

EAST INDIA (CHINCHONA PLANT).

No.	
24	Mr
25	

RETURN to an Address of the Honourable The House of Commons,
dated 14 May 1866;—for,

“ COPY of further CORRESPONDENCE relating to the Introduction of the
CHINCHONA PLANT into *India*, and to Proceedings connected with its
Cultivation, from April 1863 to April 1866.”

India Office, }
June 1866. }

E. D. BOURDILLON,
Secretary in the Public Department.

(*Mr. Ewart.*)

ordered, by The House of Commons, to be Printed,
18 June 1866.

CONTENTS.

— I. —

CHINCHONA CULTIVATION ON THE NEILGHERRY HILLS.

No.	FROM	TO	DATE.	SUBJECT.	Page.
1	Government of Madras	Secretary of State for India	11 Apr. 1863	Specimens of chinchona bark sent home for analysis.	1
	Mr. M'Ivor - - -	Secretary to Madras Government.	4 " "	- - - - -	1
2	Government of Madras	Secretary of State for India	13 " "	Monthly Report, 31 March 1863	2
	Mr. M'Ivor - - -	Secretary to Madras Government.	10 " "	- - - - -	2
3	Memorandum by Mr. Markham	- - - - -	- - - - -	Nomenclature of C. officinalis varieties	5
	Government of Madras	Secretary of State for India	13 May "	Monthly Report, 30 April 1863	6
	Mr. M'Ivor - - -	Secretary to Madras Government.	9 " "	- - - - -	6
4	Sir Charles Wood -	Government of Madras -	16 July "	Review of progress of chinchona cultivation.	8
5	Government of Madras	Secretary of State for India	16 June "	Monthly Report, 31 May 1863	8
	Mr. M'Ivor - - -	Secretary to Madras Government.	11 " "	- - - - -	9
6	Government of Madras	Secretary of State for India	13 July "	Monthly Report, 30 June 1863	11
	Mr. M'Ivor - - -	Secretary to Madras Government.	10 " "	- - - - -	11
7	Government of Madras	Secretary of State for India	12 Aug. "	Extent of planting operations	13
	Mr. M'Ivor - - -	Secretary to Madras Government.	7 July "	Establishment of a quinine manufactory.	13
	Mr. Howard - - -	Mr. Markham - - -	28 May "	Analysis of bark - - -	13
	Mr. M'Ivor - - -	Secretary to Madras Government.	27 July "	Extent of planting operation - - -	14
8	Government of Madras	Secretary of State for India	15 Aug. "	Monthly Report, 31 July	14
	Mr. M'Ivor - - -	Secretary to Madras Government.	11 " "	- - - - - 1863 - - -	15
9	Government of Madras	Secretary of State for India	12 Sept. "	Mr. M'Ivor's application for an increase of salary.	15
	Mr. M'Ivor - - -	Secretary to Madras Government.	13 Aug. "	- - - - -	17
	Order of the Madras Government	- - - - -	12 Sept. "	- - - - -	18
10	Government of Madras	Secretary of State for India	26 " "	Monthly Report, 31	18
	Mr. M'Ivor - - -	Secretary to Madras Government.	8 " "	August 1863 - - -	18
11	Government of Madras	Secretary of State for India	17 Oct. "	Monthly Report,	19
	Mr. M'Ivor - - -	Secretary to Madras Government.	10 " "	30 September 1863	20
12	Government of Madras	Secretary of State for India	11 Nov. "	Travelling allowance to Mr. M'Ivor	21
	Mr. M'Ivor - - -	Secretary to Madras Government.	10 Oct. "	- - - - -	23
	Order of the Madras Government	- - - - -	5 Nov. "	- - - - -	23
13	Government of Madras	Secretary of State for India	20 " "	Monthly Report, - - -	24
	Monthly Report - - -	- - - - -	31 Oct. "	Report, 31 October 1863 - - -	25
14	Government of Madras	Secretary of State for India	31 Dec. "	Monthly Report, - - -	25
	Mr. M'Ivor - - -	Secretary to Madras Government.	7 " "	Report, 30 November 1863	27
15	Sir Charles Wood -	Government of Madras -	30 Jan. 1864	Review of the progress of chinchona cultivation.	27
16	Public Despatch to Madras	- - - - -	29 Feb. "	- - - - -	29
16a	Mr. Howard's Analysis of bark	- - - - -	Dec. 1863	- - - - -	30
17	Government of Madras	Secretary of State for India	11 Jan. 1864	Monthly Report, - - -	30
	Monthly Report - - -	- - - - -	31 Dec. 1863	Report, 31 December 1863 - - -	32
18	Government of Madras	Secretary of State for India	23 Feb. 1864	Monthly Report, 31 January 1864	32
	Monthly Report - - -	- - - - -	31 Jan. "	- - - - -	34
19	Government of Madras	Secretary of State for India	11 Mar. "	Monthly Report, 29 February 1864	35
	Monthly Report - - -	- - - - -	29 Feb. "	- - - - -	37
20	Government of Madras	Secretary of State for India	13 Apr. "	Monthly Report, 31 March 1864	37
	Monthly Report - - -	- - - - -	31 Mar. "	- - - - -	39
21	Government of Madras	Secretary of State for India	19 May "	Monthly Report, 30 April 1864	40
	Monthly Report - - -	- - - - -	30 Apr. "	- - - - -	42
22	Government of Madras	Secretary of State for India	14 June "	Monthly Report, 31 May 1864	42
	Monthly Report - - -	- - - - -	31 May "	- - - - -	44
23	Sir Charles Wood -	Government of Madras -	8 Aug "	Review of the progress of chinchona cultivation.	44
					47

No.	FROM	TO	DATE.	SUBJECT.	Page
24	Mr. M'Ivor	Secretary to Government of Madras.	17 Mar. 1864	Bark for analysis	8
25	Mr. Howard	Under Secretary of State for India.	15 June "	Analysis of bark	8
26	Mr. Merivale	Mr. Howard	18 Aug. "	Thanks for analysing bark	50
27	Government of Madras Monthly Report	Secretary of State for India	23 July " 30 June "	Monthly Report, 30 June 1864	50 51
28	Government of Madras Monthly Report	Secretary of State for India	25 Aug. " 31 July "	Monthly Report, 31 July 1864	54 54
29	Government of Madras Monthly Report	Secretary of State for India	13 Sept. " 31 Aug. "	Monthly Report, 31 August 1864	57 57
30	Government of Madras Monthly Report	Secretary of State for India	19 Oct. " 30 Sept. "	Monthly Report, 30 September 1864	60 60
31	Government of Madras Monthly Report	Secretary of State for India	25 Nov. " 31 Oct. "	Monthly Report, 31 October 1864	63 63
32	Government of Madras Monthly Report	Secretary of State for India	22 Dec. " 30 Nov. "	Monthly Report, 30 November 1864	66 66
33	Government of Madras	Secretary of State for India	11 Jan. "	As to whether a road to the Pycara chinchona plantations will injure the view of the Pycara Falls.	69
	Colonel Hamilton	Chief Secretary to Madras Government.	2 Jan. 1863		69
	Order of the Madras Government		6 Jan. "		69
	Mr. M'Ivor	Secretary to Madras Government.	7 Jan. "		70
	Collector of Coimbatore		15 Jan. "		70
	Memorandum by Mr. Arbuthnot		8 Aug. 1864		71
	Order of the Madras Government		13 Aug. "		71
	Mr. M'Ivor	Secretary to Madras Government.	30 Aug. "		71
	Order of the Madras Government		23 Sept. "		72
	Mr. M'Ivor	Secretary to Madras Government.	11 Oct. "		72
	Memorandum by Mr. Arbuthnot				75
	Minute by Mr. Maltby		22 Oct. "		75
	Minute by Sir W. Denison		26 Oct. "		76
	Minute by Mr. Pycroft		4 Nov. "		77
	Mr. M'Ivor	Secretary to Madras Government.	3 Nov. "		79
	Order of the Madras Government		8 Nov. "		79
	Captain Beddome	Secretary to Madras Government.	15 Oct. "		81
	Order of the Madras Government		14 Nov. "		81
	Mr. M'Ivor	Secretary to Madras Government.	9 Jan. 1865		81
	Order of the Madras Government		16 Jan. "		82
84	Sir Charles Wood	Government of Madras	15 April "		82
85	" "	" "	28 Feb. "	Chinchona cultivation in Java and British India.	83
86	Dr. J. E. De Vry				83
37	Madras Government	Secretary of State for India	23 Jan. "	Monthly Report, 31 December 1864	94
	Monthly Report		31 Dec. 1864		94
88	Madras Government	Secretary of State for India	23 Feb. 1865	Monthly Report, 31 January 1864	97
	Monthly Report		31 Jan. "		97
89	Madras Government	Secretary of State for India	14 Mar. "	Forwarding Mr. M'Ivor's Report for 1863-64.	100
40	Mr. M'Ivor	Mr. Arbuthnot	9 July "		100
41	ANNUAL REPORT ON THE CHINCHONA PLANTATIONS FOR 1863-64				100
42	Order of the Madras Government		9 Feb. 1865	On the Annual Report for 1863-64	117
43	Government of Madras Monthly Report	Secretary of State for India	4 April " 28 Feb. "	Monthly Report, 28 February 1865	117 117
44	Government of Madras Monthly Report	Secretary of State for India	13 April " 31 Mar. "	Monthly Report, 31 March 1865	119 119
45	Government of Madras Mr. M'Ivor	Secretary of State for India Secretary to Madras Government.	11 May " 3 May "	Forwarding bark for analysis	122 122
46	Government of Madras Monthly Report	Secretary of State for India	26 May " 30 April "	Monthly Report, 30 April 1865	123 123
47	Government of Madras Medical Inspector General	Secretary of State for India	17 June " 30 Nov. 1863	Trial of chinchona leaves in cases of fever	126 126
	Order of the Madras Government		12 June 1863		126
	Mr. M'Ivor	Secretary to Madras Government.	21 Oct. 1864	Manuals of chinchona cultivation	126
48	Government of Madras Monthly Report	Secretary of State for India	11 July 1865 31 May "	Monthly Report, 31 May 1865	127 127

No.	FROM	To	DATE	SUBJECT.	Page.
4	Government of Madras	Secretary of State for India	25 July 1865	Monthly Report, 30 June 1865	130
	Monthly Report -	-	30 June "	-	130
50	Sir Charles Wood	Government of Madras	30 Sept. "	Review of progress of chinchona cultivation.	133
51	Mr. Howard	Under Secretary of State for India.	1 Aug. "	Report of analysis of bark	134
52	Mr. Merivale	Mr. Howard	28 Sept. "	Thanks for his analysis. Supply of chinchona alkaloids.	136
53	"	Sir Ranald Martin	30 " "	As to relative value of chinchona alkaloids.	136
54	Sir Ranald Martin	Mr. Merivale	3 Oct. "	-	137
55	Mr. Howard	Mr. Merivale	3 " "	Supply of chinchona alkaloids	138
56	Mr. Deedes	Sir Ranald Martin	6 " "	-	139
57	Sir Ranald Martin	Mr. Deedes	8 " "	-	139
58	Mr. Merivale	Messrs. Howard	13 " "	-	139
59	Messrs. Howard	Mr. Merivale	16 " "	-	139
60	Government of Madras	Secretary of State for India	24 Aug. "	Monthly Report, 31 July 1865	140
	Monthly Report -	-	31 July "	-	140
61	Government of Madras	Secretary of State for India	28 Sept. "	Monthly Report, 31 August 1865	143
	Monthly Report -	-	31 Aug. "	-	143
62	Government of Madras	Secretary of State for India	26 Oct. "	Monthly Report, 30 September 1865	146
	Monthly Report -	-	30 Sept. "	-	146
63	Government of Madras	Secretary of State for India	27 Nov. "	Monthly Report, 31 October 1865	150
	Monthly Report -	-	31 Oct. "	-	150
64	Government of Madras	Secretary of State for India	25 Dec. "	Mr. M'Ivor's theory of the formation of alkaloids in chinchona bark.	154
	Mr. M'Ivor	Secretary to Government of Madras.	24 Nov. "	-	154
	Secretary to Government of Madras.	Secretary to Government of India.	21 Dec. "	Attention drawn to Mr M'Ivor's application for a patent for mossing bark.	155
65	Government of Madras	Secretary of State for India	25 Dec. "	Monthly Report, 30 November 1865	156
	Monthly Report -	-	30 Nov. "	-	156
66	Government of Madras	Secretary of State for India	13 Nov. "	Forwarding Mr. M'Ivor's Annual Report.	160
67	ANNUAL REPORT ON THE CHINCHONA PLANTATIONS FOR 1864-65				160
68	Order of the Madras Government	-	26 Sept. 1865	On Mr. M'Ivor's Annual Report	179
69	Mr. M'Ivor	Secretary to Government of Madras.	25 Sept. "	Withdrawal of two paragraphs from his Report, in consequence of Mr. Howard's analysis.	180
70	Government of Madras	Secretary of State for India	25 Dec. "	Governor of Madras. Visit to the chinchona plantations.	184
	Minute by Sir William Denison	-	30 Oct. "	-	184
71	Dr. Cleghorn	Secretary to Government of Madras.	30 " "	Application for permission to accompany Mr. Markham to Ceylon.	187
72	Order of the Madras Government	-	8 Nov. "	Permission refused	188
73	Mr. C. R. Markham	Under Secretary of State	14 Feb. 1866	Inspection of plantations on the Neilgherries. Private enterprise. Chinchona cultivation in Wynaad.	188
	List of land purchased on the Neilgherries, under the	Waste Lands Rules	-	-	189
74	Government of Madras	Secretary of State for India	6 Feb. 1866	Monthly Report, 31 December 1865	191
	Monthly Report -	-	31 Dec. 1865	-	191
75	Government of Madras	Secretary of State for India	10 Mar. 1866	Monthly Report, 1 January 1866	194
	Monthly Report -	-	31 Jan. "	-	194
76	Thomson Hankey & Co.	Under Secretary of State	3 Feb. "	Information for the Jamaica Government, on chinchona cultivation.	197
77	Mr. Deedes	Thomson Hankey & Co.	13 " "	-	198
78	Mr. C. R. Markham	Under Secretary of State	16 April "	Supply of chinchona seeds for the Mexican Government.	198
	Don N. Lorenzano	Her Majesty's Consul General at Bagota.	4 Mar. 1864	Chinchona cultivation in South America	199
75	Memorandum by Mr. C. R. Markham	-	April 1865	On the preparation of a monograph on the chinchona genus.	200
76	Mr. M'Ivor	Secretary to Government of Bombay.	16 Nov. "	Budget estimates of the Chinchona Department for 1866-67.	201
	Order of the Madras Government	-	5 Jan. 1866	-	201
81	Government of Madras	Secretary of State for India	11 April "	Monthly Report, 28 February 1866	202
	Monthly Report -	-	28 Feb. "	-	203
82	Government of Madras	Secretary of State for India	11 April "	Mr. M'Ivor's application for a patent for his discovery of the utility of moss in increasing the deposition of quinine in chinchona bark.	206
	Minute by Mr. Pycroft	-	3 Mar. "	-	207
	Minute by Mr. Phillips	-	5 " "	-	209
	Minute by Sir William Denison	-	8 " "	-	209
83	Secretary of State for India.	Government of Madras	16 June "	-	210
84	Government of Madras	Secretary of State for India	13 Mar. "	Forwarding report from Mr. C. R. Markham, detailing the results of his inspection of chinchona plantations.	210

No.	FROM	To	DATE.	SUBJECT.	Page.
85	MR. CLEMENTS R. MARKHAM'S REPORT ON THE CHINCHONA PLANTATIONS, JANUARY 1866				218
	Minute by Sir William Denison		9 Feb. 1866		228
	Minute by Mr. Pycroft		14 " "		229
	Order of the Madras Government		12 Mar. "		230
	Papers relating to employment of convict labour on chinchona plantations				231
86	Lord de Grey	Madras Government		Review of the progress of Chinchona cultivation.	239
87	Madras Government	Secretary of State for India	22 May 1866		241
	Report		30 April "		241
88	Reports on the wood of Chinchona succirubra.				245
89	Secretary of State for India.	Madras Government	1 Aug. 1866		246
90	Madras Government	Secretary of State for India	24 Apr. "	Claim of Mr. Spruce to a pension	247
	Mr. Markham	Secretary to Madras Government.	24 Feb. "		247
91	Secretary of State for India.	Madras Government	1 Aug. "		249
92	Mr. Bourdillon	Mr. Richard Spruce	27 July "		249
93	Memorandum by Mr. Markham on Mr. Spruce's claim.		26 July "		250
94	Tabular statement showing the monthly progress of Chinchona cultivation from 1861 to 1866				252

— II. —

COLLECTION OF SEEDS OF CHINCHONA DE PITAYO, IN SOUTH AMERICA.

1	Memorandum by Mr. C. R. Markham		Mar. 1865	Importance of obtaining seeds of Chinchona Pitayo. Employment of Mr. Cross.	254
2	Mr. Mocatta	Secretary of State for India	14 Feb. "	Transmitting seeds of Chinchona Pitayo	255
3	Mr. Mocatta	Mr. C. R. Markham	14 May "	Payment of 150 L. to Mr. Cross	256
4	Mr. Cross	Under Secretary of State	10 Dec. "	Report of his proceedings in the chinchona forests near Popeyan.	256

— III. —

CHINCHONA CULTIVATION IN WYNAAD, COORG, ON THE PULNEY HILLS, AND IN TRAVANCORE.

1	Mr. Ballard (Collector of Malabar).	Secretary, Board of Revenue.	27 June 1864	Proposal to introduce chinchona cultivation into Wynaad.	279
2	Order of the Madras Government		27 July "	Rejection of Mr. Ballard's proposal	280
3	Mr. C. B. Markham	Secretary to Madras Government.	7 Feb. 1866	Chinchona cultivation in Wynaad	280
4	Report of an analysis of bark of chinchona succirubra grown in Wynaad			by J. E. Howard, Esq.	282
5	C. Soobiah	Chief Commissioner of Mysore.	26 Jan. 1866	Report on chinchona cultivation in Coorg.	283
6	Mr. C. R. Markham	Under Secretary of State	26 Dec. 1865	Chinchona cultivation on the Pulney Hills, and in Travancore.	283
7	Dr. Cleghorn	Memorandum for Mr. Newill, the President in Travancore.	6 Feb. 1866	Chinchona plantation at Peermade, in Travancore.	291

— IV. —

CHINCHONA CULTIVATION IN BRITISH SIKKIM.

1	Dr. Anderson	ANNUAL REPORT for 1862-63.			296
2	Sir Charles Wood	Government of India	7 Sept. 1863	Analysis of chinchona bark and leaves	300
3	Dr. Anderson	ANNUAL REPORT for 1863-64.			301
4	Sir Charles Wood	Government of India	24 Feb. 1864	Chinchona cultivation at Darjeeling	305
5	" "	" "	29 " "	Transmitting copies of Mr. Howard's work.	306
6	Dr. Anderson	Secretary to Bengal Government.	13 Feb. 1865	Report for January 1865	306
7	" "	" "	13 Mar. "	" February	307
8	" "	" "	10 Apr. "	" March	309
9	" "	" "	22 May "	" April	311

No.	FROM	TO	DATE.	SUBJECT.	Page.
10	Sir Charles Wood	Government of India	16 May 1865	Chinchona cultivation at Darjeeling -	812
11	Dr. Anderson	Secretary to Bengal Government.	12 July "	Report for May 1865 -	812
12	" "	" "	20 Sept. "	" August " -	813
13	" "	" "	17 Nov. "	" Sept. " -	815
14	Sir Charles Wood	Governor General of India	30 Sept. "	Relative value of chinchona alkaloids	816
15	Dr. Anderson	Secretary to Bengal Government.	3 Jan. 1866	Report for October 1865 -	816
16	" "	" "	2 Mar. "	" November " -	818
17	" "	" "	17 Mar. "	" December " -	819
18	Messrs. Mair & Co.	Secretary of State for India	9 Aug. 1864	Chinchona cultivation in Darjeeling -	820
19	Mr. Merivale	Messrs. Mair & Co.	18 " "	" " " " -	820
20	Dr. Anderson	Secretary to Bengal Government.	6 Apr. "	Report for January 1866 -	821
21	" "	" "	13 " "	" February " -	822
22	" "	" "	1 May "	" March " -	823
23	" "	" "	23 May "	" April " -	826

—V.—

CHINCHONA CULTIVATION IN THE KANGRA VALLEY (PUNJAB).

1	Captain Nassau Lees, LL.D.	Secretary to Punjab Government.	31 Dec. 1863	Chinchona cultivation in the Kangra Valley.	829
2	" "	" "	28 April 1864	" " " " -	833
3	Monthly Report for	" " " " -	May "	" " " " -	839
4	Captain Nassau Lees, LL.D.	Secretary to Punjab Government.	July "	" " " " -	840
5	Sir Charles Wood	Government of India	8 Aug. "	" " " " -	845
6	" "	" "	28 Feb. 1865	Copies of chinchona pamphlets for Captain Nassau Lees.	846
7	Captain Nassau Lees, LL.D.	Secretary to Punjab Government.	29 April "	Report on progress of cultivation	846

—VI.—

CHINCHONA CULTIVATION IN THE BOMBAY PRESIDENCY.

1	Secretary of State for India.	Bombay Government	31 Dec. 1862	" " " " -	868
2	Dr. Cook	Secretary to Bombay Government.	20 Feb. 1864	Chinchona cultivation at Mahabalesh-wur.	868
3	Secretary of State for India.	Bombay Government	16 Dec. "	" " " " -	868
4	Dr. Cook	Secretary to Bombay Government.	23 Jan. 1865	" " " " -	868
5	Bombay Government	Secretary of State for India	28 Feb. "	" " " " -	869
6	Dr. Cook	Secretary to Bombay Government.	9 Feb. 1866	" " " " -	870

—VII.—

CHINCHONA CULTIVATION IN CEYLON.

81
On
Gov
Mol

1.	Mr. Thwaites	Report to the Ceylon Government.	Sept. 1864	Chinchona cultivation at Hahn-galle -	871
2.	" "	" "	Oct. 1865	" " " " -	872
3.	Mr. C. R. Markham	Colonial Secretary at Colombo.	18 Nov. "	" " " " -	873
4.	" "	Under Secretary of State for India.	" "	Report on chinchona cultivation in Ceylon.	876
5.	Report on Specimens of Chinchona Bark grown in Ceylon, by Mr. J. E. Howard.	" "	11 July 1866	" " " " -	879

my struggling experiment in several public despatches, and for the numerous works on Chinchonas, including Mr. Howard's beautiful *Nueva Quinologia de Pavon*, which he has from time to time directed to be forwarded to me.

To Mr. Clements Markham also I am under the very greatest obligations. From the first he has taken the warmest and most lively interest in the success of this experiment, and it is mainly due to the encouraging letters I have received from him that I was induced to persevere with the cultivation up to the point it has attained, through the many obstacles I have had to contend with.

I have the honour to be, &c.

(signed) *W. Nassau Lees*, Captain,
Chinchona Planter.

APPENDIX.

REMARKS on the Propagation of Chinchona by Mr. *John McKay*, Superintendent of Capt. *W. Nassau Lees'* Plantation, "New Quito."

I NOW beg to submit a few practical remarks on the propagation and cultivation of the Chinchona plant, which, I trust, will prove interesting to you; but, as my experience in the cultivation of these valuable plants has only been for 12 months, I acknowledge that I have much to learn yet, and therefore I do not presume to give in these remarks a complete guide to the requirements necessary for the proper treatment of this plant in its different stages of growth.

When I commenced the experiment here, the loss in cuttings amounted to 10 per cent., and now I do not lose one per cent.; the great loss at first was owing to my ignorance of the climate.

One plant worthy of notice, with reference to the eight plants of Chinchona *succirubra*, which were planted in the open air in March 1864, is, that the stems of the plants grown since they have been planted here are considerably thicker in proportion than the old stems, and their leaves are much larger and more succulent than the old ones. This I conclude to be a striking proof of the suitability of the climate for the cultivation of the Chinchona plant; but if this estate had been a little more distant from the snowy ranges of the Himalaya Mountains, the increase by propagation would be much more than what it has been. My proximity to the snow is doubtless a great hindrance to propagation in winter, as the climate here is greatly influenced by the snowy ranges; and hail-storms, which are the only adversaries that the Chinchonas will have to contend with here, are very destructive to all vegetation during the months of February and March.

I have now commenced to line out the land and make pits for the reception of the plants that will be planted in the rains. I have terraced about half an acre, as I want to see whether the plants will make better progress in the terraced lands than in the land as it naturally is.

In collecting cuttings great care should be taken to placing them in a moist, shaded place, until they are ready to be put into the pots; a flower-pot, with damp moss in the bottom, is the best way to keep them. The wood best adapted for cuttings are young tender shoots, one-half to three-fourths of an inch in length, with stems of about one-eighth of an inch in diameter. Cuttings of this sort form roots much sooner, and are less liable to damp and rot, than large succulent cuttings; in preparing them for the pots they should be carefully examined, to see that there are no insects on them. To insure success, each cutting, before it is put into the soil, should be pressed firmly three or four times (the cut end) against the side of a new and dry flower-pot, so as to absorb the juice which flows from the wound, and which prevents mildew and rot; the cuttings should be examined carefully, and re-potted into fresh soil every morning until the fifth or sixth, after which time they may be considered on the safe side.

Propagation by cuttings.

The soil which I have used, and in which I have found the cuttings to root freely, is a compost of three-fourths of sand to one-fourth of pounded bricks, and a sprinkling of leaf mould; but the sand should not be too fine, as the cuttings root more freely in an open soil.

Cuttings should never be put into new pots, because the pots extract and absorb the moisture out of the soil, and, consequently, the cuttings flag or droop, a thing that is very injurious to the cuttings, and should always be prevented if possible; therefore, all new pots should be soaked in water for half an hour, and then be allowed to dry slowly in the shade.

To obtain well-rooted plants, it is essential that the pots with the cuttings be placed on a bottom of heat of from 70° to 75° Fahr. in a close moist atmosphere, for a few days, then air should be admitted gradually; they are syringed overhead twice a day, mornings and evenings, and the atmosphere in the propagating house should be always kept moist by syringing the walls and floor.

After the cuttings are well rooted they should be potted off into three-inch pots, in a compost of fine black loam and sand, about equal parts of each, with a sprinkling of fine sifted manure and brick-dust; they are then well watered, and placed in a close warm atmosphere for five or six days, during which time they are syringed mornings and evenings, and carefully shaded during sunshine. After they are established in pots air is admitted freely, and as much light as possible, and carefully watered, but never overhead; the soil in which the plants are growing should always be kept free and open, by turning up the surface with a small pointed stick three or four times a month.

Propagation by buds.

This is no doubt a good system of propagation, as it increases the number of plants more rapidly; but buds require more care and attention than cuttings or seedlings; they also take more time to form roots, and do not grow half so quick as rooted cuttings.

The way in which I prepare the buds is, I allow the plants for that purpose to attain a height of from five to six inches. I then cut them in the centre, close above the joint or node. I then take the point of the shoot for a cutting, and cut the stem between each joint, and split each down the centre. I then press each bud three or four times against the side of a dry flower-pot; they are then placed in the pots, the buds being merely covered with soil; they are then placed in the cases, and treated as cuttings are. It is of great advantage to have the leaves attached to the buds, because they form roots much sooner, and are not so liable to rot.

Propagation by layers.

This is a very slow system of propagating the plants, but a sure way to obtain fine large ones, as the layer is nourished and growing from the parent plant while it is forming roots.

The principle of layering which I adopted is a little different to that generally practised, as I found that when the layer was removed from the parent plant to be potted, it was very much checked by being raised out of the soil. To obviate this, the plants to be layered (if in pots) I plunge in soil up to the rim. I then take a four-inch pot, well drained, and fill it with soil, the same as that used for cuttings, and plunge it half into the soil at a proper distance from the plant to be layered; then the stem of the plant is cut through a joint, and a thin piece of dry brick is put into the slit, and left there for half a minute or so to absorb the juice which flows from the wound; the layer is then carefully bent into the soil in the flower-pot, and then the pot is covered with a small mound of soil, covering the layer with about half an inch of soil above where it has been cut. In placing the layer in the pot care must be taken to keep the two cut parts separate.

After the layers are well rooted, they should be carefully cut from the parent plant, and left in the pots in which they have been layered for two or three weeks, and afterwards they can be re-potted into larger pots, or planted permanently in the open air.

Propagation by seeds.

In March 1864 I received 100 seeds of *Chinchona Calisaya*, 75 of which were hermetically sealed, and 25 put up in paper; of those sealed 31 germinated, while of the latter only nine germinated, and are much inferior to the former. Previous to being sown they were steeped in cold water for six hours; they were then taken out of the water and spread on a dry cloth in a warm moist atmosphere for half an hour; the pots for the seed were half filled with potsherds and covered with moss; they were then filled with a compost of two-thirds of fine sifted leaf mould and one-third of sand; the surface being slightly pressed down and made smooth, the seeds were then sown, and merely covered with the soil used; the pots were then plunged in damp sand, on a bottom heat of from 75° to 80° Fahr., and the seed began to germinate on the 20th day after being sown.

In the treatment of seeds it is of great importance to attend to the requisites for germination, which are moisture, heat, light, and air, and these should be carefully supplied.

The soil in which the seeds are sown should always be kept moist until germination takes place; afterwards they should be watered more sparingly.

The seeds should be kept shaded, and air admitted freely. After the seedlings have attained to a height of from three-fourth inch to one inch, they may be potted singly into two-inch pots, in a compost of fine black loam and sand, equal parts of each, and kept in a warm atmosphere, carefully watered, and shaded during sunshine.

As my experience in the cultivation of these valuable plants has only been one year, I will not attempt to say anything about open air cultivation; but I hope, if spared, to give a more detailed account of the propagation and cultivation of the *Chinchona* plant in its different stages of advancement in my next report.

(signed) *John McKay.*

New Quito, Kangra Valley,
1 March 1865.

COPY of a Letter from Secretary to Government, Punjab, to the Commissioner and Superintendent, Jullunder Division; (No. 436 A., dated 28 April 1864.)

WITH reference to your letter, No. 225, dated 31st October last, I am directed to forward, for your information, copies of the correspondence, marginally noted, relative to the application of Captain Nassau Lees, LL.D., for land for the purpose of planting experimentally the Chinchona plant.

From Punjab Government to Captain Lees, No. 1004, dated 7 Nov. 1863.
From Captain Lees, dated 31 Dec. 1863.

The Lieutenant Governor has already told Captain Lees that his Honour considers any charge imputing undue obstruction either to yourself or Mr. Egerton as destitute of foundation, and it will be seen from Dr. Lees' letter, now sent, that he no longer prefers this complaint.

So far back as July last, the Lieutenant Governor informed Dr. Lees that his Honour was prepared, if he still desired it, to grant him 25 acres, at the average price per acre for the auction sales of the year, from the reserved land at Kusmul.

His Honour in so doing was actuated by the consideration that it is of great importance to give free scope to an experiment so valuable, if successful, as that which aims at the naturalization of the Chinchona plant. The objection founded by you on Captain Lees' absenteeism is now obviated by his having a professional English gardener on the spot, and his Honour is inclined to think that the experiment may perhaps be safer in Captain Lees' hands than if under the direct superintendence of Government.

The Lieutenant Governor has now, therefore, decided to grant 100 acres of the reserved land on the terms above stated, and I am to request you will be so good as to see that no delay takes place in marking off and delivering it to Captain Lees' agents.

No. 436 B., dated 28 April 1864.

COPY of the above forwarded for the information of Captain Lees.

By order, &c.,

R. H. Davies,
Secretary to Government, Punjab.

From Captain *W. N. Lees*, LL.D., to Secretary to Government, Punjab;
(dated 10 May 1864.)

I HAVE the honour to acknowledge receipt of copy of a letter from Secretary to Government, Punjab, to the Commissioner and Superintendent, Jullunder Division, No. 436 A., dated 28th April 1864.

The Lieutenant Governor has been pleased to permit me to purchase 100 acres of the land reserved by Government at the auction sale of the 9th June 1863, and I have to solicit that you will do me the favour to tender my acknowledgments to his Honour for this concession.

From Colonel *J. E. Gastrell*, Boundary Commissioner, to Captain *W. N. Lees*;
(dated Surveyor General's Office, 26 April 1865.)

REFERRING to a map of isothermal lines, I find that New Quito is situated at about the same distance north of the isothermal line of greatest heat, or, as some call it, the equator of heat, as Riobamba is to the south. The mean annual temperature of the places may therefore be assumed the same, apart of course, from all considerations of height.

The lofty ranges of mountains overhanging to the north-east of your Chinchona locality, are also very similar in relative position and effect to those dominating Riobamba to the north-west and west; both serve the same purpose for the plains and valleys extended at their feet, over which, in the first case, the south-west wind carries up clouds and vapour to be condensed, and which, falling in copious showers on the mountains, supplies the great affluents of the Indus with water, fertilising the Punjab. So also in South America, the south-east winds sweeping up from the Atlantic across the vast plains watered by the Amazon and its tributaries, carries up the clouds and vapour which subsequently supplies these great rivers with water.

The similarity between these places, notwithstanding differences of latitude, appears striking in these respects.

I hope you may be able to continue your observations at New Quito, and if you could add barometrical observations to them, they would be very valuable in helping to unravel the mysterious laws that govern our Indian atmosphere. When, hereafter, Government sanction a staff of meteorological observers in India, the whole might be reduced at the head quarter office, leaving mere recording to be done at your Chinchona plantation.

MONTHLY REPORT on the Number, Condition, and Distribution of Chinchona Plants at
New Quito on the 30th April 1865.

Number.	Names.	Number on 31st March.	Number Propagated since.	Casualties.	Number on 30th April.	REMARKS.
1	C. succirubra -	2,798	290	5	3,078	All the plants and cuttings are in a most healthy condition. The number of plants imported in March 1864 was 218, of which eight were planted out, leaving 205 as a propagating stock.
2	C. Calisaya -	118	20	-	138	
3	C. Condaminea -	1,262	150	-	1,412	
4	C. micrantha -	75	5	2	78	
5	C. Peruviana -	49	-	-	49	
	TOTAL - -	4,297	465	7	4,755	

The number of plants in nursery beds is 500; they have commenced to grow, and will produce a number of cuttings this month.

The number of plants planted out permanently, is—

C. succirubra	-	-	-	-	-	-	80
C. Condaminea	-	-	-	-	-	-	11
C. micrantha	-	-	-	-	-	-	4
C. Calisaya	-	-	-	-	-	-	1=96

The average height of these plants, when planted out on the 15th of last month, was 7½ inches; and they are now, without exception, healthy and vigorous young plants.

METEOROLOGICAL OBSERVATIONS taken at New Quito Chinchona Plantation, Kangra Valley, for September 1864.
 Latitude, 32° 7' 8" N.; Longitude, 76° 28' 35" E. Height above the Sea, 4,500 feet.

333.

3 A 2

Day of the Month.	Maximum in Air.	Minimum in Air.	Mean in Air.	Maximum in Sun's Rays.	OBSERVATIONS TAKEN AT 9.30 A.M.								OBSERVATIONS TAKEN AT 3.30 P.M.						REMARKS.	
					Wet Bulb Thermometer.	Dry Bulb Thermometer.	Dew Point Computed.	Elastic Force of Vapour.	Humidity.	Wind.	Cloud.	Rain.	Wet Bulb Thermometer.	Dry Bulb Thermometer.	Dew Point Computed.	Elastic Force of Vapour.	Humidity.	Wind.		Cloud.
1	80.5	59.2	69.8	90.0	70.2	73.8	67.7	.678	.813	S.	10	.3	71.0	77.0	66.6	.657	.709	W.	2	Dense fog till 11 a.m., then cleared, and fair all day.
2	78.2	70.0	74.1	82.0	68.0	70.2	66.2	.644	.878	S.	8	.225	68.2	71.0	60.0	.639	.843	W.	10	Ag. morn. cum. Showery in afternoon.
3	80.0	62.5	71.2	83.0	67.0	68.8	65.6	.630	.895	W.	10	.0	70.0	73.0	67.6	.675	.832	S.	10	Ag. morn. overcast. Showery in afternoon.
4	78.5	60.8	68.6	78.5	67.0	69.5	65.0	.617	.856	S.E.	8	1.82	74.0	77.2	71.8	.779	.835	S.W.	2	Heavy rain from 2 to 4 a.m.; afternoon very warm.
5	86.3	84.2	75.2	97.8	69.0	73.0	65.8	.635	.783	S.W.	5	.350	71.0	77.8	66.2	.644	.676	W.	8	Ag. morn.; afternoon cloudy; cum.
6	86.2	60.8	74.5	92.5	66.8	67.2	66.5	.650	.697	W.	10	.091	72.5	79.8	67.4	.670	.660	W.	5	Showery in morn. Thundering in afternoon.
7	87.2	68.5	77.8	92.5	75.0	77.8	73.0	.811	.852	W.	5	.175	70.2	75.8	66.3	.646	.725	W.	8	Ag. morn. heavy dew stratus. Showery in afternoon.
8	82.2	65.0	73.6	91.8	67.5	69.2	66.1	.641	.899	E.	2	.1	70.5	72.5	68.9	.706	.885	S.W.	10	Del. morn. heavy dew stratus. Afternoon rainy.
9	80.2	65.0	72.6	89.0	68.0	69.8	66.6	.658	.897	W.	5	.175	70.2	74.2	67.4	.671	.794	W.	2	Dist. thr. and a few drops rain in morn. Ag. afternoon.
10	83.2	58.0	70.6	92.0	70.2	75.5	66.8	.650	.737	W.	0	.0	71.5	83.5	63.1	.578	.804	S.W.	2	Del. morn. heavy dew stratus. Del. afternoon.
11	84.2	58.0	71.1	96.5	68.2	80.0	59.9	.518	.504	S.E.	0	.0	71.2	84.8	61.7	.550	.460	N.W.	2	Ag. morn. heavy dew. Sun's rays very hot.
12	88.0	59.8	68.4	98.0	71.0	80.0	64.7	.611	.697	N.	0	.0	74.0	85.5	65.9	.637	.521	N.	2	Cum. del. morn. Sun very hot all day.
13	86.5	59.8	73.1	96.8	73.0	77.0	70.2	.738	.796	N.	0	.0	73.5	85.0	65.4	.626	.520	S.	2	Morn. sun very hot. Del. afternoon.
14	87.0	64.5	75.5	99.8	68.2	69.8	66.9	.659	.905	N.	2	.0	70.0	70.0	70.0	.783	1.000	N.	10	Ag. morn. stratus. Thunder and rain in afternoon.
15	83.5	60.5	72.0	99.2	70.0	74.0	67.2	.666	.794	N.	2	.480	74.0	77.8	71.3	.766	.808	N.	2	Snow on high ranges. Afternoon sun very hot.
16	82.5	62.0	72.2	89.8	64.3	67.5	61.7	.550	.817	N.W.	2	.0	70.5	76.8	66.1	.641	.696	W.	10	Del. morn. stratus. Thunder in afternoon.
17	80.5	60.2	70.3	90.2	67.5	75.8	61.7	.550	.617	S.W.	5	.0	69.0	75.0	64.8	.613	.706	S.W.	8	Del. morn. heavy dew. Most ag. afternoon.
18	81.5	65.0	73.2	90.0	70.5	76.8	66.1	.641	.696	N.E.	2	.0	71.0	83.8	62.0	.556	.480	N.E.	2	Ag. morn. cum. Again afternoon cum.
19	82.0	60.0	71.0	91.2	68.0	76.0	62.4	.564	.829	W.	5	.0	76.0	80.8	72.6	.800	.762	W.	2	Del. morning, heavy dew. Sun very powerful.
20	82.2	64.5	73.3	94.5	65.5	69.5	62.8	.562	.780	N.	2	.0	75.0	82.5	69.7	.726	.654	N.	2	Ag. morn. stratus. Sun very hot all day.
21	83.1	59.2	71.1	95.8	62.5	69.2	57.1	.467	.655	N.	0	.0	67.0	82.0	56.5	.457	.418	N.W.	2	Morn. sun very hot. Cum. Del. afternoon.
22	82.0	59.2	70.6	96.2	60.0	64.8	56.2	.452	.787	N.	0	.0	70.2	81.4	62.4	.564	.527	N.	0	Morning very cold. Sun very hot all day.
23	81.8	53.8	67.8	97.2	61.8	67.3	57.4	.472	.707	N.	0	.0	71.2	77.8	66.6	.653	.685	N.	0	Most ag. morn. Afternoon sun very hot.
24	84.2	54.8	69.5	97.8	61.8	66.2	57.4	.472	.733	N.	0	.0	65.8	72.0	60.8	.538	.680	S.	0	Del. morn. Sun's rays very powerful all day.
25	89.0	57.5	73.2	100.0	60.8	69.8	58.6	.412	.566	S.	0	.0	64.5	80.5	53.3	.407	.391	S.	0	Ag. morn. Sun's rays very powerful.
26	87.2	52.5	69.8	102.4	59.2	70.3	50.3	.364	.491	N.	0	.0	65.5	82.0	53.9	.416	.381	N.	0	Morning very cold. Del. afternoon.
27	89.2	54.5	71.8	100.8	57.2	80.2	41.1	.258	.251	N.	0	.0	67.2	79.5	58.6	.493	.490	N.	0	Morning sun very hot. Ag. afternoon.
28	90.2	53.8	72.0	105.5	60.8	80.0	47.4	.328	.321	N.	0	.0	64.8	80.5	53.8	.415	.399	N.	0	Very cold morn. Sun's rays very hot all day.
29	94.2	57.8	76.0	100.8	67.8	79.8	59.4	.507	.499	N.	0	.0	66.8	82.2	56.0	.449	.409	N.	0	Ag. morn. Del. afternoon.
30	90.8	52.8	71.8	99.8	60.2	76.8	48.6	.348	.372	N.	0	.0	69.0	84.8	57.9	.481	.403	N.	0	Cold morn. Very warm afternoon.
Sums -	2534.1	1804.2	2151.7	2761.4	1986.5	2185.6	-	-	-	-	88	3.716	2105.3	2366.5	-	-	-	-	100	
Means -	84.4	60.1	71.7	92.1	66.2	72.9	60.8	.533	.659	-	2	.123	70.2	78.9	64.1	.598	.606	-	3	

OF THE CHINCHONA PLANT INTO INDIA.

361

METEOROLOGICAL OBSERVATIONS taken at New Quito Chinchona Plantation, Kangra Valley, for the Month of October 1864.
 Latitude, 32° 7' 8" N.; Longitude, 76° 28' 35" E. Height above the Sea, 4,500 feet.

Day of the Month.	Maximum in Air.	Minimum in Air.	Mean in Air.	Maximum in Sun's Rays.	OBSERVATIONS TAKEN AT 9.30 A.M.								OBSERVATIONS TAKEN AT 8.30 P.M.							REMARKS.
					Wet Bulb Thermometer.	Dry Bulb Thermometer.	Dew Point Computed.	Elastic Force of Vapour.	Humidity.	Cloud.	Wind.	Rain.	Wet Bulb Thermometer.	Dry Bulb Thermometer.	Dew Point Computed.	Elastic Force of Vapour.	Humidity.	Cloud.	Wind.	
1	84.5	54.8	69.6	98.2	58.2	70.0	48.8	.345	.471	0	N.	0	70.2	75.8	66.8	.646	.725	0	N.	Del. morn. Beautiful afternoon.
2	80.8	52.2	66.5	90.2	57.8	69.2	48.7	.344	.482	0	N.	0	68.0	80.5	59.2	.504	.485	0	N.	Ag. morn. heavy dew. Del. afternoon.
3	87.2	53.0	70.5	99.8	60.0	69.8	52.2	.391	.537	0	N.	0	62.2	81.0	49.0	.348	.329	2	N.E.	Del. morn. heavy dew. Ag. afternoon cum.
4	85.5	50.2	67.8	99.2	60.8	71.5	52.2	.391	.507	0	S.	0	68.5	70.8	66.7	.655	.870	2	N.	Del. morn. heavy dew. Afternoon squally.
5	88.5	51.2	69.8	90.4	57.8	68.4	49.3	.352	.507	0	-	0	68.5	75.8	63.4	.584	.655	2	N.	Ag. morn. Del. afternoon cum.
6	85.5	57.8	71.0	90.8	60.5	66.8	55.5	.441	.670	0	N.	0	67.6	75.5	62.4	.584	.639	2	N.	Ag. morn. Del. afternoon cum.
7	84.8	50.8	67.8	90.5	67.2	69.0	65.8	.635	.896	0	N.	0	69.8	74.2	66.7	.655	.775	2	N.	Del. morn. heavy dew. Ag. afternoon cum.
8	84.5	48.8	66.6	97.8	59.8	64.2	55.8	.446	.743	0	N.	0	64.8	69.8	60.8	.533	.732	2	N.	Very cold morn. Beautiful afternoon cum.
9	89.5	50.2	69.8	99.8	48.8	59.8	38.9	.287	.461	0	N.	0	67.2	70.8	64.3	.603	.801	5	N.	Del. morn. Beautiful afternoon cum.
10	79.8	45.8	62.8	90.2	49.8	58.8	41.7	.264	.582	0	N.	0	65.8	74.8	59.5	.509	.590	2	N.	Del. morn. Del. afternoon stratus.
11	84.8	50.5	67.6	97.8	57.8	64.5	52.4	.388	.639	0	N.	0	64.8	74.8	57.8	.479	.556	5	N.	Ag. morn. Beautiful afternoon stratus.
12	87.8	50.2	68.0	99.8	54.2	60.0	49.0	.348	.672	0	N.	0	64.8	72.0	59.0	.500	.688	2	N.	Ag. morn. Del. afternoon cum.
13	87.8	49.8	68.8	100.0	52.5	56.8	46.8	.320	.645	0	N.	0	69.8	74.2	66.7	.655	.775	2	N.	Cold morn. heavy dew. Ag. afternoon cum.
14	79.8	47.4	63.6	90.8	50.6	57.2	44.7	.296	.631	0	N.	0	64.8	77.2	56.1	.461	.483	5	N.	Del. morn. Beautiful afternoon cum.
15	87.8	43.8	65.8	89.8	49.5	52.8	46.2	.313	.782	0	N.	0	68.2	72.4	64.8	.613	.771	8	N.	Very cold morn. Thunder in afternoon.
16	80.8	47.8	64.3	88.8	49.8	57.2	43.1	.270	.595	0	N.	0	60.2	70.0	52.4	.394	.544	8	N.	Cold morn. heavy dew. Thunder; a few drops rain.
17	82.2	43.0	62.6	90.0	47.2	50.0	44.1	.289	.801	0	N.	0	60.0	65.8	55.4	.439	.691	5	N.	Very cold morn. Beautiful afternoon.
18	82.8	47.4	65.1	86.8	49.8	54.5	45.1	.301	.708	0	N.	0	60.2	65.0	56.4	.456	.739	8	N.	Beautiful morn. Thunder and one shower of rain.
19	80.5	50.0	65.2	84.8	54.5	64.5	46.5	.317	.522	2	N.	0	64.0	75.8	55.7	.444	.498	2	S.	Del. morn. cum.; one shower rain at 12 p.m.
20	80.8	50.0	65.4	84.8	47.0	52.2	41.8	.265	.678	0	N.	0.275	61.2	77.8	49.6	.356	.374	0	S.	Del. morn. Squally in afternoon.
21	88.8	48.8	68.8	99.0	52.5	56.5	48.9	.346	.757	0	N.	0	60.5	70.2	52.7	.398	.539	0	N.	Del. morn. Del. afternoon.
22	80.2	48.8	64.5	88.8	50.2	59.2	42.1	.268	.582	0	N.	0	61.2	70.2	54.0	.418	.566	2	N.	Ag. morn. Beautiful afternoon.
23	84.5	47.2	65.8	90.8	49.8	60.5	40.2	.249	.472	0	N.	0	64.8	72.8	58.4	.489	.607	0	N.	Del. morn. Del. afternoon.
24	80.7	45.8	63.2	97.2	49.5	60.0	40.0	.248	.479	0	N.	0	60.0	64.0	56.4	.456	.765	0	N.	Ag. morn. Beautiful afternoon.
25	84.8	50.2	67.5	90.2	54.0	64.2	44.8	.397	.495	0	S.	0	50.2	60.0	41.4	.281	.504	0	N.	Ag. morn. heavy dew. Del. afternoon.
26	82.8	48.8	65.8	90.0	50.0	58.8	42.1	.268	.540	0	S.	0	62.2	65.8	59.3	.505	.795	0	N.	Del. morn. Beautiful afternoon.
27	84.2	48.5	66.3	89.2	52.2	60.0	45.2	.302	.586	0	N.	0	55.5	60.2	51.3	.378	.724	0	N.	Ag. morn. Del. afternoon.
28	80.8	45.2	63.0	90.2	49.2	55.5	42.9	.277	.628	0	N.	0	55.5	59.8	51.6	.393	.745	0	N.	Ag. morn. heavy dew. Ag. afternoon.
29	85.8	49.8	67.8	89.8	52.2	60.2	45.0	.299	.573	0	N.E.	0	60.5	67.8	54.7	.428	.629	0	N.	Del. morn. Beautiful afternoon.
30	89.5	47.8	68.6	99.8	49.8	55.5	44.1	.289	.655	0	N.	0	60.2	66.8	54.9	.432	.655	0	N.	Ag. morn. Del. afternoon.
31	80.5	50.2	65.3	88.5	55.2	60.5	50.4	.366	.694	2	N.	0	60.2	68.5	53.6	.412	.591	5	N.	Ag. morn. cum. Beautiful afternoon cum.
Sum	2608.3	1525.8	2065.8	2773.8	1658.2	1890.1	-	-	-	4	-	0.275	1961.6	2200.1	-	-	-	71	-	
Means	84.1	49.2	66.6	89.4	53.5	61.0	46.7	.319	.594	-	-	.008	63.3	71.0	57.1	.467	.616	2	-	

METEOROLOGICAL OBSERVATIONS taken at New Quito Chinchona Plantation, Kangra Valley, for November 1864.
 Latitude, 32° 7' 8" N.; Longitude, 76° 28' 35" E. Height above the Sea, 4,500 feet.

353.

3 A 3

Day of the Month.	Maximum in Air.	Minimum in Air.	Mean in Air.	Maximum in Sun's Rays.	OBSERVATIONS TAKEN AT 9.30 A.M.								OBSERVATIONS TAKEN AT 3.30 P.M.							REMARKS.	
					Wet Bulb Thermometer.	Dry Bulb Thermometer.	Dew Point Computed.	Elastic Force of Vapour.	Humidity.	Cloud.	Wind.	Rain.	Wet Bulb Thermometer.	Dry Bulb Thermometer.	Dew Point Computed.	Elastic Force of Vapour.	Humidity.	Wind.	Cloud.		
1	79.2	47.8	63.5	89.5	49.8	54.2	45.4	.304	.722	0	N.	0	60.8	75.2	50.7	.370	.424	N.	0	Ag. morn. heavy dew. Del. afternoon.	
2	78.8	49.5	64.1	88.5	50.2	54.5	45.9	.310	.729	0	N.	0	55.8	70.8	43.8	.286	.380	N.	0	Fresh morn. heavy dew. Ag. afternoon.	
3	88.5	48.0	68.7	94.5	50.0	54.2	45.8	.309	.734	0	N.	0	60.5	77.8	48.4	.340	.357	N.	0	Ag. morn. heavy dew. Del. afternoon.	
4	80.0	45.5	62.7	89.2	47.2	50.4	43.7	.285	.779	0	N.	0	62.5	77.8	51.8	.386	.405	N.	2	Cold morn. heavy dew. Ag. afternoon stratus.	
5	79.5	47.8	63.5	88.5	48.8	54.5	45.1	.301	.708	0	S.	0	59.8	67.8	53.4	.409	.602	N.	0	Beautiful morn. Afternoon very cold.	
6	88.4	44.5	66.4	89.8	47.2	50.2	43.9	.287	.768	0	N.	0	60.2	68.8	53.3	.407	.578	N. E.	2	Cold morn. heavy dew. Ag. afternoon cum.	
7	80.2	45.2	62.7	87.0	48.2	54.5	41.9	.286	.626	0	N.	0	60.8	72.5	51.4	.380	.476	N.	2	Ag. morn. Del. afternoon cum.	
8	80.2	47.0	63.6	85.2	50.0	54.2	45.8	.309	.734	0	N.	0	62.5	66.2	59.5	.509	.790	N.	2	Del. morn. Beautiful afternoon cum.	
9	80.0	46.2	63.0	84.0	48.8	52.2	45.4	.304	.777	0	N.	0	55.5	65.8	47.3	.326	.513	N.	5	Ag. morn. heavy dew. Del. afternoon cum.	
10	77.5	47.2	62.3	88.0	49.5	54.0	45.0	.299	.715	0	N.	0	60.0	70.2	51.8	.386	.523	N.	2	Del. morn. Afternoon squally.	
11	78.2	48.0	63.1	81.5	50.0	54.2	45.8	.309	.734	0	N.	0	58.2	66.8	51.3	.378	.575	N.	5	Ag. morn. heavy dew. Beautiful afternoon cum.	
12	79.2	48.2	63.7	84.0	50.2	57.5	43.6	.284	.599	0	N.	0	58.8	66.8	52.4	.394	.600	N.	2	Ag. morn. afternoon squally.	
13	77.8	45.2	61.5	82.5	47.5	50.2	44.5	.294	.808	0	S.	0	64.5	77.2	55.6	.443	.475	N.	2	Cold morn. Del. afternoon stratus.	
14	79.5	45.0	62.2	82.2	48.2	52.2	44.2	.291	.744	0	N.	0	62.2	75.5	52.9	.401	.455	N.	8	Cold morn. heavy dew. Mild afternoon cum.	
15	79.2	45.5	62.3	84.0	48.5	52.0	45.0	.299	.771	0	N.	0	58.2	67.8	50.5	.368	.541	N.	5	Ag. morn. Afternoon very threatening.	
16	77.2	46.0	61.6	82.0	48.2	52.0	44.4	.293	.755	0	N.	0	60.2	64.0	56.8	.462	.775	N.	10	Cold morn. Thunder all night, one shower rain.	
17	75.8	44.2	60.0	79.8	46.2	48.0	44.2	.291	.868	5	N.	0	57.0	64.2	50.5	.368	.613	N.	5	Thunder, a few drops rain. Del. afternoon cum.	
18	70.2	41.0	56.6	77.2	46.2	50.0	42.0	.267	.740	0	N.	0	67.0	71.2	63.6	.588	.770	N.	2	Very cold morn. Ag. afternoon stratus.	
19	74.2	39.5	56.8	78.5	41.8	50.0	32.8	.187	.518	0	N.	0	60.2	75.0	49.8	.358	.413	N.	2	Very cold morn. Del. afternoon cum.	
20	78.5	40.8	59.6	87.2	44.2	48.8	39.1	.239	.693	0	N.	0	58.2	66.8	51.3	.378	.575	N.	2	Ag. morn. Del. afternoon cum.	
21	77.8	40.0	58.9	88.5	43.5	50.2	36.1	.213	.585	0	N.	0	51.2	61.0	42.4	.271	.505	N.	0	Cold morn. heavy dew. Del. afternoon.	
22	78.0	39.5	58.7	88.2	42.0	60.0	25.8	.135	.261	0	N.	0	50.5	65.0	38.9	.237	.384	N.	0	Sharp morn. Cold afternoon.	
23	80.0	38.2	58.2	87.0	40.0	46.2	33.2	.200	.639	0	N.	0	51.5	65.5	40.3	.250	.398	N.	0	Very cold morn. Del. afternoon.	
24	77.5	38.2	57.8	85.2	46.0	54.0	38.0	.229	.548	0	N.	0	51.5	65.2	40.5	.252	.405	N.	0	Very sharp morn. Beautiful afternoon.	
25	74.5	39.5	57.0	80.0	49.0	61.0	38.2	.231	.430	0	N.	0	50.2	66.2	37.4	.224	.348	N.	0	Cold morn. heavy dew. Del. afternoon.	
26	70.2	39.8	55.0	84.2	44.5	47.5	41.2	.259	.787	0	N.	0	60.0	64.2	56.2	.452	.753	N.	5	Ag. morn. Beautiful afternoon cum.	
27	75.2	40.2	57.7	79.5	47.6	54.8	40.8	.255	.593	0	S.	0	60.2	66.8	54.9	.432	.658	N.	6	Ag. morn. Del. afternoon cum.	
28	70.0	40.2	55.1	78.5	44.2	60.0	30.0	.165	.319	0	S.	0	60.8	65.5	57.0	.466	.742	N.	8	Ag. morn. Del. afternoon cum.	
29	77.2	39.5	58.3	84.2	42.8	55.0	30.6	.189	.390	0	S.	0	55.5	67.8	45.7	.307	.451	W.	10	Cold morn. heavy dew. Ag. afternoon cum.	
30	70.8	40.5	55.6	77.0	47.8	54.2	41.4	.261	.820	0	N.	0	60.5	70.8	52.3	.393	.523	W.	0	Ag. morn. Beautiful afternoon.	
Sums	2333.3	1807.7	1820.2	2535.4	1409.3	1690.7	-	-	-	5	-	0	1754.8	2066.2	-	-	-	-	-	89	
Means	77.7	43.5	60.6	84.5	47.0	53.0	41.0	.267	.638	-	-	0	58.5	68.9	50.2	.364	.516	-	3		

OF THE CHINCHONA PLANT INTO INDIA.

363.

METEOROLOGICAL OBSERVATIONS taken at New Quito Chinchona Plantation, Kangra Valley, for December 1864.
 Latitude, 32° 7' 8" N.; Longitude, 76° 28' 35" E. Height above the Sea, 4,500 feet.

Day of the Month.	Maximum in Air.	Minimum in Air.	Mean in Air.	Maximum in Sun's Rays.	OBSERVATIONS TAKEN AT 9.30 A.M.								OBSERVATIONS TAKEN AT 3.30 P.M.						REMARKS.	
					Wet Bulb Thermometer.	Dry Bulb Thermometer.	Dew Point Computed.	Elastic Force of Vapour.	Humidity.	Rain.	Cloud.	Wind.	Wet Bulb Thermometer.	Dry Bulb Thermometer.	Dew Point Computed.	Elastic Force of Vapour.	Humidity.	Cloud.		Wind.
1	74.2	38.2	56.2	79.5	40.2	45.8	34.0	.196	.634	0	0	N.	56.2	65.8	52.1	.390	.614	2	N.	Ag. morn. Beautiful afternoon.
2	74.2	36.0	55.1	80.5	39.5	44.2	3.9	.195	.670	0	0	N.	50.0	54.2	45.8	.309	.734	0	N.	Ag. morn. dew. Cold afternoon.
3	78.0	32.0	55.0	80.8	36.5	40.0	31.9	.180	.726	0	0	N.	54.8	64.2	46.3	.314	.528	2	N.	Sharp morn. Beautiful afternoon.
4	Broken.	-	-	-	37.5	44.2	29.5	.161	.553	0	0	S.	50.0	64.8	38.2	.231	.377	5	N.	Ag. morn. dew. Del. afternoon.
5	-	-	-	-	40.2	44.0	35.6	.209	.726	0	5	W.	50.2	54.2	46.2	.313	.743	5	W.	Pleasant morn. Afternoon threatening.
6	-	-	-	-	40.2	45.5	34.4	.199	.052	0	10	W.	50.0	54.0	46.0	.311	.744	10	W.	Ag. morn. cum. Very strong wind afternoon.
7	-	-	-	-	40.0	41.0	38.7	.235	.914	.075	10	N.	45.0	45.0	45.0	.299	1.000	10	N.	Very disagreeable morn. Driz. rain all day.
8	-	-	-	-	45.8	47.5	43.9	.287	.872	.4	10	N.	54.2	54.8	58.6	.412	.958	10	N.	Rain in morn. Raining all day.
9	-	-	-	-	45.8	54.2	37.4	.224	.532	.3	10	N.	54.2	58.2	50.6	.369	.759	10	N.	Mild morn. Strong wind in afternoon.
10	-	-	-	-	45.8	49.5	41.7	.264	.746	0	10	N.	50.5	63.2	39.1	.289	.412	10	N.	Del. morn. Strong cold wind in afternoon.
11	-	-	-	-	47.2	49.8	44.3	.292	.816	0	10	N.	50.5	55.2	45.8	.309	.709	10	N.	Strong cold wind all day.
12	-	-	-	-	47.2	47.2	47.2	.325	1.000	.025	10	N.	56.8	60.2	53.7	.418	.791	10	N.	Ag. morn. Del. afternoon mild.
13	-	-	-	-	48.2	49.8	46.4	.316	.888	.150	10	N.	50.2	54.0	46.4	.316	.706	10	N.	Mild morn. Ag. afternoon.
14	-	-	-	-	47.8	49.2	46.3	.314	.897	.2	10	N.	50.0	52.2	47.8	.338	.852	10	N.	Thunder, rain, and hail all day.
15	-	-	-	-	40.2	44.8	34.7	.202	.660	.225	10	N.	48.8	50.5	47.1	.324	.880	10	N.	Driz. rain in morn. Ag. afternoon.
16	-	-	-	-	38.8	40.2	37.0	.220	.884	0	10	N.	48.2	48.8	47.5	.329	.954	10	N.	Cold morn. Raining in afternoon.
17	-	-	-	-	48.5	51.0	46.0	.311	.832	.325	10	E.	50.2	51.2	49.2	.350	.928	10	N. E.	Gold morn. Heavy rain in afternoon.
18	-	-	-	-	47.8	49.2	46.3	.314	.897	1.108	10	S. W.	51.2	54.8	47.6	.330	.767	10	W.	Heavy rain in morn. Thunder all day.
19	-	-	-	-	40.2	47.8	31.8	.179	.538	.4	0	N.	48.5	54.2	42.8	.276	.656	0	S.	Ag. morn. Beautiful afternoon.
20	-	-	-	-	40.0	49.8	29.2	.159	.444	0	0	N.	51.5	61.0	42.9	.277	.516	0	N.	Very cold morn. Del. afternoon.
21	-	-	-	-	47.8	54.0	41.6	.263	.629	0	0	N.	54.8	60.1	50.0	.361	.694	0	N.	Del. morn. dew. Beautiful afternoon.
22	-	-	-	-	43.5	50.0	34.2	.198	.548	0	0	N.	54.2	62.8	46.5	.317	.554	0	N.	Ag. morn. frost. Beautiful afternoon.
23	-	-	-	-	38.2	50.0	25.2	.131	.368	0	0	N.	58.0	62.5	58.9	.416	.735	0	-	Ag. morn. frost. Del. afternoon.
24	-	-	-	-	40.2	47.8	31.8	.179	.538	0	0	N.	50.2	54.8	45.6	.306	.712	0	N.	Ag. morn. dew. Beautiful afternoon.
25	-	-	-	-	38.2	45.5	30.2	.163	.544	0	0	N.	54.2	61.0	48.1	.336	.626	0	N.	Ag. morn. frost. Del. afternoon.
26	-	-	-	-	38.2	45.0	30.0	.165	.552	0	0	N.	40.2	48.8	30.7	.170	.493	0	N.	Very sharp morn. frost. Del. afternoon.
27	-	-	-	-	40.2	48.8	30.7	.170	.493	0	0	N.	55.0	64.2	46.7	.319	.531	0	N.	Del. morn. dew. Beautiful afternoon.
28	-	-	-	-	38.2	40.8	34.8	.202	.792	0	0	N.	54.2	60.1	48.9	.346	.665	2	N.	Cold morn. frost. Del. afternoon.
29	-	-	-	-	38.8	47.2	29.6	.162	.498	0	2	N.	50.2	58.8	42.5	.272	.548	0	N.	Ag. morn. Beautiful afternoon.
30	-	-	-	-	40.2	47.8	31.8	.179	.538	0	2	N.	50.2	64.0	37.8	.227	.391	0	N.	Del. morn. Ag. afternoon.
31	-	-	-	-	40.2	48.8	30.7	.170	.493	0	0	N.	54.2	64.0	45.4	.304	.510	0	N.	Ag. morn. Beautiful afternoon.
Sums	226.4	106.2	166.3	240.8	1300.1	1460.4	-	-	-	3.208	139	-	1598.4	1781.6	-	-	-	146	-	
Mean	75.3	35.4	55.4	80.2	41.9	47.1	36.2	.214	.660	.103	4	-	51.6	57.5	46.3	.314	.662	4	-	

Quito Chinchona Plantation, 1 January 1865.

METEOROLOGICAL OBSERVATIONS taken at New Quito Chinchona Plantation, Kangra Valley, for January 1865.
 Latitude, 32° 7' 8" N.; Longitude, 76° 28' 35" E. Height above the Sea, 4,500 feet.

353.

3 A 4

Day of the Month.	OBSERVATIONS TAKEN AT 9.30 A.M.								OBSERVATIONS TAKEN AT 3.30 P.M.								REMARKS.
	Wet Bulb Thermometer.	Dry Bulb Thermometer.	Dew Point Computed.	Elastic Force of Vapour.	Humidity.	Cloud.	Wind.	Rain.	Wet Bulb Thermometer.	Dry Bulb Thermometer.	Dew Point Computed.	Elastic Force of Vapour.	Humidity.	Cloud.	Wind.		
1	49.0	47.8	31.4	.176	.529	0	N.	0	50.2	57.8	43.4	.282	.589	5	N.	Ag. morn. Afternoon cold and squally.	
2	39.0	44.5	30.2	.166	.565	0	N.	0	50.8	61.0	41.6	.263	.490	0	N.	Cold morn. frost. Del. afternoon.	
3	37.5	48.5	25.4	.132	.387	0	N.	0	54.2	61.2	47.9	.334	.617	0	N.	Ag. morn. Del. afternoon, very warm.	
4	38.5	45.8	30.5	.169	.547	0	N.	0	54.8	61.2	49.0	.346	.643	2	N. W.	Beautiful morn. Afternoon pleasant.	
5	41.8	50.0	32.8	.187	.518	0	N.	0	50.2	58.0	48.2	.280	.591	5	S.	Ag. morn. heavy dew. Beautiful afternoon.	
6	39.8	44.8	28.8	.194	.653	0	N.	0	49.8	51.8	47.8	.333	.863	8	S.	Pleasant morn. Beautiful afternoon.	
7	50.0	54.2	45.8	.309	.734	10	S.	0	50.0	52.2	47.8	.333	.852	10	N.	Mild morn. Cold afternoon, heavy rain.	
8	38.8	45.8	31.1	.174	.563	0	N.	4	48.8	52.5	45.1	.301	.762	8	N.	Ag. morn. Del. afternoon.	
9	38.5	44.2	31.7	.179	.615	0	N.	0	50.0	61.5	39.6	.244	.447	2	N.	Del. morn. heavy dew. Beautiful afternoon.	
10	37.8	48.5	28.0	.136	.399	0	N.	0	49.8	58.5	42.0	.267	.544	0	N.	Very sharp morn. Beautiful afternoon.	
11	39.8	44.8	33.8	.194	.653	2	N.	0	48.8	59.5	39.2	.240	.472	5	S.	Beautiful morn. Del. afternoon.	
12	40.8	59.2	24.2	.125	.248	2	S.	0	58.0	61.2	55.1	.435	.604	8	S.	Mild morn. Pleasant afternoon.	
13	39.8	45.0	33.6	.198	.645	0	N.	0	50.8	64.2	38.7	.235	.392	8	N. E.	Ag. morn. Del. afternoon.	
14	39.8	49.8	28.8	.156	.486	10	S.	0	52.0	59.2	45.5	.305	.605	8	S.	Mild morn. Beautiful afternoon.	
15	50.0	61.2	39.9	.247	.457	2	S.	0	60.2	64.8	56.5	.457	.746	8	S.	Beautiful mild morn. Del. afternoon.	
16	53.0	59.2	47.4	.328	.651	5	S.	0	60.0	64.8	56.2	.452	.737	5	S.	Mild morn. Beautiful afternoon.	
17	52.2	60.0	45.2	.302	.583	5	N.	0	44.2	59.0	30.9	.172	.344	5	S.	Del. morn. Cold afternoon, squally.	
18	54.0	60.2	48.4	.340	.651	2	S.	0	60.0	65.8	55.4	.439	.691	5	N. W.	Del. morn. Beautiful afternoon.	
19	49.8	58.2	42.2	.269	.554	10	W.	0	58.5	64.8	53.5	.410	.669	8	S.	Ag. morn. dew. Del. afternoon.	
20	44.2	50.2	37.6	.226	.621	2	S.	0	59.8	64.2	55.8	.446	.743	8	S.	Ag. morn. dew. Beautiful afternoon.	
21	48.5	54.0	48.0	.278	.666	5	S.	0	64.2	64.5	64.0	.596	.932	10	S.	Very mild morn. Del. afternoon, rainy.	
22	47.8	50.2	45.2	.302	.630	5	W.	.075	62.5	64.8	60.7	.531	.866	5	S.	Ag. morn. dew. Pleasant afternoon.	
23	47.8	60.0	36.8	.219	.423	0	N.	0	55.5	64.5	48.3	.339	.558	2	S.	Pleasant morn. Beautiful afternoon.	
24	55.2	62.5	48.6	.348	.606	2	S.	0	57.2	64.5	51.4	.380	.626	5	W.	Del. morn. Pleasant afternoon.	
25	50.2	60.2	41.2	.259	.496	8	S.	0	58.5	65.0	49.7	.357	.579	5	S. W.	Beautiful morn. dew. Del. afternoon.	
26	51.0	57.5	45.2	.301	.635	0	S.	0	55.0	65.0	47.0	.328	.524	0	W.	Del. morn. Sun very hot in afternoon.	
27	51.0	57.0	45.6	.306	.657	0	N.	0	55.5	63.5	48.3	.339	.578	2	S.	Ag. morn. dew. Beautiful afternoon.	
28	56.0	64.2	48.6	.343	.572	0	S.	0	60.2	65.8	55.7	.444	.699	2	S.	Del. morn. Pleasant afternoon.	
29	49.0	52.5	45.5	.305	.772	10	S.	0	60.0	65.8	55.4	.439	.691	8	S. W.	Threatening morn. Afternoon squally.	
30	44.0	44.2	43.8	.286	.988	10	S. W.	.1	46.2	46.8	45.5	.305	.953	10	S. W.	Disagreeable morn. ; heavy rain all day.	
31	41.0	41.0	41.0	.257	1.000	10	S. W.	2.625	44.2	44.2	44.2	.291	1.000	10	S. W.	Disagreeable morn. ; heavy rain and hail all day.	
Sums -	1405.6	1525.2	-	-	-	100	-	3.200	1677.9	1877.6	-	-	-	167	-		
Means -	45.3	49.2	41.0	.257	.734	-	-	-	54.1	60.6	48.2	.338	.639	-	-		

OF THE CHINCHONA PLANT INTO INDIA.

365

METEOROLOGICAL OBSERVATIONS taken at New Quito Chinchona Plantation, Kangra Valley, for February 1865.

Latitude, 32° 7' 8" N.; Longitude, 76° 28' 35" E. Height above the Sea, 4,500 feet.

Day of the Month.	OBSERVATIONS TAKEN AT 9.30 A.M.								OBSERVATIONS TAKEN AT 3.30 P.M.							REMARKS.
	Wet Bulb Thermometer.	Dry Bulb Thermometer.	Dew Point Computed.	Elastic Force of Vapour.	Humidity.	Cloud.	Wind.	Rain.	Wet Bulb Thermometer.	Dry Bulb Thermometer.	Dew Point Computed.	Elastic Force of Vapour.	Humidity.	Cloud.	Wind.	
	°	°	°	Inches.					°	°	°	Inches.				
1	41.2	51.2	31.2	.174	.462	5	S.	1.150	39.8	40.5	38.9	.237	.940	8	S.E.	Beautiful morn. Terrific thunderstorm in afternoon.
2	40.0	44.2	35.0	.204	.701	2	S.	1.0	44.5	54.8	34.2	.198	.460	8	S.	Del. morn. Light rain and threatening afternoon.
3	38.2	44.2	31.0	.173	.594	0	N.	0	50.0	58.2	42.6	.273	.562	0	S.W.	Sharp morn.; heavy dew. Del. afternoon.
4	45.8	52.8	38.8	.236	.590	5	N.	0	55.5	65.2	47.7	.331	.532	2	S.	Ag. morn. Beautiful afternoon.
5	40.2	55.2	25.2	.131	.300	2	N.	0	60.2	65.8	55.7	.444	.699	5	S.W.	Del. morn. Beautiful mild afternoon.
6	47.8	56.2	39.4	.242	.535	0	N.	0	57.8	66.2	51.1	.376	.584	5	S.	Ag. morn. Del. afternoon, very mild.
7	46.0	53.2	38.8	.236	.581	10	S.	0	52.8	64.0	42.7	.274	.460	10	S.	Mild morn. Beautiful afternoon.
8	50.0	54.2	45.8	.309	.734	5	S.	0.6	46.2	47.8	44.4	.293	.880	10	S.	Ag. morn.; heavy rain at 4 a.m. Disagreeable afternoon.
9	41.0	41.2	40.7	.254	.981	10	S.	1.875	45.0	45.2	44.8	.297	.983	10	N.	Heavy rain all morn. Sharp afternoon.
10	40.0	43.5	35.8	.210	.742	0	S.	0.6	48.5	51.8	45.2	.302	.782	10	N.	Ag. morn. Beautiful afternoon; heavy rain at 10 p.m.
11	40.0	44.8	34.2	.198	.667	0	W.	0.350	49.2	54.0	44.4	.293	.700	10	E.	Del. morn. Ag. afternoon. Thunder.
12	48.8	55.0	42.6	.273	.630	0	N.	0	54.2	61.0	48.1	.336	.626	5	S.	Ag. morn. Beautiful afternoon.
13	38.2	38.5	37.8	.227	.970	10	S.	0.380	50.2	58.8	42.5	.272	.548	8	S.	Disagreeable morn.; heavy rain. Ag. afternoon.
14	40.0	50.5	29.5	.161	.438	0	S.	0.2	54.2	58.8	50.1	.362	.730	2	S.	Del. morn. Beautiful afternoon.
15	40.2	56.2	24.2	.125	.377	0	S.	0	54.8	62.8	47.6	.330	.577	2	S.	Ag. morn. Pleasant afternoon.
16	39.8	48.8	29.9	.164	.475	8	S.W.	0	47.8	52.2	43.4	.282	.721	10	S.	Threatening in morn. Strong wind in aft. Drizz. rain.
17	47.0	51.5	42.5	.272	.714	10	S.	0.1	50.0	58.2	42.6	.273	.562	8	S.	Ag. morn. Del. afternoon, very mild.
18	48.2	50.0	46.2	.313	.867	5	S.	0	50.2	60.0	41.4	.261	.504	2	S.	Del. morn. Mild afternoon.
19	40.8	48.8	32.0	.181	.525	0	S.	0	58.2	61.0	55.7	.444	.827	10	S.	Ag. morn. Showery afternoon.
20	42.8	54.8	30.8	.171	.398	0	N.	0.2	57.0	61.0	53.4	.409	.762	5	S.	Pleasant morn. Del. afternoon.
21	42.0	48.8	34.5	.200	.580	2	S.	0	54.8	60.2	49.9	.360	.690	5	S.	Del. morn.; very mild. Pleasant afternoon.
22	42.5	48.8	35.6	.209	.606	0	S.	0	51.5	62.2	41.9	.266	.475	8	S.W.	Sharp morn. Del. afternoon; mild.
23	46.0	51.2	40.8	.255	.676	10	N.	0	48.2	50.2	46.0	.311	.854	5	S.E.	Ag. morn. Beautiful afternoon.
24	39.8	40.0	39.5	.243	.980	10	E.	0.9	45.5	46.2	44.7	.296	.946	10	E.	Heavy rain all morn. Torrents of rain all day.
25	50.0	54.8	45.2	.302	.702	8	S.W.	0.85	48.2	52.8	43.6	.284	.710	8	S.	Ag. morn. Del. afternoon.
26	42.5	48.8	35.6	.209	.606	2	S.	0	58.2	60.0	56.6	.459	.866	2	S.	Del. morn. Beautiful afternoon.
27	48.5	52.0	45.0	.299	.771	8	S.	0	54.2	58.8	50.1	.362	.730	8	S.	Pleasant morn. Del. mild afternoon.
28	44.2	44.5	43.8	.286	.973	10	S.	0	48.0	48.2	47.8	.333	.985	10	S.	Disagreeable morn.; heavy rain all day.
Sums	1211.5	1383.7	-	-	-	122	-	8.205	1434.7	1585.9	-	-	-	186	-	
Means	43.3	49.4	36.6	.217	.615	-	-	-	51.2	58.6	46.8	.314	.684	-	-	

METEOROLOGICAL OBSERVATIONS taken at New Quito Chinchona Plantation, Kangra Valley, for the Month of March 1865.

Latitude, 32° 7' 8" N.; Longitude, 76° 28' 35" E. Height above the Sea, 4,500 feet.

Day of the Month.	OBSERVATIONS TAKEN AT 9.30 A.M.								OBSERVATIONS TAKEN AT 3.30 P.M.								REMARKS.
	Wet Bulb Thermometer.	Dry Bulb Thermometer.	Dew Point Computed.	Elastic Force of Vapour.	Humidity.	Rain.	Cloud.	Wind.	Wet Bulb Thermometer.	Dry Bulb Thermometer.	Dew Point Computed.	Elastic Force of Vapour.	Humidity.	Rain.	Cloud.	Wind.	
1	46.8	47.0	43.8	.318	.985	2.725	10	N.	46.8	50.5	43.1	.279	.758	-	10	N.	Heavy rain all night, and during day.
2	43.0	43.0	43.0	.278	1.000	3.225	10	N.	45.0	45.0	45.0	.299	1.000	-	10	N.	Disagreeable morn. Torrents of rain all day.
3	43.5	43.5	43.5	.283	1.000	4.950	8	N.	46.8	46.8	46.8	.320	1.000	-	10	N.	Heavy rain all day. Dense fog in evening.
4	45.8	48.8	42.5	.272	.788	1.225	10	N.	55.8	60.0	52.0	.388	.749	-	5	S.	Hail in morn. Del. afternoon; very mild.
5	50.0	56.8	43.9	.287	.621	0	8	S.	50.8	54.5	47.1	.324	.762	-	8	N.	Beaut. morn. Ag. afternoon; a few drops of rain.
6	44.0	48.8	38.7	.235	.681	0	0	E.	58.8	60.2	57.5	.474	.908	-	8	N.	Sharp morn. Pleas. afternoon; hail in evening.
7	44.8	48.5	40.7	.254	.745	0.1	0	N.	55.5	60.0	51.4	.380	.734	-	5	N.	Del. morn. Afternoon very mild.
8	46.0	53.5	38.5	.234	.571	0	2	N.	58.8	60.8	57.0	.466	.874	-	0	N.	Beaut. morn. Pleas. afternoon.
9	44.8	58.0	32.9	.188	.390	0	0	N.	60.0	66.2	55.0	.433	.672	-	2	N. W.	Ag. morn. Beaut. afternoon.
10	46.5	54.8	42.2	.269	.626	0	8	S. W.	54.5	60.0	49.5	.354	.683	-	10	S.	Beaut. morn. Del. mild afternoon.
11	48.5	49.0	47.9	.334	.960	0	10	S.	50.2	50.5	49.9	.360	.978	-	10	S. W.	Threat. in morn. Disagreeable afternoon; heavy rain.
12	45.8	48.5	42.8	.276	.809	1.175	10	S. E.	55.5	60.8	50.7	.370	.694	-	5	S.	Disagreeable morn. Driz. rain. Del. afternoon.
13	44.5	50.0	38.4	.233	.645	0.05	0	W.	55.5	65.8	47.3	.326	.513	-	5	S. W.	Sharp morn. Heavy dew. Beaut. afternoon.
14	46.5	54.5	42.5	.272	.640	0	5	S.	60.0	66.8	54.6	.427	.650	-	0	S. W.	Beaut. morn. Pleas. afternoon.
15	48.8	56.5	41.9	.266	.680	0	0	N.	58.8	65.5	53.4	.409	.651	-	0	N.	Del. morn. Ag. afternoon; very mild.
16	52.0	60.5	44.3	.292	.554	0	2	S.	58.8	68.5	51.0	.374	.587	-	0	S.	Ag. morn. Beaut. afternoon.
17	53.0	63.0	44.0	.288	.500	0	0	S.	55.2	64.5	47.8	.333	.549	-	0	S.	Beaut. morn. Pleas. afternoon.
18	55.0	66.5	45.8	.309	.475	0	0	S.	58.8	68.2	51.8	.378	.549	-	0	S.	Del. morn. Beaut. afternoon; very mild.
19	56.5	62.5	54.9	.432	.763	0	0	N.	60.0	68.8	53.0	.403	.572	-	0	S.	Del. morn. Ag. afternoon.
20	50.8	58.8	43.6	.284	.573	0	0	N.	60.8	67.5	55.4	.439	.652	-	0	S.	Ag. morn. Beaut. afternoon.
21	50.5	60.8	41.2	.259	.486	0	0	N.	58.5	68.2	50.7	.370	.537	-	0	S.	Beaut. morn. Del. afternoon; mild.
22	57.2	63.5	51.5	.361	.650	0	2	S. W.	60.5	75.5	50.0	.361	.409	-	5	S. W.	Del. morn. Hazy; beaut. afternoon.
23	59.2	75.8	47.6	.330	.370	0	2	S. E.	64.5	75.2	57.0	.460	.534	-	2	S.	Beaut. morn. Pleas. afternoon.
24	48.8	60.2	38.5	.234	.448	0	0	N.	60.2	75.0	49.8	.358	.412	-	2	S.	Ag. morn. Beaut. afternoon.
25	53.8	73.0	38.4	.233	.287	0	2	S.	59.5	67.8	52.9	.401	.589	-	2	S.	Del. morn. Ag. afternoon.
26	56.2	68.5	50.0	.361	.518	0	0	S. E.	70.0	77.5	64.7	.611	.648	-	2	S.	Beaut. morn. Del. afternoon; very mild.
27	60.0	70.2	51.8	.386	.523	0	2	S.	65.2	75.8	57.8	.479	.538	-	0	S.	Del. morn. Beaut. afternoon.
28	60.0	73.5	50.5	.368	.446	0	0	N.	70.0	78.5	64.0	.596	.612	-	0	S.	Pleas. morn. Del. afternoon; very warm.
29	65.2	69.8	61.5	.546	.750	0	0	S. E.	68.8	78.5	62.0	.556	.571	-	0	S. W.	Del. morn. Pleas. afternoon; very warm.
30	59.5	64.2	55.3	.438	.730	0	0	N.	71.2	80.5	64.7	.611	.588	-	0	S.	Beaut. morn. Afternoon, sun very warm.
31	54.8	68.2	44.1	.289	.419	0	0	N.	72.1	85.2	62.9	.574	.474	-	2	S.	Del. morn. Beaut. afternoon.
Sums -	1580.8	1820.2	-	-	-	13.450	91	-	1826.9	2048.6	-	-	-	-	103	-	
Means -	51.3	58.7	44.6	.295	.596	-	-	-	58.9	66.1	53.1	.404	.630	-	-	-	

New Quito, 31 March 1865.

(signed) J. McKay.

OF THE CHINCHONA PLANT INTO INDIA.

— VI. —

CHINCHONA CULTIVATION IN THE BOMBAY PRESIDENCY.

— No. 1. —

EXTRACT of a DESPATCH from the Secretary of State for India to the Government of Bombay.

31 December 1862.

5. I DESIRE that you will furnish me with a Report of the experimental sowing of Chinchona seeds at Mahabaleshwur, which were sent there by Mr. Dalzell in 1861.

— No 2. —

EXTRACT from the ANNUAL REPORT on the Hill Station of Mahabaleshwur, Bombay, for 1863, by Dr. *H. Cook*, Superintendent.

20 February 1864.

THE site for the Chinchona plantation has been fixed at Lingmulla, on the banks of the Yenna, above the waterfall. I was induced to select this spot, as it seemed to offer all, or nearly all, the natural advantages essential to the success of the cultivation of the Chinchona. These are briefly, a northern aspect, the disposal of the ground in narrow terraces, protection from prevalent winds, a good soil and subsoil, a plentiful supply of running water, and the least possible rainfall. As the rainfall at Sindola Park is 60 inches less than that at Malcolm-penth, and as a high peak intervenes between this and Lingmulla, I am hopeful that the rainfall at the latter place will not exceed 150 inches. If this prove to be the fact, there need be no fear of the success of the experiment. A house for the local superintendent of the plantation, propagating houses, &c. are to be immediately constructed, and if the sanction of the Government to construct a good branch road from the Paunchganny-road to the site be obtained, this lovely spot will, I feel sure, become a favourite place of resort to visitors, and an added charm to the station.

— No. 3. —

EXTRACT of a DESPATCH from the Secretary of State for India to the Government of Bombay.

16 December 1864.

THE reference made by Dr. Cook to the plantation of Chinchona, at Lingmulla, leads me to hope that the experiment will be successful. In paragraph 5 of my Despatch of the 31st of December 1862, I desired that I might receive a Report on the Chinchona seeds sent by Mr. Dalzell to Mahabaleshwur, in 1861. None has yet been sent, and I have to desire that you will supply the omission.

— No. 4. —

EXTRACT from the ANNUAL REPORT on the Hill Station of Mahabaleshwur, Bombay, for 1864, by Dr. *H. Cook*, Superintendent.

23 January 1865.

THE Chinchona plantation at Lingmulla, which was commenced last year, has been established. The plants have thriven, and many of them have attained a height of above three feet. The services of a soldier from the Artillery, who understands gardening, has been granted by Government.

— No. 5. —

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

Bombay Castle, 28 February 1865.

WITH reference to your Despatch, dated the 16th December last, we have the honour to transmit herewith copies of the papers noted in the margin, showing the progress of the Chinchona plants since grown at Mahabaleshwar.

Memorandum from the Acting Revenue Commissioner S. D., 3 February 1865, with accompaniments.
Resolution of Government on the above, 15 February 1865.

Enclosure in No. 5.

From Dr. H. Cook, Superintendent at Mahabaleshwar, to F. S. Chapman, Esq., Collector of Sattara.

Sir,

Mahabaleshwar, 24 January 1865.

I HAVE the honour to forward for your information, and for transmission to Government, the accompanying two monthly Returns of the growth of the Chinchona plants at Lingmulla, the one for the month of November and the other for that of December last.

MONTHLY RETURN of the Growth of Chinchona Plants at Lingmulla for the Month of November 1864.

No.	Height in Inches.	No.	Height in Inches.
1	9½ Inches.	32	1 Foot and 1½ inch.
2	5 Ditto.	33	1 Ditto 11 inches.
3	1 Foot and ½ inch.	34	2 Feet and 7 "
4	1 Ditto 1 inch.	35	1 Foot and 8. "
5	9 Inches.	36	2 Feet.
6	1 Foot and 1 inch.	37	1 Foot and 6 inches.
7	5 Inches.	38	1 Ditto.
8	9 Ditto.	39	1 Ditto and 6½ "
9	9 Ditto.	40	1 Ditto and 7 "
10	10 Ditto.	41	1 Ditto and 8 "
11	1 Foot and 5 inches.	42	2 Feet.
12	6½ Inches.	43	2 Ditto and 11 inches.
13	1 Foot and 1½ inch.	44	2 Ditto.
14	10½ Inches.	45	2 Ditto and 1½ inch.
15	1 Foot and 6 inches.	46	2 Ditto.
16	1 Ditto 8 "	47	2 Ditto and 1 inch.
17	3 Feet.	48	2 Ditto.
18	10 Inches.	49	2 Ditto.
19	1 Foot and 8 inches.	50	1 Foot and 6½ inches
20	1 Ditto 4 "	51	11 Inches.
21	11 Inches.	52	1 Foot.
22	1 Foot and 8 inches.	53	1 Ditto.
23	1 Ditto 4 "	54	11½ Inches.
24	1 Ditto 4½ "	55	1 Foot and ½ inch.
25	1 Ditto 7½ "	56	1 Ditto and 11½ inches.
26	2 Feet.	57	2 Feet and 4 "
27	1 Foot and 9 inches.	58	2 Ditto.
28	1 Ditto 9 "	59	
29	1 Ditto 5½ "	60	
30	2 Feet.	61	
31	1 Foot.	62	

L. Gillingwater,
Acting Assistant Superintendent, G.B.C.,
Chinchona Plantation, Lingmulla.

Lingmulla, 1 December 1865.

MONTHLY RETURN of the Growth of Chinchona Plantation at Lingmulla for the Month of December 1864.

No.	Height in Inches.	No.	Height in Inches.
1	1 Foot.	31	1 Foot and 5½ inches.
2	8 Inches.	32	1 Ditto and 6¼ "
3	1 Foot and 3 inches.	33	2 Feet and 3½ "
4	1 Ditto 5 "	34	2 Ditto 11½ "
5	1 Ditto 1½ "	35	1 Foot and 11½ "
6	1 Ditto 4 "	36	2 Feet and 5½ "
7	7 Inches.	37	1 Foot and 10½ "
8	1 Foot.	38	1 Ditto and 6½ "
9	1 Ditto.	39	1 Ditto and 10½ "
10	1 Ditto and 1 inch.	40	2 Feet.
11	1 Ditto and 10 inches.	41	1 Foot and 11½ "
12	8½ Inches.	42	2 Feet and 7½ "
13	1 Foot and 4½ inches.	43	3 Ditto 4 "
14	1 Ditto ½ "	44	2 Ditto 5 "
15	1 Ditto 10½ "	45	2 Ditto 5½ "
16	1 Ditto 11½ "	46	2 Ditto 5½ "
17	3 Feet and 1½ "	47	2 Ditto 6½ "
18	1 Foot and 1½ "	48	2 Ditto 7½ "
19	2 Feet.	49	2 Ditto 5½ "
20	1 Foot and 7½ "	50	1 Foot and 10½ "
21	1 Ditto and 3½ "	51	1 Ditto 5½ "
22	2 Feet and ½ "	52	1 Ditto 3½ "
23	1 Foot and 11 "	53	1 Ditto 2½ "
24	1 Ditto and 10½ "	54	1 Ditto 1½ "
25	1 Ditto and 11½ "	55	1 Ditto 5½ "
26	2 Feet and 2½ "	56	2 Feet and 7½ "
27	2 Ditto and 1½ "	57	2 Ditto 8½ "
28	2 Ditto and 1½ "	58	2 Ditto 1 "
29	1 Foot and 8½ "	59	Without leaf.
30	2 Feet and 2½ "	60	Ditto ditto.

L. Gillingwater,

Acting Assistant Superintendent, G. B. G.,
Chinchona Plantation, Lingmulla.

Lingmulla, 1 January 1865.

— No. 6. —

EXTRACT from the ANNUAL REPORT on the Hill Station of Mahabaleshwur,
Bombay, for 1865, by Dr. H. Cook, Superintendent.

9 February 1866.

THE Chinchona plantation established last year has progressed favourably. At the close of the year 1864 there were 60 young plants; these have been increased to 270 by layering 40 of their number. This system of propagation is necessarily slow, but, in the absence of a propagating house, it is the only one that has been found to succeed. As the new propagating house will soon be finished, I trust that the number of young plants will hereafter rapidly increase. Twenty of the original stock, planted on the 18th February 1864, have been allowed to grow up, and some of them have already attained a height of six feet. The average growth of these 20 plants during the year have been 3 feet 2½ inches. The average growth of 11 plants at Neddiwuttum, on the Neilgherries, has been for the past three years only 2 feet 9 inches. If, therefore, the present rate of growth is continued at Lingmulla, it will exceed that of the Neilgherry plants.

RESOLUTION of the Bombay Government.

The report as to the growth of Chinchona plants at Lingmulla is very satisfactory; it is hoped that no time will be lost in completing the propagating house.

— VII. —

CHINCHONA CULTIVATION IN CEYLON.

— No. 1. —

EXTRACT from the REPORT on the Royal Botanic Garden at Peradenia, Ceylon, by Mr. Thwaites, F.R.S. (Director).

September 1864.

CHINCHONAS.—Complete success is attending the cultivation and propagation of the different species of Chinchonas now growing in the Hakgalle Garden. The plants exhibit the most perfect condition of health and vigour, and the number of each kind in the following list furnished to me by Mr. MacNicoll shows how successful he has been in their propagation.

LIST of Chinchona Plants in the Hakgalle Garden.

<i>Chinchona succirubra</i> , planted out in the forest	- - - - -	1,345
(The largest plant being 13½ feet high, and the stem at the base 8½ inches in circumference.)		
Ditto	Stock plants, for taking cuttings from	2,380
Ditto	Plants ready for distribution	42,450
Ditto	Cuttings in different stages of rooting	32,800
<i>Chinchona officinalis</i> , planted out in the forest	- - - - -	1,044
(The largest plant being 6½ feet in height, and the stem at the base 5½ inches in circumference.)		
Ditto	Stock plants, for taking cuttings from	1,934
Ditto	Plants ready for distribution	58,747
Ditto	Cuttings in different stages of rooting	47,400
<i>Chinchona crispella</i> (not distinguishable from <i>C. officinalis</i>) planted out in the forest	- - - - -	430
<i>Chinchona micrantha</i> , planted out in the forest	- - - - -	300
Ditto	Stock plants, for taking cuttings from	320
Ditto	Cuttings in different stages of rooting	229
<i>Chinchona Calisaya</i> , Stock plants, for taking cuttings from	- - - - -	82
Ditto	Cuttings in different stages of rooting	24
<i>Chinchona Pahudiana</i> , Stock plants, for taking cuttings from	- - - - -	24
Ditto	Cuttings in different stages of rooting	12

It having been determined by Government that plants of Chinchonas should be distributed, to the extent they could be spared, free of charge to persons residing in the island making applications for them in the following form:

"I, A. B., possessing (or having under my care) available land at _____, suitable for the cultivation of Chinchona, beg to apply for _____ plants, which I undertake to plant upon the said land within 12 months from this date, and to carefully cultivate when so planted."

It is satisfactory to me to be able to report that I have already received applications in the above prescribed form from eighteen planters, and that the aggregate number applied for by them is 28,524: of this number nearly 9,000 have been issued from Hakgalle, and it will be seen by the foregoing list that there will be no difficulty in supplying the remainder at once. I have reason

to believe that I shall, before long, receive applications for many more plants, and I have no fear of being unable to meet them, as Mr. MacNicoll informs me he can furnish plants at the rate of 20,000 per month, if they are required.

The small number of plants of *Chinchona succirubra* growing in the open ground at Peradenia, are making great progress, and are in perfect health, though not so robust in character as plants of the same age at Hakgalle.

A few plants of *Chinchona officinalis*, which were planted by way of experiment at Newera Ellia, were destroyed by a temperature of 24° Fahr. in one of the cold nights of February last, so that it is quite clear it would not be safe to plant Chinchonas in the island much above the elevation of 5,000 feet, or where they would be liable to frosty nights succeeding the exceedingly hot days of the dry season.

I have transmitted to Sir William Hooker, who has kindly promised to have it submitted to analysis for me, a small quantity of bark of *Chinchona succirubra*, from a tree three years old, and I hope to be able to communicate the results in a short time. Dr. De Vry, professional chemist to the Chinchona plantations of Java, who favoured me with a visit a few months ago, took to Europe with him some bark from a tree at Hakgalle which had died, owing to the roots getting into swampy undrained ground, and he found even in this unpromising specimen of bark, more than two per cent. of alkaloids, and of this nearly one per cent. of quinine.

I regret to say that some seeds of *Chinchona Pitayensis*, obligingly sent to me by Mr. Clements R. Markham, in March last, failed altogether to germinate.

— No. 2 —

EXTRACT from the REPORT on the Royal Botanic Garden at Peradenia, Ceylon, by Mr. Thwaites, F. R. S. (Director).

October 1865.

CHINCHONAS.—Again am I able to give highly satisfactory accounts of the progress made in the cultivation of Chinchonas in the island. Many thousands of plants have been distributed from the Hakgalla Garden, and I have received from the various parts of the island where they have been planted, most favourable reports of their perfect health and vigorous growth; and not a single report of an opposite character has yet reached me: so that there appears to be every prospect of quinine becoming, before very long, one of the most important products of the island.

Mr. MacNicoll has been hitherto able to keep up a sufficient supply of healthy, well-rooted plants to meet the demand which has been made at Hakgalla for them. He has supplied 39 applicants, presenting orders from me, with 129,350 plants, in the proportion of three-fourths of *C. succirubra* and one-fourth of *C. officinalis*.

Up to the present date I have received applications, in the prescribed form, from 43 persons, for altogether 439,274 plants. Three of the applicants requested each to have as many as 100,000 allotted to them, if such a number could be spared. Plants are distributed without stint to the utmost extent of the capabilities of the Hakgalla Garden. I would suggest, however, to persons who may have an intention of cultivating Chinchonas very extensively, that it would be very desirable for them to establish nurseries upon their estates, for the propagation of the plant by cuttings. The operation is a very simple one, and an ordinary cooly labourer could be taught it in a few days at Hakgalla, whither he might be sent for the purpose.

LIST of Chinchona Plants now in Hakgalla Garden.

<i>Chinchona succirubra</i> , planted out (the largest plant being 17 feet in height and the trunk 12½ inches in circumference at the base)	1,345
Ditto — Stock plants for taking cuttings from	2,380
Ditto — Plants fit for distribution	63,158
Ditto — Small plants and cuttings in different stages of growth	78,290

Chinchona

<i>Chinchona officinalis</i> , planted out	1,044
Ditto - Stock plants for taking cuttings from	1,934
Ditto - Plants fit for distribution	109,845
Ditto - Small plants and cuttings in different stages of growth	93,880
<i>Chinchona crispella</i> , (not distinguishable from <i>C. officinalis</i>) planted out	430
<i>Chinchona micrantha</i> , planted out	600
Ditto - Small plants and cuttings	612
<i>Chinchona Calisaya</i> , planted out	100
Ditto - Small plants and cuttings	261
<i>Chinchona Pahudiana</i> , planted out	25
Ditto - Small plants and cuttings	122

I have not yet received from Kew the result of Mr. Howard's analysis of the specimens of Chinchona bark from Hakgalla and from this garden, which were sent to England some months ago. As soon as it reaches me, I shall make it known without loss of time.

Several of the plants of *Chinchona officinalis* at Hakgalla are producing seeds, and one plant of *C. succirubra* is coming into flower.

Some seeds of *C. officinalis* collected at Loxa, and sent to me from Kew, have unfortunately not germinated.

I am not losing sight of the importance of ascertaining, as soon as possible, firstly, the period of growth at which the bark may be most profitably removed from the different species of Chinchona respectively; secondly, the best season for removing it; and thirdly, in what state it is desirable it should be sent to Europe; whether merely dried and carefully packed, and, if so, how this may be best accomplished; or whether, as was suggested to me by Dr. De Vry, some preliminary simple chemical process may not be carried out in the island, which, by eliminating what is of no value, may very much reduce the bulk of the article to be exported. As soon as I succeed in getting any reliable information on these points, I shall lose no time before communicating it.

— No. 3. —

From Mr. Clements R. Markham to the Colonial Secretary, Ceylon.

Sir,

Colombo, 18 November 1865.

I HAVE the honour to inform you that I have inspected the Chinchona Plantation at Hakgalla, and one of the large coffee estates (that of Rothschild) where several acres have been planted with Chinchona, in company with Mr. Thwaites. The site of the plantation at Hakgalla has been so admirably selected, and resembles so closely the native habitat of the Chinchona in South America, that the healthy growth of the plants there must have been a certainty from the first, and the skill of Mr. MacNicoll in propagating has already made Hakgalla a thoroughly efficient nursery for the supply of a practically unlimited number of plants. This portion of the work is in such excellent hands that it would be presumptuous on my part to offer any suggestions, even if I had any to make; but it has occurred to me that the information derived from the analysis of bark in England, and the deductions obtained from it with regard to the probable commercial advantages of Chinchona cultivation, might advantageously be furnished to individuals who have embarked in this important enterprise, from time to time.

2. I shall take care that, in future, all papers on this subject are transmitted to Ceylon without delay; and in the meanwhile it may be useful that I should offer some remarks on the cultivation which has been so generally entered upon by the enterprising planters of Ceylon, with special reference to the recent scientific investigations by Mr. Howard, the great quinine manufacturer in London.

B. I am informed by Mr. Thwaites that as many as 500,000 Chinchona plants have been applied for, and that 180,000 have actually been distributed, so that there is clearly a serious intention among the planters to make Chinchona bark

one of the staple products of the island. On the Rothschild estate several acres are planted with trees of the *Succirubra* or "red bark" species, and, though fully exposed to the effects of the sun and wind, on a hill-slope, denuded of trees, they now present an exceedingly robust and healthy appearance. The span of the branches, the condition of the leaves, and the girth of the stems, all indicate vigour of growth which promises the best results for the future, and although these plants are only 3,200 feet above the sea, there is reason to hope that an analysis of their bark will show a yield but little less favourable than that obtained from bark grown on the Neilgherry Hills in Southern India. I propose, therefore, to state briefly, and in general terms, the results of four successive experiments which have been made on barks sent home from the Neilgherries, in order that some idea may be formed of the probable yield from barks of the same species grown in Ceylon.

4. In May 1863 some bark was cut at a period when the sap was beginning to rise. The product of rough alkaloids in this bark proved to be 4.3 per cent., of purified alkaloids 3.4 per cent., of which 2.4 was quinine. On this occasion, Mr. Howard remarked that the bark cutting should take place as soon as the bark is thick enough to repay cultivation, and that there is positive disadvantage in allowing bark to attain the age indicated by the samples imported from South America, because there is a continual process of deterioration after a certain period in the bark's history. The point to ascertain is the exact time when it has reached its fullest stage of development.

5. The second analysis by Mr. Howard was of bark taken in October 1863, during the rains, when the sap is in full flow. This bark, 18 months old, yielded 6 per cent. of rough and 5 of purified alkaloid. In the following month the bark of a *C. succirubra* tree, aged one year and six months, was delivered to Dr. De Vry, the eminent Dutch chemist. It had been thickened by moss, and he obtained the hitherto unprecedented yield of 8.4 per cent. of alkaloids, of which 2.7 was quinine.

6. The third analysis by Mr. Howard was of bark taken in February 1864, when the plants were in a state of rest. Two lower branches were removed from a plant which had been in the ground for two years and five months, and they yielded 8½ ounces of dry bark. This bark contained 6 per cent. of purified alkaloids, of which 3.14 was quinine, 2.06 chinchonidine, and 0.80 chinchonine. Mr. Howard considered that this large yield might be still further increased by surrounding the stems with moss, and he also came to the conclusion that February was the most favourable time for taking the bark.

7. The fourth and most recent analysis was of bark cut early in April 1865, at the time when the sap begins to rise. It was found that the system of removing strips of bark from the stem can be practised without injury, provided that the wound is instantly covered with damp moss. This bark contrasted most favourably with the average specimens from South America. It was three years and five months old, and had been thickened by the application of moss. The alkaloids were in a state of purity such as is not found in South American red barks, and it was evident that cultivation had improved the yield of this species. Mr. Howard, on this occasion, used the analysis which is followed to ascertain the commercial value of the bark, depending chiefly on the amount of crystallizable sulphates. His result was eight per cent. of alkaloids, of which six per cent. was crystallized sulphate, 0.94 soluble in ether, and 1.06 insoluble. Dr. De Vry, who was furnished with some of the same bark, adopted a method of analysis which gave him the total amount of febrifuge alkaloids. He pronounced it to be the most valuable specimen he had ever manipulated, and obtained the extraordinary yield of 11 per cent. of alkaloids! Another very important point in this investigation was the analysis of bark re-produced on a portion of the stem which had yielded the bark given to Dr. De Vry, in November 1863. This second harvest of bark was thus one year and five months old, and it yielded 7.7 per cent. of alkaloids, of which five per cent. was crystallizable sulphates. During the summer of the present year, Mr. Howard has also analysed bark of *C. officinalis* at an age of one year and seven months, which gave 1.5 per cent. of alkaloids; and bark of *C. micrantha* two years and five months old, thickened by moss, which yielded as much as 5.82 of crystallized sulphate of quinidine.

8. The

8. The highly promising results of these several investigations of bark grown on the Neilgherry Hills are manifest, and the following deductions may be drawn from them. 1. That the yield of chinchona plants under cultivation increases two and threefold, even during the first three years of growth, as compared with the yield of barks imported from South America. 2. That not only may a large yield be obtained from branches lopped from the tree, but that strips may even be taken from the stem, without injury to the tree, provided that damp moss is placed on the wound immediately. 3. That the application of damp moss tends materially to thicken the bark. 4. That bark from the young branches of *C. officinalis*, of plants only a year and a half old, is recognised by experienced dealers in London as identical with the famous "thin rusty crown" of commerce, which fetches 1 s. 3 d. to 1 s. 4 d. per lb., and is generally used by chemists in making the various preparations of Peruvian bark. 5. That the bark of *C. micrantha*, which produces Chinchonine and nothing else in its wild state, has under cultivation been brought to yield the far more valuable febrifuge called quinidine. 6. That the red bark of India and Ceylon will fetch as high a price as the *Calisaya* of Bolivia, the most valuable of all the barks (4 s. per lb.).

9. It has often been suggested that the bark might be greatly reduced in bulk for transmission to the London market, by adopting some cheap chemical process, with a view to eliminating the woody and other useless parts. Mr. Howard, however, is of opinion that it would not be profitable to bring the bark into a smaller bulk for facility of transport. His reasons are founded partly on the complexity of the organic constituents of the bark, leading (especially under the influence of lime or alkalis) to deteriorating changes in the alkaloids, and partly on the tendency of the heat to which the bark must be subjected, to operate in the same direction.

10. There is another point to which I think it particularly important that the attention of the Government of Ceylon should be directed. There are four febrifuge substances in Chinchona bark, found in larger or smaller proportions according to the species. These are quinine, quinidine, chinchonidine, and chinchonine. At present, the first of these is alone of great commercial value. Yet it is the opinion of the most eminent chemists in Europe that quinidine and chinchonidine are of nearly equal efficacy, while chinchonine is by no means devoid of febrifuge virtue. The presence of these alkaloids, other than quinine, is at present, therefore, a disadvantage in a commercial, but not in a medicinal point of view; and looking to the large yield of chinchonidine in our *C. succirubra*, and of quinidine in our *C. micrantha* plants, it becomes a matter of the utmost importance to clear away all prejudice and error on this point. Chinchonidine, I may remark in passing, was undoubtedly the therapeutic agent in the famous cure of the Countess of Chinchon in 1639, who gave her name to the genus, and its febrifuge value has been recognised by the late Dr. Royle, by M. Briquet, the eminent French quinologist, by Mr. Howard, and by Dr. De Vry. The true position of these febrifuges may be established by appointing commissions, consisting of medical men, to report upon them; and with this view the Secretary of State for India has issued the instructions contained in the enclosed despatch to the Madras Government, dated 30th September 1865, to which I would venture to invite particular attention. A similar measure adopted by the Ceylon Government might materially assist the common object in view.

11. From paragraphs 4 to 8 of the same despatch, it will be seen that it is contemplated to establish a manufactory of some cheap form of the Chinchona febrifuge in India. I am aware that measures of this nature do not come within the scope of the Ceylon undertaking, and I have therefore confined myself in this letter to points, which appear important to planters, who cultivate with a view to commercial profit. In this point of view the enterprise is, however, a very important one, likely to advance the prosperity of the colony, and to prove a material blessing to its inhabitants.

12. A periodical analysis of the bark actually grown on coffee estates from 3,000 to 4,500 feet above the sea, is very essential, in order that cultivators may see their way; and I would strongly recommend that they should be made aware of the importance of this measure. In conclusion, I must express my admiration at the zeal and ability with which this great undertaking has been

conducted by Mr. Thwaites and his assistant Mr. MacNicoll; and at the thorough efficiency of the plantation at Hakgalla, which so completely secures the objects contemplated by the Government.

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

The Honourable the Colonial Secretary, Colombo.

P.S.—I also beg to enclose a copy of Mr. Howard's most recent report of an analysis of Chinchona bark which is referred to in the despatch from Sir Charles Wood. Portions of the information might advantageously be printed and circulated for general information.

— No. 4. —

Mr. Clements R. Markham to the Under Secretary of State for India.
Report on Chinchona Cultivation in Ceylon.

Sir,

Colombo, 18 November 1865.

I HAVE visited and inspected the Government Chinchona plantation in Ceylon, as well as some of the coffee estates where the cultivation has been undertaken, and now have the honour to report the results of my observations. The Secretary of State in Council will thus be fully informed respecting the position and prospects of the experiment in Ceylon, when questions relating to Chinchona cultivation in India are submitted for consideration.

2. The plants in Ceylon, with the exception of those of *C. Calisaya*, which came from Java, are entirely derived from seeds procured from South America under my superintendence, at the expense of the India Office, and the Ceylon cultivation may therefore be considered as a branch of the great undertaking which has been successfully carried out under the auspices of the Secretary of State for India.

3. In Ceylon, the Chinchona experiment is under the able superintendence of Mr. Thwaites, the Director of the Botanical Garden at Peradenia, and the cultivation is conducted, under him, by Mr. M'Nichol, a very intelligent gardener, who resides on the spot. The first plants arrived in 1861, when the site for a plantation was selected by Mr. Thwaites, and the work commenced.

4. The knot of mountains in the central province of Ceylon, which at one point attains a height of 8,280 feet above the sea, is entirely composed of gneiss with veins of quartz. The soil formed by the disintegration of this rock is not rich, not to be compared with the fertile loam produced by the more modern volcanic rocks of Java, but this poverty of soil is made up for by abundant supplies of water and a genial climate. The valleys formed by the mountain spurs are extensively cleared and planted with coffee, but there is still a good deal of forest on the higher elevations, and on one of the highest plateaux is the hill station of Neuera-Ellia, 6,220 feet above the sea. From Kandy the mountains are ascended, on their northern face, by an excellent road, and, as Neuera-Ellia is approached, the *flora* resembles closely that of the Pulneys, or of the Neilgherries, near Coonoor. The woods are, like those of the Southern Indian hills, composed of *Michelia*, *Symplocos*, *Gaultheria*, *vaccinium*, myrtles, with an undergrowth of *Lobelia excelsa*, balsams, *Osbeckia* and *Sonerila*, *Solanum Indicum*, a passion-flower, and madder. Beautiful tree ferns grow in the shade, and the *Rhododendron arboreum* is scattered over the open grass land. The station, consisting of bungalows nestling amongst Australian trees, is on a plain, bounded on the east and west by tree-covered hills, crested here and there by bare ridges of gneiss. The masses of cryptogams on the branches and stems of the trees indicate the extreme dampness of the climate.

5. The Chinchona plantation is at a place called Hak-galle, six miles south of Neuera-Ellia, and 5,200 feet above the level of the sea. The position is admirably chosen. Hak-galle is a magnificent perpendicular cliff, rising out of a fine forest which clothes the steep slopes of the mountain. The site faces the north-east. It is protected from the full force of the south-west monsoon by the cliff, while it receives a good supply of rain during both seasons. Half a mile on the road towards Neuera-Ellia the effects of the north-east monsoon are

are lost, and about a mile in the other direction is the limit of the influence of the south-west monsoon. Thus Hak-galle is exactly situated so as to receive ample supplies of moisture throughout the year. No place in the East has so vividly reminded me of the Chinchona *pajonales* of Peru as the view from the Hak-galle plantation. A mountain torrent dashes through the wide ravine, and the hills on either side are clothed with alternate forest and grass land, while to the south are the distant hills and valleys of the Oovah district. These open grass lands, called *patenas* in Ceylon, are precisely analogous to the *pajonales* of Peru. They are of frequent occurrence in the Ceylon hills, being covered with coarse tufts of lemon grass (*Andropogon schænanthus*), and the forest stopping abruptly on their verge. No trees grow on these *patenas*, except the *rhododendron* and a very few others, and they are considered unsuitable for coffee cultivation. On the day of my visit to Hak-galle there were showers from the south-west in the forenoon, and in the afternoon a dense mist rolled up from the Oovah valleys to the east, and enveloped the plantation. This is exactly the course of atmospheric daily change in the uplands of Caravaya, and as I watched the white mist wrapping tree after tree in its thick folds, I almost fancied myself standing on a Chinchona *pajonel* in Peru.

6. Some eight or 10 acres have been cleared on the forest-covered slope under the grand old Hak-galle cliff, and about five are now planted with Chinchona trees. It is worthy of remark that, although the roots of the felled trees have been allowed to remain in the ground, the Chinchona have in no instance been attacked by fungi, as was the case in Java. The plants are completely in the open, and look remarkably healthy and vigorous. In the lower part of the clearing are the *C. succirubra*, which average a height of from eight to 10 feet. Several are in flower. The largest tree is 18 feet 6 inches high, with a stem 14 inches in girth at the base. It was planted in February 1862. The *Calisaya* trees are smaller, but look healthy; and the *C. micrantha* look remarkably strong. The *C. officinalis* trees, of which kind about 4,000 are planted out, are in the upper part of the clearing; they grow very fast, and have already yielded an abundant supply of seeds.

7. The nurseries for cuttings and young plants are beds containing many thousands placed close together, and merely shaded from the heat of the sun by a moveable roofing of grass. An ordinary cooly puts in the cuttings, and the loss only amounts to a half per cent.; 2,000 plants of *C. succirubra* have been raised from buds placed in drills, in the same way as French beans are raised, with half an inch of earth over them, and 90 per cent. came up; and of the *C. officinalis* seeds (30 in each capsule) all came up. The total number of plants and cuttings is now upwards of 500,000. With reference to the method of taking the bark, I found that a tree of *C. succirubra*, which was cut down at Hak-galle for bark analysis in April 1864, had, in November 1865, put up another shoot perpendicularly from the side of the old stem, which was 5 feet high and 5 inches in girth near the ground.

8. The most cheering feature in the Chinchona cultivation of Ceylon is the hearty way in which it has been taken up by the coffee planters. The facility for acquiring good titles, the excellence of the roads, and other advantages, probably render them, as a body, more enterprising than their brethren in India, and this important experiment is evidently destined to receive a fair and complete trial at their hands. The plants are given away by the Government,* the only expense to the cultivator being their carriage to his estate. As many as 50 planters have made applications for plants, 500,000 plants have been asked for, and 180,000 actually distributed.

9. One of the most energetic Chinchona cultivators is Mr. Corbett, who manages the estate of Rothschild, at Pusilawe (on the road from Peradenia to Nuera-Ellia), for the Ceylon Company. It may be looked upon as a representative estate. The coffee plants occupy the slopes on both sides of the Pusilawe

* The following form of application for Chinchona plants is in use in Ceylon:—

"I, A. B., possessing (or, having under my care) available land at _____, suitable for the cultivation of Chinchonas, beg to apply for _____ plants, which I undertake to plant upon the said land within 12 months from this date, and to carefully cultivate when so planted.

"Dated _____

"(signed) A. B.

"To the Directors of the Royal Botanic Gardens, Peradenia."

Pusilawe valley, extending to the very crown of the grand hills of Mooneragalle, whose battlemented ridges of gneiss bound the view to westward. Excepting a clump of jacks high up on the eastern side, and some palms near the houses, every tree has been felled as far as the eye can reach, and rows of coffee plants entirely occupy the site of the primeval forest. No regard whatever has been paid to forest conservancy, belts of verdure are neither left along the watercourses nor on the hill tops, and planters have to send many miles for their firewood; yet there has been no sensible diminution of the water supply, and cascades and torrents dash over masses of rock through this coffee-covered valley.

10. About four acres have been planted with Chinchona trees on the Rothschild estate, on a steep hill slope, facing the east, all except one being of the red bark species. There are about 2,500 plants, or 600 to an acre, planted 12 feet apart, alternating with coffee bushes; they are fully exposed to the full blaze of the sun, yet nothing can be more vigorous and healthy than their appearance. The oldest had been in the ground nearly three years, and are 12 feet high and 8 feet across the branches, with stems 13 inches in girth near the ground; but the majority of the plants were about 20 months old, with stems eight inches in girth. Mr. Corbett is about to plant 600 acres with Chinchona plants at another estate, called Deek-oya, which is 4,000 feet above the sea. Rothschild only has an elevation of 3,200 feet. He has applied for 100,000 plants, and has already received 10,000; and he calculates that, after three years, the cost of cultivation will be 6 *l.* an acre, exclusive of original price of land and interest of money. This will ensure a very remunerative return on the sale of the bark.

11. The object of the Ceylon Government in establishing the Hak-galle plantation is confined to supplying Chinchona to individuals who are willing to undertake the cultivation, and the extensive plantations of the Neilgherries, where a far grander and more important system is contemplated, would therefore be out of place here. The expenditure on Hak-galle is only 500 *l.* a year, 250 *l.* of which is the salary of Mr. M'Nicholl, the gardener; but the Hak-galle plantation fully secures the object for which it was established; it is admirably managed by Mr. M'Nicholl, and it forms a most efficient source of supply for the issue of young plants. I have no doubt whatever that Chinchona cultivation, under the auspices of the enterprising planters of Ceylon, will prove a great commercial success, and be a benefit of no small value to the inhabitants of the island.

12. I sail for Tuticorin on the 19th instant, in a native small craft, in order to visit the pearl oyster nursery, and to deliver the instruments and instructions respecting the aquaria to Captain Phipps. Dr. Cleghorn, the Conservator of Forests, with the permission of Sir William Denison, is to meet me at Palamcottah, and to travel with me, by way of Travancore, to the Neilgherry Hills.

The Under Secretary of
State for India.

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

— No. 5. —

REPORT on Specimens of Chinchona Bark grown in Ceylon by
John Eliot Howard, Esq.

11 July 1866.

I HAVE the honour to report, for the information of Her Majesty's Government, on the four samples of bark received from Mr. Thwaites of Ceylon. I must remark, in the first place, that they contrast disadvantageously in appearance with the specimens of Chinchona bark received from Mr. McIvor. It looks as though the climate of Ceylon were less favourable than that of Ootacamund for the cultivation of this plant. No. 1 in particular, and next to this No. 3, would be considered poor and badly grown barks in commerce, and moreover they have not had the advantage of "mossing," which leads so much to increase the product

duct of the alkaloids. The yield, under these circumstances, is more favourable than I expected, especially from the *Condaminea* bark, concerning which it would be important to know whether it is the *C. officinalis* (var. *Uritusinga*) or some other variety.

No. 1. *C. succirubra* bark taken from trees growing in the forest under dense shade. Plants planted out 8th February 1862, yields,—

Sulphate of quinine	-	-	-	-	-	-	-	-	1.48
Chinchonidine	-	-	-	-	-	-	-	-	0.61
Chinchonine	-	-	-	-	-	-	-	-	2.54
TOTAL									4.63

The proportion of chinchonine in this sample is very remarkable. In the next the quinine and chinchonidine may be looked upon as more than doubled, and the chinchonine reduced by three-quarters.

No. 2. *C. succirubra* bark taken from trees growing in the open garden, planted 25 feet apart. Plants planted out 8th February 1862,—

Sulphate of quinine	-	-	-	-	-	-	-	-	2.35
Uncrystallized quinine	-	-	-	-	-	-	-	-	0.95
Chinchonidine	-	-	-	-	-	-	-	-	1.11
Chinchonine	-	-	-	-	-	-	-	-	0.58
TOTAL									4.99

No. 3. *C. succirubra* bark taken from trees planted in the open garden, six feet apart. Plants planted out on 1st June 1863,—

Sulphate of quinine	-	-	-	-	-	-	-	-	1.90
Uncrystallized quinine	-	-	-	-	-	-	-	-	1.18
Chinchonidine	-	-	-	-	-	-	-	-	0.53
Chinchonine	-	-	-	-	-	-	-	-	0.32
TOTAL									3.93

It seems, from these two last experiments, that the plants have done better six feet apart than 25 feet apart, having made more quinine in proportion to the time, and less chinchonine and chinchonidine. Further experiments are needed to confirm this conclusion.

No. 4. *C. Condaminea* (variety?). This has much the appearance of bark grown in Peru. The climate of Ceylon seems to suit it, which is quite probable, as the scorching heat of the sun, which destroys this plant, does not seem to injure the coarser texture of the large-leaved *Chinchonæ*. It is probable that a climate which does not suit the latter may be friendly to the former. It yields,—

Sulphate of quinine	-	-	-	-	-	-	-	-	3.93
Uncrystallized quinine	-	-	-	-	-	-	-	-	2.41
Chinchonidine	-	-	-	-	-	-	-	-	0.51
Chinchonine	-	-	-	-	-	-	-	-	0.28
TOTAL									7.13

This is evidently the sort to cultivate in Ceylon, as there can be little doubt that, by attention, the uncrystallized quinine might be brought into a condition capable of crystallization. Indeed, I have no doubt that, with a larger sample of bark, I could even now have obtained a somewhat better result. The quantity sent over for examination was, in each case, less than 1,000 grains, and consequently not sufficient for very accurate analysis.

R E T U R N.

East India (Chinchona Plant).

*Ordered, by The House of Commons, to be Printed,
18 June 1866.*

[Price 5 s. 6 d.]

353.

Under 2 lbs. 8 oz.