep up a slight degree of moisture about the roots. Care was also taken to allow no accumulation of dead leaves in the cases.

Between Tounghoo and Plumadoe during the journey which occupied four days from the 22nd to 25th December, the cases were kept closed and shaded during the day, but were opened at night, and left so until the hour for starting. For the first two days, although the latter part of the route lay through very hilly country, near the sources of the Choung-maguay, it was possible to have the cases carried on elephants as far as the Myatswah Choung. Thence Karens were engaged from village to village for this purpose; the ascent and descents, as the Myetguan Choung was approached, being very steep, as well as numerous, in consequence of the path, like all Karen pathways, being made in as straight a line as possible from village to village, without any regard apparently to the topographical features of the country.

After a somewhat tedious journey, 188 plants, mostly strong and with few exceptions unaffected by the trip, were brought in safety to Plumadoe by the 25th December.

5. *Plantation at Plumadoe.*—The site originally selected for the Chinchona plantation by Mr. Kurz is to the south of Plumadoe village, and along the north bank of a small water-course known as the Zalorlah Choung. Assuming the elevation of Plumadoe to be about 2,100 feet, the site above-mentioned will probably be not more than 2,000 feet above sea level. Judging from the stately proportions attained by the betel palm (*Arca catechu*) which is cultivated here to a very large extent, the soil must be particularly rich, and the situation well adapted to the cultivation of plants of the evergreen variety. The soil, in fact, appears to be a rich alluvial as well as diluvial deposit, of great depth, and of a dark colour. The ground has a considerable fall westward, and towards the bank of the water-course, which is joined a little lower down by the Teethorlo, another little rivulet, and flows thence towards the Myetguan, a southern tributary of the Thonkyaghat river.

The site thus selected appears suitable in many ways for Chinchona cultivation, but as experience hitherto has shown that a well-drained locality, with light open soil, is best adapted to Chinchona, it appeared advisable to select another site upon a well-drained slope, where some of the plants could be planted out at no great distance from water.

6. *Upper or new Site Selected.*—To the south of Zaylorlah such a spot was chosen on the slope of the hills which shut in the Plumadoe Valley on the south. In elevation it may be about 100 feet above Plumadoe; it has a north-easterly aspect, and is well sheltered from winds on every side; whilst, should it be determined to extend the plantation upwards, an elevation of about 3,000 feet would be obtained.

The soil there is much about the same as that on the ground near the Zaylorlah, with the exception of its possessing more of a reddish tinge, caused doubtless by its being entirely a diluvial deposit.

The vegetation on this slope is confined to bamboos of young growth (*kyathoungwa*) and a species of grass, with a few trees which are probably left standing by the "toungya" cultivators for the sake of the branches.

7. *Temperature.*—The mean temperature on this slope within the 24 hours was ascertained by placing a thermometer in the shade near the ground, to be 59° Fahrenheit, the maximum being 70° and minimum 48°.

8. *Planting Operations.*—It was at first planned to have the plants put out in a nursery artificially shaded, but as this would have involved the Deputy Conservator coming to Plumadoe, at the commencement of the rains, to superintend the final planting operation, a time when his presence could be ill-spared from Tounghoo, it was deemed expedient to plant out at once, and furnish each plant with a separate covering as protection from the sun.

8½. On the 26th December, a spot sufficient for putting out 105 plants at 6 feet distances, was cleared of jungle at the upper site, and a commencement made towards pitting the ground to a depth of 1½ to 2 feet. On the 28th this was completed; circular fascines of split bamboo-work were made, and the planting out of the young plants commenced; about 11 only having been put out as an experiment on the evening of the 26th.

In this latter operation, sand and brick-dust were freely mixed with the soil, which, prior to being filled into the pits, was slightly moistened and cleared, as far as possible, of roots, stones, hard clods, &c. Care was taken not to subject the roots of the plants to any pressure from the hand, and to have them as straight as possible before filling in the mould; as each plant was put out, it was immediately shaded by a fascine (open at both ends) with ferns and dried sheaths of the "waboh" bambo, so placed as to shield the plant from the direct rays of the sun at noon.

Altogether 188 plants were thus put out, viz., 105 in the upper site, and the remainder, 83 in number, on the ground originally selected near the Zaylorlah. The work was brought to a close by noon on the 29th December. Directions were given for the fencing in of the upper plantation, and the preparation of a catch-drain above it. Instructions were also issued regarding the careful watering of the plants, both morning and evening, should the same appear necessary, and towards adding fresh soil round the roots on the lateral roots becoming exposed. From the vigorous appearance of the 11 plants put out on the 26th, it was assumed that if proper care were bestowed on the plantation, and the above instructions rigidly adhered to, a very small per-centage of the plants would fail.

9. *Plantation Establishment.*—After consultation with the deputy conservator, it was deemed

deemed sufficient for the present to have the following temporary establishment for the Plumadoe Plantation:—

1 Goung, on	-	-	-	-	Rs. 10 per mensem.
2 Peons, on	-	-	-	-	„ 8 each per mensem.

10. *Experimental Plantation of 1865.*—In returning to Tounghoo, the Bogalay and Palawah route was taken. This gave an opportunity of inspecting the two plants, *C. succirubra* variety, put out by my predecessor, Mr. Leeds, on a slope a little below the crest of the hill, in March 1865. The plants looked healthy; the leaves, though fresh and green, had the reddish tinge, which is always a sure indication of vigour in the *succirubra* variety. In height they were six feet five inches and five feet two inches, respectively, though not more than three inches in girth. The lower branches were found to have been a good deal mutilated by village goats, owing to the absence of a fence, in the erection of which there appears to have been unaccountable delay. These broken branches were collected, and have since been forwarded by me, for analysis of the bark, to Mr. Broughton, quinologist to Government, Madras.

It is difficult to account for such slow development in girth of these plants, except that they were originally very weak and puny.

11. *Propagation of the Plant by Seed.*—I have now to note the measures taken with reference to the propagation of the plant by seed.

On my return to Tounghoo, after consultation with Mr. Graham and Dr. Mason of the Karen mission, I decided that the main experiment should be made at Tounghoo, where the proper amount of care and attention essential to success can be bestowed on it; but which could not be expected from the Karens on the hills. A supply of seed of both the red and grey bark varieties was then made over to Dr. Mason, with a copy of Mr. McIvor's work on the treatment of medical Chinchonas, Dr. Mason being willing to devote the utmost care to the experiment, and anxious to introduce the plant as early as possible among the Karens. The remainder of the seed was entrusted to Mr. Graham, who will experiment with it, and distribute some of it also to other gentlemen connected with the Karen mission for the same purpose, it being understood that on the seed germinating the seedlings, when sufficiently hardy, are to be sent to trustworthy parties on the hills, to be placed in nurseries, as is the practice on the Neilgherries, preparatory to final planting.

I was led to adopt this plan from knowing the difficulties to be encountered in the rearing of the plants, which, when very young, are liable to damp off if over-watered, or not exposed to free currents of air. It is only when they are a few months old that they can be said to be hardy, and not likely to suffer from neglect.

12. In conclusion, it only remains to describe the present condition of the plantation, and the steps I purpose taking in the future treatment of it.

From the accompanying inspection report of Mr. Graham, Deputy Conservator of Forests, it would appear that the Plumadoe plantation, on the 15th and 16th February, contained 188 plants, 20 having apparently died; which, out of 188, the number planted, gives only a percentage of 10·6 as failures.

The inspection report gives the following details:—

Very healthy plants	-	-	-	-	-	-	-	150
The stems of which have died, and re-sprouted	-	-	-	-	-	-	-	12
At present sickly	-	-	-	-	-	-	-	6
Apparently dead	-	-	-	-	-	-	-	18
Disappeared	-	-	-	-	-	-	-	2
								188

From the fact that several with dead stems have re-sprouted, it may be hoped that some of those classed as apparently dead may yet give signs of vitality. The healthy and vigorous condition of many of the plants also encourages the hope of the locality proving a suitable one.

13. The height of the plants should have been recorded, and Mr. Graham's attention will be called to it.

14. In the future treatment of the plantation, the main work will be to have the plants moderately sheltered from the sun, carefully watered also, and their lateral roots well looked to; their exposure to the atmosphere usually resulting in the death of the plant.

15. During the rains it will be possible to reduce the establishment, and retain only the goung, who can see to the repairs of the fence and maintenance of the shade required for the weaker plants, as the larger ones will then be sufficiently hardy to bear exposure.

16. Towards the close of the rains, if the experiment with the seed succeed at Tounghoo, nurseries will be formed for the reception of the young plants, a further supply of seed must be obtained from the Neilgherries; and as the two lads now being trained at Ootacamund will then have returned, these nurseries and the work of propagation, will then be entrusted

to them. From the experience they will have had, it may be confidently assumed that a large number of seedlings will be obtained for distribution among the Karens, who, it is needless to add, are most anxious to commence the cultivation of a plant of so much value to the fever-stricken population of the hills.

17. Mr. Graham mentions that fever has been unusually virulent this year among the hill population.

— No. 16. —

From the Secretary of State for India to the Government of India.

India Office, 8 July 1869.

I HAVE considered, in council, your Excellency's Despatch, dated 28th April 1869, transmitting a copy of correspondence relating to the introduction of Chinchona cultivation into British Burmah.

Captain Seaton has made himself thoroughly acquainted with the method of cultivation in use on the Neilgherry Hills, and has successfully transported a number of plants to Tounghoo, and planted them out in a carefully selected site. The plants will be under his personal supervision, and it appears that he has secured the co-operation of other residents who are impressed with the importance of the experiment. Captain Seaton deserves great credit for the zeal he has shown in performing this service, and I trust that such slight assistance as may be required to ensure final success will be extended by the local Government.

3. An elevation of only 2,000 feet is, it is to be feared, insufficient for the successful cultivation of bark as a commercial speculation, but there can be no doubt that the possession of the febrifuge bark, naturalised in their country, will be a great blessing to the native population of British Burmah.

— No. 17. —

From the Government of India to the Secretary of State for India.

My Lord Duke,

Simla, 15 July 1869.

IN continuation of our Despatch, of the 26th August 1868, we have the honour to forward the special narrative of the proceedings of the Government of Bengal, with three copies of the annual report on Chinchona cultivation in Bengal for 1868-69, and the resolution of the Lieutenant Governor thereon.

We have, &c.
(signed) *Mayo.*
W. R. Mansfield.
H. M. Durand.
H. S. Maine.
John Strachey.
B. H. Ellis.

Enclosure in No. 17.

From C. B. Clarke, Esq., M.A., Officiating Superintendent, Botanical Gardens, and in charge of Chinchona cultivation in Bengal, to the Secretary to the Government of Bengal (Botanic Gardens, 27 May 1869).

Sir,

I beg leave to submit the annual report on the cultivation of Chinchona in Bengal, for the year ending 31st March 1869.

2. I took charge of the office of superintendent of the Botanic Gardens, Calcutta, yesterday only, and the present report is constructed almost entirely out of materials supplied by Mr. Gammie, in charge of the Government Chinchona Gardens, near Darjeeling, and by Mr. Biermann, in charge of the Government Chinchona Nursery at Nunklow, Cossyah Hills.

3. In the Government Chinchona Gardens near Darjeeling, the propagation has been hitherto by cuttings only, as the shrubs do not produce seeds till they have attained a few years' growth. It is expected that in a year or two large quantities of seeds will be obtained. Chinchona seed has always been raised under glass, in order to ensure the germination of the greatest possible proportion of the rare and precious seeds; but Dr. Anderson lately caused a quantity of the seeds of *C. Pahudiana* (a worthless species) to be sown under mats, and excellent plants were raised quite as well as under glass. It may be hoped from the result of this important experiment that the propagation by cuttings may be shortly discontinued, and that any person wishing to commence Chinchona cultivation may be able to do so by simply purchasing a little seed.

4. The propagation (at the Darjeeling Government gardens) of *C. succirubra* by cuttings has been discontinued and the stock plants thrown away, because enough nursery plants have already been obtained to complete the planting of 1,000 acres, which is the area intended to be occupied by *C. succirubra*. The stock plants of *C. Calisaya* have been increased from 4,158 to 10,000, because it has been ascertained that the species is a very valuable one in quinine, and the number of this species planted out is as yet very few as compared with that of *C. succirubra* and *C. officinalis*. The stock plants of *C. micrantha* have been thrown away. The stock plant of *C. officinalis* has not been increased, as seed is expected this year, and better plants can be produced by seed than from cuttings.

5. The increase during the year of all the species of Chinchona plants is 673,654, being 12,816 less than that of the preceding year. The increase in each month is as under—

April	-	1868	-	-	-	-	-	-	63,600
May	-	"	-	-	-	-	-	-	70,400
June	-	"	-	-	-	-	-	-	91,000
July	-	"	-	-	-	-	-	-	204,000
August	-	"	-	-	-	-	-	-	88,200
September	"	-	-	-	-	-	-	-	72,000
October	"	-	-	-	-	-	-	-	51,000
November	"	-	-	-	-	-	-	-	38,000
December	"	-	-	-	-	-	-	-	2,000
January	1869	-	-	-	-	-	-	-	2,000
February	"	-	-	-	-	-	-	-	1,000
March	"	-	-	-	-	-	-	-	1,500
									684,700
Deduct Number distributed									10,046
Ditto - thrown away									1,000
									11,046
TOTAL									673,654

6. In the nursery beds on the 1st April, there were 556,798 plants, all in excellent condition, and 200,000 of them ready for transplanting out in the plantations so soon as the weather should be favourable.

7. In the permanent plantations 534,236 plants have been planted out. Of this number 342,807 are *C. succirubra*, 167,320 are *C. officinalis*, and 24,109 are *C. micrantha*. The area of ground planted with Chinchonas on 1st April 1869 was 610 acres, of which 500 acres are *C. succirubra*; the remaining 110 acres of *C. succirubra* proposed to be planted have been cleared of jungle, and will be planted before the end of 1869-70. For *C. officinalis*, 80 acres have been cleared, and for *C. Calisaya*, 10 acres. The growth made by the plants in the Rungbee and Rishap plantations during the year has far exceeded that during the preceding year. The tallest plant of *C. succirubra* is 19 feet high, of *C.*

officinalis is 11 feet 3 inches. Many plants of *C. officinalis* have a good crop of seeds ripening on them, and others are coming into flower. A few plants of *C. succirubra* are also coming into flower.

8. The number of Chinchonas distributed during the year was as under—

Mr. Johnson, Dooteriah, Darjeeling	-	-	-	-	8,000
Officiating Superintendent, Botanic Gardens, North Western Provinces	-	-	-	-	1,300
Lord Lawrence	-	-	-	-	600
Dr. J. M. Coates, Hazareebaugh	-	-	-	-	100
Colonel Strutt, Kangra Valley	-	-	-	-	42
Mr. Miller, Darjeeling	-	-	-	-	4
TOTAL	-	-	-	-	10,046

9. Of Ipecacuanha there are five rooted plants, and one cutting in the Government Chinchona Gardens, Darjeeling.

10. The Darjeeling Chinchona Association possessed, on 1st April 1869, 671,518 Chinchonas, of which 652,506 were *C. succirubra*. The area planted was 275 acres. The plantations are in good order, and the association has lately purchased a large tract of land adjoining their plantation, and continue to push on the cultivation with great rapidity.

11. On the Tukvar Tea Company's estate there are 75,000 Chinchonas, 20,000 of which are planted out and growing well.

12. The Darjeeling Tea Company have 30,000 plants of *C. succirubra* on the Tukvar tea plantation. Of these 20,000 are planted out and growing well.

13. In other plantations near Darjeeling there are 19,000 Chinchonas.

14. The total number of Chinchonas in the Darjeeling district is 3,028,050, viz., 2,232,532 in Government, and 795,518 in private plantations. The area planted is about 965 acres.

15. Between 1st April 1868 and 31st March 1869, there was paid into the Darjeeling Treasury by the Chinchona cultivation Rs. 1,562. 12. as under:—

	Rs.	a.	p.
Rent of land	1,162	-	-
Rent of shops	42	-	-
Sale of Chinchona plants	289	12	-
Sale of Wardian cases	60	-	-
Sale of timber	9	-	-
TOTAL	1,562	12	-

16. At Nunklow the total number of Chinchonas in the Government gardens was 18,975 on 31st March 1869, as against 6,778 on 31st March 1868. Of these 18,221 are *C. succirubra*, 421 are *C. micrantha*, and 333 are *C. officinalis*. The garden here being of scarcely more than two years, standing, the chief part of this number of plants are cuttings or nursery plants, but 823 have been planted out in experimental plantations.

17. During the year 1,045 plants (all of *C. succirubra*) have been sold, and Rs. 240. 10. resulting therefrom, and from the sale of some wardian cases, has been paid into the Treasury.

18. The plants of *C. succirubra* planted out for experiment, at elevations varying from 1,000 to 3,800 feet of elevation, look promising. The experimental plantations near Nunklow were severely cut by hail in April 1868, when hailstones two inches in diameter fell. The young plants, even up to a growth of two inches diameter of stem, have been eaten through by locusts in some cases.

19. Neither *C. officinalis* nor *C. micrantha* can be said to have succeeded as yet in these nurseries.

20. A path of four miles has been made to connect the experimental nurseries. The labourers' huts have been repaired and good drinking water brought to them. About eight acres of ground have been cleared ready for planting out. Mr. Biermann considers there is little hope of the cultivation of the tropical Chinchonas being successful near Shillong; plants of *C. succirubra*, which have been tried there by private persons, have been severely injured by frost.

21. Mr. Biermann considers that, in order that the object for which he was sent to the Coosyah hills may be attained, it is essential that the nursery should be placed where facilities for communication exist, as the great cost of coolie hire in the Coosyah hills must otherwise render the transmission of plants, and the formation of paying plantations impracticable.

NUMBER and DISTRIBUTION of CHINCHONA PLANTS in the Government Plantations of Darjeeling, on the 31st March 1869.

Names of Species of Chinchona.	Number in Permanent Plantations.	Number of Stock Plants for Propagation.	Number of Seedlings or Rooted Cuttings in Nursery Beds for Permanent Plantations.	Number of Rooted Plants in Cutting Beds.	Number of Cuttings made during March.	Total Number of Plants, Cuttings and Seedlings.
C. Succirubra - - - -	6,15,730	20,000	2,83,006	3,24,979	- none -	12,43,715
C. Callaya - - - -	220	10,000	2,460	13,174	1,500	27,354
C. Micrantha - - - -	20,067	- none -	- none -	- none -	- none -	29,667
C. Officialis and varieties -	3,12,719	10,000	2,71,332	3,32,653	- none -	9,26,704
C. Pahudiana - - - -	5,082	- none -	- none -	- none -	- none -	5,082
TOTALS - - -	9,63,129	40,000	5,56,798	6,70,806	1,500	22,32,532

ABSTRACT of METEOROLOGICAL OBSERVATIONS at RUNGBEE and RISHAP for 1868.

MONTHS.	Second Plantation, Altitude 5,000 Feet.					Fourth Plantation, Altitude 3,332 Feet.					Fifth Plantation, Altitude 2,000 Feet.					Rain-fall at Second Plantation in Inches.
	Mean Temperature.	Maximum Temperature.	Mean Maximum.	Minimum Temperature.	Mean Minimum.	Mean Temperature.	Maximum Temperature.	Mean Maximum.	Minimum Temperature.	Mean Minimum.	Mean Temperature.	Maximum Temperature.	Mean Maximum.	Minimum Temperature.	Mean Minimum.	
January - - -	44.9	59	49.8	36	40.1	50.6	59	57.5	38	43.8	53.8	73	67.9	36	39.8	0.95
February - - -	45.8	67	50.6	36.5	41	52.7	65	58.3	43	47.1	53.8	76	66.9	34	40.8	1.2
March - - -	54.05	72	60.8	39	47.27	59.32	75	67.7	44	50.24	62.09	85	76.79	38.5	47.38	1.3
April - - -	60.65	72	68.2	46	53.1	65.6	78	76.2	52	55	65.5	84	78.37	43	52.63	7.0
May - - -	63.59	78	70.0	49.5	50.28	67.9	80	76.4	57	59.4	69.91	90	82.84	51	56.98	5.95
June - - -	68.61	79	74.42	59	62.8	71	80	77.3	62	64.7	73.6	90	84	60	63.2	43.6
July - - -	-	-	-	61	63.5	73	80	78.3	66	67.7	72.7	91	82.06	61	63.37	44.7
August - - -	-	-	-	62.5	64.0	73.9	82	80	67	67.81	74.49	92	84.61	62	64.37	41.85
September - - -	-	-	-	57.5	61.57	71.28	80	78.94	61	63.62	72.7	92	83.14	59	62.26	24.1
October - - -	-	-	-	51.5	56.37	66.56	78	75.62	54	57.5	68.46	87	82.95	47	53.98	5.75
November - - -	-	-	-	47	49.62	58.31	67	65.16	49.5	51.46	62.13	83.5	77.67	43	46.6	-
December - - -	-	-	-	37	44.01	-	-	-	43	46.1	61.33	80	76.61	42	46.05	0.05
MEANS - - -	56.26	71.16	62.45	48.54	53.33	64.56	74.9	71.94	53.04	56.2	65.87	85.29	78.65	48.04	53.12	176.45

— No. 18. —

From the Secretary of State for India to the Government of India.

11 September 1869.

I HAVE received your Excellency's Despatch, dated 15th July (No. 59) 1869, and notice with satisfaction the good progress that has been made at Darjeeling in Chinchona cultivation.

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N N 3

Several

Several private companies appear to be entering upon this cultivation on a large scale, and as I presume they would not do so without thoroughly investigating the subject, and satisfying themselves of the adaptability of the district, as regards soil and climate, for producing satisfactory results, I look upon this readiness to undertake the cultivation as some guarantee of the successful growth of these febrifuge trees on the slopes of the Himalayas.

The Government plantations appear to be in excellent order, and reflect credit upon those who have had the management of them.

— No. 19. —

From the Government of India to the Secretary of State for India.

My Lord Duke,

Simla, 10 June 1870.

IN continuation of our Despatch, dated the 15th July 1869, we have the honour to forward the Special Narrative of the Proceedings of the Government of Bengal, enclosing the annual report on Chinchona Cultivation in Bengal, for the year 1869-70, with the resolution of the Lieutenant Governor thereon.

We have, &c.
(signed) *Mayo.*
Napier of Magdala.
John Strachey.
R. Temple.
J. F. Stephen.
B. H. Ellis.
H. W. Norman.

Enclosure to No. 19.

GOVERNMENT OF BENGAL.

Special Narrative.

Fort William, 19 May 1870.

HEREWITH is forwarded, for transmission to his Grace the Secretary of State for India, the accompanying copy of a letter from the Officiating Superintendent of the Botanical Gardens, No. 188, dated the 29th ult., submitting the annual report on the cultivation of Chinchona in Bengal for the year 1869-70, together with a copy of the resolution recorded thereon by the Honourable the Lieutenant Governor of Bengal.

By order of the Lieutenant Governor of Bengal,

(signed) *Rivers Thompson,*
Officiating Secretary to the Government of Bengal.

From *C. B. Clarke*, Esq., M.A., Officiating Superintendent, Botanic Garden, and in charge of Chinchona Cultivation in Bengal, to the Secretary to the Government of Bengal; dated Botanic Garden, Calcutta, the 29th April 1870.

Sir,

I BEG leave to submit the annual report on the cultivation of Chinchona in Bengal, for the year ending 31st March 1870.

2. The three species of Chinchona, of which the cultivation has been extended during the year, are *C. succirubra*, *C. officinalis*, and *C. Calisaya*.

The

The number of plants of these species in permanent plantations was as under:—

	<i>C. Succirubra.</i>	<i>C. Officinalis.</i>	<i>C. Calisaya.</i>
31 March 1869 - - - -	615,730	312,719	220
31 March 1870 - - - -	1,055,100	406,899	4,000
Increase - - -	439,370	94,180	3,780

3. The increase of permanent plantation of *C. succirubra* and *C. Calisaya* has been made about Rishap at an elevation of 2,500 feet; the increase of *C. officinalis* at Rungbee, at an elevation of about 4,500 feet.

4. The average growth for the year of the 10 measured plants of *C. succirubra*, planted in March 1867, at Rishap, has been 51 inches, which fairly represents the satisfactory general growth of the *C. succirubra* plantations.

5. The average growth for the year of the 10 measured plants of *C. officinalis*, planted in October 1864, at Rungbee, has been 12 inches, which fairly represents the unsatisfactory general growth of the *C. officinalis* plantations.

6. The average growth for the year of the 10 measured plants of *C. Calisaya*, planted in June 1867 at Rishap, has been 52 inches, which represents the average growth of all the plants in the plantation catalogued as *C. Calisaya*. But several important varieties are included under the name *C. Calisaya*, and the tree variety, raised by seed in February 1867 and planted out in June 1867, has attained a height of 12 feet in October 1869, and a tree of this age, lately cut down, has produced 2 lbs. of dry bark.

7. As fully explained by Dr. T. Anderson in his annual Chinchona report in Bengal, for the year ending 31st March 1868, the exceeding steepness of the hills, combined with the large rain-fall, prevents any tillth on these Chinchona plantations. The grass and low jungle having been cut close, the young Chinchona plants are planted out in the permanent plantations. The weeds having been merely headed down, not eradicated, grow with great strength in a moist and warm climate, and continual scouring of the young plantations is necessary. This is the chief expense under this system of cultivation.

8. *C. succirubra* and *C. Calisaya* (tree variety) grow so freely, that by the third year the young trees in the plantations are all locked; they then crush the jungle beneath them, and can take care of themselves, and little further expense upon them is called for.

9. But *C. officinalis* shows no inclination to become a tree at these plantations; it remains a shrub with very scanty foliage, and even on the plantations which are five years old, there continues the same expenditure in scouring.

10. *C. succirubra* and *C. Calisaya* are planted about 1,200 to the acre; *C. officinalis* about 4,000 to the acre.

11. In the fifth year of growth in permanent plantation an acre of *C. officinalis* carries less than one-fourth the bark carried by an acre of *C. succirubra*, and costs more than four times as much annual expenditure. Moreover, the *C. officinalis* then appears disinclined to grow much larger, whereas *C. succirubra* will clearly grow into a considerable tree.

12. I calculate that, at present, it has not been discovered how to grow *C. officinalis* to economic profit at Rungbee. I therefore stopped its extension in September last, though I was aware of the high quality of the grey bark. The present quantity is large for an experiment; and as an experiment, a few acres of *C. officinalis* were planted in September last, at a somewhat higher level (5,000 feet) than the main plantation; also, in all the *C. officinalis* plantations below the level of 4,000 feet (above which level *C. succirubra* does not thrive). *C. succirubra* has been planted between the ranks of *C. officinalis*, and will doubtless soon overgrow it.

13. The propagation and extension of *C. Calisaya* has been pushed as fast as possible. There is no difficulty in multiplying *C. succirubra* and *C. officinalis* by cuttings, but at Rishap there is found the greatest difficulty and uncertainty in multiplying *C. Calisaya* by cuttings. Herr von Gorkom, the director of the Dutch Government Chinchona cultivation in Java, informs me, that there the same difficulty with *C. Calisaya* is found; but on the other hand, Mr. McIvor, in the drier climate of the Neilgherries, strikes cuttings with perfect success.

14. Herr von Gorkom has sent me on several occasions most valuable packets of *C. Calisaya* seed, which germinated excellently; but if it could be discovered how to grow *C. Calisaya* by cuttings, I should greatly prefer that method, as by it, I am sure of getting exactly

exactly the variety which I wish to propagate. Mr. McIvor is of opinion that not merely do the varieties cross freely, but that many hybrids are formed from different species of Chinchona.

15. The most valuable bark known in the European market is the *C. Calisaya* bark: this species grows admirably at Rishap, and during the past year propagation has been almost entirely confined to it. In growing for profit, I believe it will ultimately be found advisable to grow one or two species only on these plantations; and that it is best to discard a species at once which is clearly inferior with us to *C. Calisaya* and *C. succirubra*.

16. I have lately brought from the Neilgherries two new kinds of Chinchona, one provisionally named *C. mirabilis*, of Mr. Broughton, the other *C. pitayo*. In *C. mirabilis* the bark contains the astonishing quantity of 13½ per cent. of quinine alkaloid, and more than 9 per cent. of crystallisable quinine. *C. pitayo* is a rich bark from Peru, a very high-level species, said to be found growing through the snow.

17. During the year both *C. succirubra* and *C. officinalis* ripened seeds: 5½ ounces of the former and 5¼ ounces of the latter were distributed. One ounce of seed will raise nearly 50,000 plants.

18. There were distributed from Rungbee, during the past financial year, Chinchona plants as under:

	C. Succirubra.	C. Calisaya.	C. Officinalis.
Mr. Werniche, Kursiong - - -	2,500	50	—
Dr. Jameson, Saharunpore - - -	1,500	260	500
Mr. Robson, Tukrar - - -	- - -	200	—
Colonel Strutt, Kangra Valley - -	- - -	12	—
TOTAL - - -	4,000	522	500

19. The amount of propagation having been greatly reduced, a considerable number of the old frames and glass were sold. The receipts for the past year of the Chinchona plantation paid into the Darjeeling treasury were as under:—

	Rs.	a.	p.
Rent from land let - - - - -	1,130	-	-
Price of a wardian case - - - - -	10	-	-
Sale of Chinchona plants - - - - -	156	4	-
Sale of old glass - - - - -	187	8	-
TOTAL - - -	1,483	12	-

20. The total expenditure for the year on the Sikhim Chinchona cultivation was 50,224 rupees, being 18,642 rupees less than the estimate, and 18,040 rupees less than that of the preceding year.

21. The *C. succirubra* trees stand 6 feet by 6 in the plantations, and, as an experiment in January last, a small portion of the denser plantation was thinned by cutting down three trees out of every four. This was found to produce 300 lbs. of dried bark, worth about 250 rupees per acre.

22. At the same time a considerable portion of the more advanced trees were pruned by the removal of the lower branches. There was stored from the thinnings and prunings in all 2,400 lbs. of dried bark.

23. The only private plantation in Sikhim, which (so far as I know) is extending Chinchona planting on a considerable scale, is that of Mr. Lloyd and Colonel Angus, known as the Darjeeling Chinchona Association, and which occupies the north side of the Rungbee valley. This association now has about 500 acres of permanent plantation of *C. succirubra*, and has cut a considerable quantity of three-year-old bark during the late cold weather, and sold it in the London market.

24. The Government Chinchona plantation at Nunklow, in the Khasi Hills, was formed for the supply of Chinchona plants to the planters in Assam and Cachar. Seed is now easily transmitted, and I believe the discontinuance of the plantation at Nunklow has been decided upon by Government.

NUMBER and Distribution of Chinchona Plants in the Government Plantations near Darjeeling on the 31st March 1870.

Names of Species of Chinchona.	Number in Permanent Plantations.	Number of Stock Plants for Propaga- tion.	Number of Seedlings or Rooted Cut- tings in Nursery Beds for Permanent Plantations.	Number of Rooted Plants in Cutting Beds.	Number of Cuttings made during the Month.	Total Number of Plants, Cuttings, and Seedlings.
C. Succrabra - - - -	1,055,100	20,000	164,615	- none -	- none -	1,239,715
C. Callisaya - - - -	4,000	10,000	8,758	32,274	2,000	57,032
C. Micrantha - - - -	29,667	None -	- none -	- none -	- none -	29,667
C. Officinalis, and varieties - -	406,899	10,000	205,952	307,853	- none -	930,704
C. Pahudiana - - - -	5,092	None -	- none -	- none -	- none -	5,092
TOTAL - - - -	1,500,758	40,000	379,325	340,127	2,000	2,262,210

C. B. Clarke,
Officiating Superintendent, Botanic Garden, and in charge
of Chinchona Cultivation in Bengal.

(RESOLUTION.)

General Department.—General.

Fort William, 19 May 1870.

READ a letter* from the Officiating Superintendent of the Botanical Gardens, in charge of Chinchona cultivation in Bengal, submitting the annual report on the cultivation of Chinchona in Bengal, for the year ending with the 31st of March 1870.

* No. 188, dated the 29th ultimo.

The Lieutenant Governor notices, with approbation, the successful extension of Chinchona cultivation on the Government plantations, at a less cost than in the preceding year.

Ordered, that a copy of this Resolution be forwarded to the Superintendent of the Botanical Gardens in charge of Chinchona cultivation in Bengal, for information.

Also, that the report be published in the Supplement to the "Calcutta Gazette."

By order of the Lieutenant Governor of Bengal,

(signed) Rivers Thompson,
Officiating Secretary to the Government of Bengal.

— III. —

BOMBAY CHINCHONA COMMISSION.

— No. 1. —

From the Government of Bombay to the Secretary of State for India.

Right Honourable Sir, Bombay Castle, 19 April 1867.
 WITH reference to Sir Charles Wood's Despatch, No. 28, dated the 30th September 1865, we have the honour to forward the accompanying report* of the results of the investigations of the Commission appointed to test the efficacy in fevers of the alkaloids procure from the bark of the Chinchona trees grown on the Neilgherry Hills.

* Collection No. 1.

* Letter from the President of the Commission, dated 26 March 1867.

We have, &c.
 (signed) *Wm. R. Seymour V. Fitzgerald.*
B. H. Ellis.
C. J. Erskine.

Enclosure in No. 1.

From Dr. Arnott to the Chief Secretary to Government.

General Department, Bombay,
26 March 1867.

Sir,
 I do myself the honour to report that, as required by Government Resolution, No. 1072, dated 26th May last, the medical committee, as therein appointed, consisting of myself as president, and Drs. Nicholson, Hunter, and Joynt, as members, has had under investigation the alkaloids procured from the bark of the Chinchona trees grown on the Neilgherry Hills, and now begs to submit to the Government of Bombay the results of that investigation.

2. To give full effect to the instructions conveyed in the Secretary of State's letter, the committee deemed it advisable at once to forward to medical officers, both in civil and military employ, at various stations of this Presidency, and particularly those situated in malarious districts, small quantities of each alkaloid for the most careful experiment and report. The committee, at the same time, requested the co-operation of the principal medical officer, British troops, in allowing experiments to be made in the hospitals of Her Majesty's regiments, which he most kindly acceded to, so that the committee is able to judge of the effects of the alkaloids both on the European and native constitution.

3. In forwarding the alkaloids, the committee, at the same time, sent certain instructions which it had drawn up, and which it was directed each medical officer should observe as much as possible in making his observations and in framing his report. These instructions were as follows, and the committee have to record its high sense of the care with which the greater number of the reports have been framed, and the valuable and conclusive information they furnish:

"Sir,—Her Majesty's Government being desirous to have tested the febrifuge and other therapeutical effects of certain alkaloids procured from the bark of the Chinchona trees growing on the Neilgherry Hills, the Commission, of which I am president, has the honour to inform you that small quantities of them, as noted below, have been forwarded to you, and requests that you will subject each to the most careful experiment in your hospital.

"2. The Commission is anxious to ascertain—

- I.—What medicinal virtues these alkaloids possess.
- II.—Their general effects on the human system in health and disease.
- III.—To what extent they possess the anti-periodic effects of quinine.
- IV.—Their efficacy in the treatment of the common fever of the country, as well as in other diseases for which quinine is held in repute.
- V.—Their relative values as remedial agents; and
- VI.—Their proper doses.

"3. On the completion of your experiments, which it is hoped may be not later than the 1st of January 1867, you are requested to report to me the opinions you have arrived at on the various points mentioned in paragraph 2 of this letter, stating generally the circumstances

stances under which you have prescribed the different alkaloids, that is showing the nature of the case with its most prominent symptoms, and anything else that may occur to you in the elucidation of the investigation.

"4. Two ounces of each of the following alkaloids have been dispatched to you, for which you are requested to send a receipt on their safe arrival:—

Sulphate of quinine.
Sulphate of chinchonine.
Sulphate of quinidine.
Sulphate of chinchonidine.

I have, &c.
(signed) *F. S. Arnott*,
President of Commission."

4. In analysing the various reports that have been received, the committee begs briefly to observe that the results of the experiments that have been made are most favourable. There is no difference of opinion as to the highly valuable effects of these alkaloids, though, as was to be expected, there is some difference of opinion as to the exact order of importance in which their medicinal virtues should be arranged. All concur in assigning to them most valuable therapeutic effects as febrifuges, anti-periodics, stomachics and tonics, and they have been most successfully tried in fevers, in neuralgic affections, and rheumatism, in debility and want of appetite. All give a preference to the sulphate of quinine, after which most, though not all, rank quinidine, though others prefer chinchonine, which again is by many placed at the bottom of the list. In the treatment of disease, one of their most important properties seems to be in their effects when given alternately with other remedies, and with each other, as for instance, both quinidine and chinchonine proved effectual in cases of fever where quinine and arsenic had failed. One medical officer, in recording his want of confidence in chinchonine as an anti-periodic, states that he found it most useful in diarrhoea, and as a restorer of appetite.

5. The committee having thus tested the efficiency of these alkaloids on a scale sufficiently extensive to insure decisive results, has unanimously come to the conclusion, that they form a very valuable class of therapeutic agents, and taking the order of the instructions sent to medical officers, they consider them to be—

1st. Febrifuges, anti-periodics, and tonics.

2nd. Their general effects are similar to those of quinine, though, perhaps, in an inferior degree.

3rd. As variously estimated, they possess the same effects as quinine, to the extent of one-half or two-thirds.

4th. They are very efficacious in treating the common fever of the country, hemi-crania, and disordered digestion, &c. &c.

5th. Their relative value seems to be—

1st. Quinine.
2nd. Quinidine.
3rd. Chinchonidine about equal.
" Chinchonine "

6th. Their proper doses are—

Quinine, from 3 to 20 grains.
Quinidine, from 5 to 20 grains.
Chinchonidine, from 7 to 20 grains.
Chinchonine, from 7 to 20 grains.

I have, &c.
(signed) *F. S. Arnott, M.D. & C.B.*,
President of Commission.

— No. 2. —

From the Secretary of State for India to the Government of Bombay.

23 August 1867.

THE Report of the Medical Commission in your Presidency, appointed to test the febrifuge efficacy of Chinchona alkaloids, other than quinine, which was transmitted with your Despatch, dated 19th April 1867, has been printed for the information of physicians and chemists in England and on the Continent.

It is satisfactory to find that the Chinchona Commissions appointed in your Presidency and in that of Madras have arrived at similar conclusions.

R E T U R N.

East India (Chinchona Cultivat

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