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ANNUAL REPORT ON THE BOTANIC GARDENS, SINGAPORE,
FOR THE YEAR 1888.

1888-1889
Introduction.

1. The various changes in the staff during the past year, together with the fact that I did not arrive in the Colony till the close of the year, prevents the Report from being as full as it otherwise would have been.

The late Mr. CANTLEY took leave of absence on account of ill-health in December, 1887, and the charge of the Gardens was taken by Mr. DERRY, Assistant Superintendent of Forests, Malacca, while Mr. FOX was still absent from the Colony on leave. Mr. Fox returned in April, 1888, and superintended the Gardens till my arrival in November.

Visitors.

2. The number of visitors to the Gardens increased somewhat last year, the greatest number being noticed on Mail days and Sunday afternoons.

The Band of the 82nd Regiment performed as usual on moonlight nights, and was much appreciated by the general public, as evidenced by their attendance in large numbers.

Flower Beds.

3. The flower beds around the band-stand have been replanted from time to time, and have been kept bright with coloured foliage plants. The beds below the terrace, formerly occupied by rose plants, have been entirely replanted with other kinds of flowering plants, as the roses, from cutting, had become somewhat unsightly. It is intended, however, to replant the roses when a sufficient stock has been obtained and made available. The flower bed design on the site of the old aviaries, formerly planted with English annuals, has been converted into a bulb garden. This has been most successful, as at all times a number of the plants are in flower. The most floriferous of these seem to be *Crinum asiaticum* and *C. zeylanicum*, the tuberose (*Polianthes Tuberosa*), several *Hippeastrums*, and *Zephyranthes*. From the Bulb Garden to the entrance to the Fernery a border has been made and planted with shade-loving plants, such as *Cannas*, *Alpinias*, *Calatheas*, etc., all of which seem likely to do well, although at the end of the year they were much injured by a small species of beetle which devoured the leaves at night.

Plant Borders.

4. The plant borders fringing the carriage-drive leading from the band-stand to Garden Road, have been replanted and manured. The mounds at the end of the lake, originally intended for a Rock Garden, have been covered with suitable plants, which have grown rapidly and well. Plant borders have also been made along the two sides of the manure tank, so as to screen it as much as possible from view.

Lakes.

5. The main lake has been cleared of weeds and rubbish from time to time. The Committee have authorised the purchase of a small boat, which will be very useful, not only in clearing the weeds in otherwise inaccessible spots, but also in replanting the island. A large lizard (*Hydrosaurus salvator*) haunted the lake for part of the year, and did much damage to the water-fowl. It has since been captured and destroyed. The upper end of the lake, where the stream comes in, requires planting, and will be a very suitable place to cultivate some of the *Eichornias*, *Sagittarias* and other beautiful semi-aquatics. The Nymphaea pond was thoroughly cleansed in 1887, some hundreds of cart-loads of mud being taken from it, so that during the past year the water lilies have grown and flowered well. I look forward to making this very interesting, by introducing some of the best of the indigenous aquatics, as well as some from Brazil and other distant countries. The *Victoria Regia* lily has grown and flowered well.

Lawns.

6. The lawns have been maintained in good order, but the turf is much cracked by the sun's heat in the dry weather. The ordinary turf grasses do not seem to cover the ground thickly enough in parts to prevent the fissuring of the soil. *Desmodium triflorum* seems to be the most valuable plant for turfing in the drier spots. But the whole question of making lawns in places so hot and dry as the Gardens requires much attention.

7. But little planting has been done on the lawns, except to fill up blank spaces. I hope shortly, however, to plant some of the barer places more thickly with palms and other trees, and so overcome the unfinished appearance of the Gardens in these parts. A number of the palms have fallen victims to the attacks of the red weevil (*Calandra palmarum*) and the elephant beetle (*Oryctes nasicornis*) so well known for the injury they cause to the coco-nut palms. The former is the more injurious in the Gardens. It seems to attack and destroy not only *Cocos nucifera*, but also *Corypha gebanga*, *Cocos plumosa*, *Martinezia caryotæfolia*, *Verschaffeltia splendida*, *Livistona chinensis*, and several other palms are more or less injured. The eggs of the beetle are laid at the base of the leaf stalks, and the larvæ burrow through the terminal shoot, or cabbage, and so destroy the growing point. The trees require to be carefully examined and overhauled from time to time, and the insects destroyed by the insertion of a flexible iron wire barbed at the point into their burrows.

Soils.

8. The soil in almost every part of the Gardens is exceedingly poor and deficient in the salts most necessary for the growth of plants. With a view of ameliorating this, if possible, a selection of six specimens of soil from various parts of the Gardens was made and submitted to Mr. JOHN HUGHES, F.C.S., of London, for analysis. The specimens range from a peaty swamp soil through various argillaceous strata, to a sandy hill soil. The following table gives the results of Mr. HUGHES' exhaustive analysis:—

Analysis of six Samples of Singapore Soil, representing the ordinary hilly and low-lying or swampy soils.

[Nos. 1, 2 and 3 from low ground Experimental Garden; Nos. 4, 5 and 6, high ground Military Reserve, Tanglin.]

	1	2	3	4	5	6
Water expelled at °212 F.,	84.631	19.040	14.645	18.940	26.190	25.810
Organic matter and combined water,*	10.056	5.149	3.926	2.190	2.882	6.684
Oxides of iron,	.224	3.416	.871	2.505	1.087	1.373
Alumina,	1.948	2.526	2.219	1.125	1.219	2.248
Lime,	.081	.151	.200	.262	.065	.124
Magnesia,	.010	.029	.064	.029	.036	.024
Potash,	.036	.022	.052	.062	.059	.031
Soda,	.009	.007	.037	.016	.020	.013
Thuplinic acid,	.010	.020	.021	.051	.018	.023
Sulphuric acid,	.030	.028	.017	.038	.019	.030
Carbonic acid,	.049	.162	.256	.389	.147	.555
Chlorine,	.011	.003	.002	.004	.003	.005
Silica and Silicates,†	18.866	85.786	91.015	91.767	92.654	15.011
	100.000	100.000	100.000	100.000	100.000	100.000
*Containing Nitrogen,	1.097	.045	0.30	.017	.030	.123
†Coarse sand separated on washing,	5.010	51.940	62.520	20.182	7.230	43.272

Roads and Walks.

9. These have occupied considerable time and attention throughout the year, no less than five hundred cubic yards of road metal having been used. The following roads have been thoroughly re-formed:—The carriage drive leading from the front entrance to the band-stand; the drive leading from the office entrance to the band-stand, and from thence to its junction with Garden Road. A special band of twelve Klings was employed on this work, and the result is very satisfactory.

Plant House.

10. This has continued to look bright with Crotons, Calathéas, and other foliage plants, as well as many orchids. Of these, there is now a fairly good collection of the Eastern kinds, thanks in great measure to many kind donors. The group has received, and is still receiving, much attention from amateurs here, and has taken the place of Crotons in popularity. Many of the smaller species, rarely seen in cultivation, such as *Erias*, *Cirrhopetala*, *Bulbophylla*, *Thelasis*, are represented, as well as the more showy *Dendrobia*, *Cælogynes*, *Phalænopsis* and *Cypripedia*; great improvements have been effected in their cultivation by the use of a species of moss (*Leucobryum*) which is eminently suited for basket cultivation, but is unfortunately rather scarce in the island, and difficult to procure. Many of the orchids, too, have been re-potted, or transferred to baskets or blocks of wood where it seemed that this style of culture would improve them. The species which thrive best here are naturally those which are commonly grown in the East India House, while those of the cooler houses are more shy of flowering here, on account of excess of heat and moisture. Their chief enemies are one or two species of beetles, snails, white ants, and a small species of wood-louse which nibbles the roots.

Buildings.

11. Little has been done beyond repairs where necessary, such as re-roofing the cooly lines, the Police watchmen's quarters, etc. A tool store and carpenter's shop is now a pressing desideratum, as the building at present used is in a most dilapidated and rotten condition. The Committee have, however, approved of a new building being erected chargeable to this year's vote. A small building will also be erected this year on the north side of the plant-house for the accommodation of the rapidly increasing collection of orchids, the present orchid nursery being unsuitable for them.

Aviary.

12. During the year, the Aviary has been put in thorough repair and re-painted at the cost of \$150. Mr. DAVISON, the Curator of the Raffles Museum, has been good enough to name the animals and birds. A number of specimens have been added, both by purchase and donation, among the most interesting of which are the rare Horsfield Hawk-eagle (*Limnetis Horsfieldii*) and the lesser Malayan Hornbill.

Experimental Garden Vegetables.

13. The exhaustive experiments in the cultivation of European vegetables, which was initiated and partly carried out by the late Superintendent, ceased in the early part of the year. It appears that, although success attended the trial of some varieties, speaking generally, the result must be considered a failure. Great difficulty seems to be experienced in getting the Chinese market gardeners to take up the cultivation of European vegetables, or indeed of any newly introduced plants, despite the fact that the European population would readily purchase them.

The following list, taken from Office records, comprises those vegetables worth cultivation:—

Tomatos, ...	... Very good especially the Cherry Tomato. The larger kinds are best grown in tubs.
Jerusalem Artichokes, ...	Very good.
Turnips,	... Fair.
Onions,	... Fair.
Carrots, ...	... Early Short-horn fair, but flavour inferior.

Of tropical vegetables, the Cho-cho (*Sechium edule*), though growing readily, has as yet fruited but scantily.

Fruits.

14. In the Kew Bulletin for October, 1888, a short account is published of the

fruits of the Straits Settlements, with a list shewing the large exports of fruit from the Colony (chiefly preserved pine-apples) a great deal of which is derived from Penang, Malacca and the Native States. The annual value of the preserved fruit exported is \$100,000. The import of fruit chiefly consists of plantains from the Dutch islands, oranges and Japanese persimmon (*Diospyros kaki*) from China, pumeloes and mangos from Siam. As a whole the fruit grown in the Colony, if ever of good strains, appears to deteriorate, owing doubtless to the poverty of the soil; but there is no doubt but that careful cultivation might improve it greatly.

15. The following fruits have been just introduced:—Barbados cherry (*Malpighia urens*), Brazil cherry (*Eugenia braziliensis*), Figs (*Ficus carica*), Queensland plum (*Davidsonia pruriens*), Water melon (*Citrullus vulgaris*), Kei apple (*Aberia caffra*). All these are young plants and have not as yet borne fruit, except the figs. The figs seem likely to be a success, the few fruits which have been borne already are of good quality and size; and care will be taken to propagate the plant. The Coco plum (*Chrysobalanus Icaco*) thrives very well and fruits heavily, but the fruit is almost uneatable. The Tree Tomato (*Cyphomandra betacea*) is quite a failure as regards culture here, the climate being too hot.

Various Economic Plants.

Patchouli.

16. The attention of planters has been called to the cultivation of this plant through the published correspondence of Mr. CURTIS, the Assistant Superintendent of Forests, Penang, the authorities at Kew, and some experts in London. I quote a letter from Messrs. PIESSE & LUBIN, of New Bond Street, London, referring to a sample of the dried leaves sent from Penang:—

“The sample No. 2 is excellent. The commercial value we estimate to be about £80 or £100 per ton. No. 2 is less valuable *pro rata*, for the weight of stalks, which have no odour, and yield no attar on distillation. No. 3 (*Urena lobata*) you correctly describe as being used for the adulteration of the genuine leaves. The demand for leaves and attar of Patchouli is both steady and continuous. The attar fetches about 2/6 to 3/0 per oz. weight.”

17. Patchouly grows as easily and well here as in Penang, and from the above extracts it will be seen that by cultivation patchouly may well be one of the minor products of the Colony. Detailed information as to methods of cultivation has been supplied in answer to various enquiries, but at the same time a caution has been given that the demand is limited, and that a large quantity thrown on the market would render it comparatively valueless, and that care should be taken not to grow it exclusively.

Coca.

18. The Kew Bulletin for January gives a very full description of this plant, with analysis of leaves received from Jamaica, St. Lucia, India, Java, Ceylon and British Guiana, from which it appears that leaves yielding 80 per cent. of the Alkaloid Cocaine are valued at 6*d.* to 8*d.* per pound. The plant grows very well here, and might be easily cultivated, but the demand is limited, and though small and exceptionally fine samples might find a market in Europe, the supply from South America is so large that, without further extension of cultivation, that country could swamp the cocaine market were it to send in one-eightieth of the amount it could produce. From this it will be seen that extensive cultivation here would not pay, but small quantities might be grown at a profit.

Cubebs.

19. There is a great demand for cubeb plants by planters just now, on account of the high price this pepper commands. It grows well in Singapore, but there is some difficulty in procuring the right species, as undoubtedly many of the plants sent out from Java as cubebs are merely forms of the wild and valueless *Piper caninum*. A figure of the true species has been published in the Kew Bulletin, so that it can be now readily recognised by us.

Pepper.

20. The cultivation of pepper is steadily increasing, and prices are well maintained.

Cocoa.

21. The cocoa plants introduced from Trinidad through Ceylon in 1883 are now fruiting well, and there seems to be no reason for the plants being a failure here if properly cultivated. The series in the Gardens comprises a considerable number of varieties, differing in colour and form of the fruit, all of which seem to do well. It is probable that in parts of the Peninsula where the soil is richer than in Singapore the cultivation of this plant would be very profitable.

Tapioca.

22. During the year, six varieties of the best kinds of tapioca used in British Guiana were received. They are highly esteemed in South America, and form a considerable portion of the food of the natives. They have grown very well here, and we have now a sufficient stock for distribution.

Rubbers.

23. The various kinds of rubbers mentioned in former Reports continue to grow well. There is at present, however, little demand for young plants, a circumstance which would seem to point to the necessity of Government planting largely, as planters, as a rule, prefer to plant crops having a quicker return. Meanwhile the consumption of rubber is increasing, and it seems probable that, with only natural reproduction to meet the demand, at no distant date the supply will become very limited.

Library.

24. The Library has been re-arranged and catalogued, and the following books have been added:—

- HERSCHELL—Meteorology, presented by the Royal Gardens, Kew.
 GIBSON and DALZELS—Bombay Flora, "
 TRINIUS—Agrostographia, "
 " De Graminibus Unifloris and Sesquifloris, "
 " Clavis Agrostographiæ, "
 DOZY and MOLKENBOER—Bryologia Javanica, "
 BLUME—Tabelle Javanischen Orchideen. "
 HASSKARL—Hortus Bogoriensis. "
 DECAISNE—Herbarii Timoriensis Descriptio. "
 KURZ—Burmese Flora, 3 parts. "
 WALKER and ARNOT—Prodromus Floræ Indiæ Orientalis, Vol. I. "
 " Pugillus Plantarum Indiæ Orientalis. "
 GUILLEMIN—Icones Lithographiæ Australiæ. "
 KEW BULLETIN, for 1888. "
 HOOKER'S Icones Plantarum, Vols. 1, 2—5, Series III, presented by the Bentham Trustees.
 P. SAGOT—Les Differentes Espèces de Musa; presented by Dr. TRIMEN, Peradeniya, Ceylon.
 THWAITES—On Genus Ancistrocladus, "
 ONDAATJE—Observations on Vegetable Products of Ceylon. "
 W. FERGUSON—Grasses Indigenous to Ceylon. "
 H. TRIMEN—Vascular Cryptograms of Ceylon. "
 KELAART—Notes on Cultivation of Cotton in Ceylon. "
 DYER—Origin of Cassia Lignea. "
 RIDLEY, H. N.—Monographs of Liparis, Microstylis and Orestia; presented by the Author.
 " Monocotyledonous Plants of New Guinea, "
 " Cyperacæ of W. Tropical Africa, "
 " Scitaminæ of Angola, "
 " Fresh-water Hydrocharideæ of Africa, "
 " Orchids of Tropical Africa, "
 " Orchids of Madagascar, "
 DURAND—Index to Genera Plantarum, purchased.
 VEITCH—Orchid Manual, Vols. I, II, III, "
 NICHOLSON—Dictionary of Gardening, "
 WILLIAMS—Orchid Growers' Manual, "
 " Choice Stove and Green House Plants, "

Garden and Forest Reports were received from Ceylon, Jamaica, Trinidad, British Guiana, Natal, Calcutta, Adelaide, and Sydney; and the Illustration Horticole.

Florida Despatch and Chemist and Druggist for the year 1888, were presented by their respective Editors.

Herbarium.

25. The Herbarium has been partially arranged, but the absence of any Curator during the greater portion of the year prevented much being done.

A fine series of *Cupuliferæ*, *Euphorbiaceæ* and *Ficus* from the Peninsula was presented by Dr. KING of Calcutta, and these have been incorporated with the Herbarium, and specimens have been also received from Mr. CURTIS of Penang.

EX-ESTABLISHMENT.

Government House Domain.

26. Under His Excellency's personal direction, the department has effected a great improvement at the entrance to Government House Grounds, by the removal of a number of unsightly and worn out fruit trees, and the substitution of clumps of palms in their stead. Other trees in the grounds have been pruned and manured where necessary.

People's Park.

27. This Recreation and Pleasure Ground, which has just been handed over by the Government to the Municipality, was designed, and planted entirely by the department. Some thousands of trees and shrubs were used for this purpose. The plants have grown and look well, and the Park has already become an ornament to the town and a favourite resort for the Chinese, who principally form the residents of the locality.

28. The usual exchanges in plants and seeds took place during the year. The number of plants received from abroad was 690, and 206 parcels of seeds. The number of plants sent abroad was 1,278, and 40 parcels of seeds.

The following have been the chief contributors :—

		Plants.	Packets of Seeds.
Royal Gardens, Kew,	...	...	19
Botanic Gardens, Hongkong,	...	...	6
" " Bangalore,	...	59	...
" " Trinidad,	...	...	6
" " Saharunpur,	...	...	27
" " British Guiana,	...	70	...
" " Adelaide, ...	...	...	29
" " Ceylon, ...	...	50	2 sacks.
" " Jamaica, ...	...	2	...
" " Buitenzorg, ...	...	1	...
" " Melbourne, ...	...	21	...

The following were purchased :—

Messrs. JOHN LAING & Co.,...	...	12
" CANNELL & SON, ...	...	37
" CARTER & Co., ...	...	36
" SUTTON & Co., ...	...	76
" PAUL & SON, ...	...	16

The following are the chief contributors within the Settlements :—

- H. E. Governor Sir CECIL C. SMITH, K.C.M.G., seeds of *Bauhinia bidens*.
W. BOXALL, Esq., *Cypripedium claptonense*, *Vanda Parishii*.
W. VALENTINE, Esq., *Cypripedium Godefroyæ*.
J. C. RAVENSWAY, Esq., *Saccolabium Blumei*, *Vanda tricolor*, *Begonia* sp.
W. NANSON, Esq., *Cypripedium Lawrencianum*, *Dendrobium formosum*,
D. album, *Calanthe vestita*, *Ærides crispum* var. *Warneri* and *Vanda Roxburghii*.
C. CURTIS, Esq., Penang, *Cypripedium niveum*, *C. barbatum*, *Bonapartea juncea*, *Pteris* sp., *Didymocarpus* sp., *Calanthe ceciliæ*, *C. curculigoides*.
H. C. JOHNSTON, Esq., *Phalænopsis violacea*, *Phal. grandiflora*, *Cypripedium niveum*, and *Saccolabium Hendersonianum*.
A. GENTLE, Esq., *Tacsonia* sp., and *Ipomea bona-nox*.

29. The chief recipients were:—
 Royal Gardens, Kew.
 Botanic Gardens, Trinidad.
 " Adelaide.
 " Hongkong.
 " Saigon.
 British Resident, Sélángor.
 British Resident, Pahang.
 The Malay College, the Government Schools, and other institutions.
 Messrs. LOW & Co., London.
 H. C. JOHNSTON, Esq.
 A. GENTLE, Esq.
 A. F. AYRE, Esq.
 R. C. FALKNER, Esq.
 A. R. VENNING, Esq.
 Mrs. CULLING HANBURY, England.
 J. C. RAVENSWAY, Esq.
 The Assistant Superintendents, Forest Departments, Penang and Malacca.
30. Attached is the usual return of Revenue and Expenditure.

H. N. RIDLEY,
Director.

BOTANIC GARDENS,
Singapore, 11th March, 1889.

Botanic Gardens, Singapore.—Statement of the Receipts and Expenditure, for the year 1888.

RECEIPTS.				EXPENDITURE			
			\$ c.			\$ c.	
By Balance in Bank,	...	...	7 49				
„ Government Grant,	...	...	8,500 00	Mason,	...	37 20	
„ Sale of Plants and Flowers,	...	...	313 77	Carpenters,	...	157 02	
„ Interest on Current Account,	...	...	37 80	Printers (label),	...	160 27	
„ Overdraft refunded,	...	...	10 00	Aviary Keeper,	...	83 99	
				Peon,	...	79 14	
				Coolies,	...	3,308 22	
							3,825 84
					<i>Bills.</i>		
				Purchase of Plants and Seeds,	...	251 32	
				Inspector-General of Police,	...	360 00	
				Director's Transport and Personal Allowance,	...	76 16	
				Assistant Superintendent's Transport,	...	36 66	
				Birds' Food,	...	198 86	
				Manure and Cartage,	...	254 81	
				Wood for Constructive Purposes,	...	102 78	
				Purchase of Tools, and Repairs,	...	377 64	
				„ Flower-pots and Tubs,	...	201 46	
				Freight on Plants and Seeds,	...	64 71	
				Laterite,	...	641 50	
				Petty Expenses,	...	147 85	
				Botanical Books,	...	137 32	
				Repairs to Buildings,	...	344 80	
				Garden Seats,	...	177 20	
				Analysis of Soil,	...	126 88	
				Miscellaneous,	...	152 00	
							3,651 95
							7,477 79
							1,391 17
					<i>Balance in Bank,</i>		
							\$8,869 06
			\$8,869 06				

H. N. RIDLEY,
Director.

ANNUAL REPORT ON THE FORESTS OF SINGAPORE,
FOR THE YEAR 1888.

1. THE changes in the staff consequent on the death of Mr. CANTLEY, the late Superintendent, together with the small grant allowed this year (viz., \$2,500) has prevented any very extensive works being carried out in this Department. Mr. FLANAGAN, the Forest Overseer, left the service in October, and was succeeded by Mr. GOODENOUGH.

Area.

2. The total area of forests now under conservation has been increased from 13,043 to 13,133 acres by the addition of a piece of land at Bedoh taken over from the Land Office in September. This piece of land consists at present chiefly of *lalang* ground, but parts are damp and the soil rich, and it may prove of value when put under timber.

The cost of demarcation was \$25.28.

Boundaries.

3. These have been kept in good order—the paths maintained and kept clear of weeds, and the streams bridged—by the constant attention of the Forest Watchmen, and have been inspected and patrolled by the Forest Overseer and occasionally also by myself. As the boundary paths now extend for a length of 80 miles, the amount of work entailed in this will be easily understood to be considerable, when the small number of men employed is taken into account.

Collecting Plants and Seeds.

4. The Forest men have been instructed to collect in quantity any seeds or fruits found fallen from the trees in the forests and to send them in to the Gardens, where they are planted and as soon as they have germinated and are fit to transplant are removed to the different places which require re-planting. Besides seeds and fruits, they have sent in young plants of various ornamental and useful species and, under my instructions, have recommenced sending in specimens for the herbarium.

Nurseries.

5. With the exception of the experimental nursery, little has been done in raising young stock. In the Jurong nursery there is a good series of young trees many of which are now ready to be planted out, and I hope shortly to be able to plant some of the waste lands on a more extensive scale.

In the Bukit Timah nursery seeds of forest trees have been planted and have, for the most part, germinated well. It is intended to make nurseries round all the watchmen's quarters, whence young plants can be easily transferred to places requiring re-planting.

In the Tanglin experimental nursery a large number of *sěráya* and other useful timber trees have been raised from seed, and some of these have been planted out in the Military Reserve. Over 8,000 young plants of Para Rubber (*Hevea Braziliensis*) were raised from seed sent from Ceylon. The young seedlings grew very rapidly, the largest of which have been put out in the Military Reserve. Others will be planted out in low-lying positions, such as the marshes of Jurong reserve, which are the most suitable localities for this species.

The attempt to grow teak here on a large scale can only be described as a complete failure. The trees require the best soil that we possess, and there are but few spots in the Colony where it will grow at all.

Mahogany does a little better, and in some forests may be planted with advantage, but its cultivation here cannot be considered very successful. The bilion trees introduced from Borneo all perished, but I hope to be able soon to give this valuable timber tree another trial.

Military Reserve.

6. The young trees of sĕráya and other native timber trees planted out here in 1884-1885 had some difficulty in coping with the strong *lalang* grass and other worthless plants. The under-growth was, however, cleared away, and this improved matters considerably. The reserve, however, is by a natural reproduction becoming stocked with tembusu (*Fagræa peregrina*) a very hard and durable timber much valued in Burma. The trees here are somewhat straggly in growth, but by planting them closely together this may be remedied.

Fires.

7. Three fires occurred during the year, two of which were serious, large tracts of forest on the North-East side of Bukit Timah and in the Jurong reserve being destroyed. A smaller fire occurred at Bukit Mandi passing over into the Sembawang reserve. Although every effort was made to discover the cause of these fires, the origin was never traced.

Prosecutions.

8. Ten cases of prosecutions were instituted during the year, for timber-cutting and encroachments. Of these, two cases were withdrawn, and the remainder convicted. The fines inflicted amounted to \$410, of which \$310 were paid.

Rules for Forest Watchmen.

9. A code of rules for Forest Watchmen was drawn up and printed in English and Malay, and copies were sent to all the stations.

Extirpation of Lalang.

10. A very large proportion of the forest reserves is at present covered with *lalang* grass (*Imperata cylindrica* Cyr) which is not only useless, but very injurious, both by reason of its inflammability, and also on account of its preventing any cultivation of the land covered by it, except with a great deal of labour and expense. The subject, therefore, of the growth of *lalang* and its extermination is one of paramount importance.

Wherever the land is burnt, or having been under cultivation is suffered to run to waste, it is soon covered with *lalang*, whatever may have been the previous vegetation. In comparatively rare cases, e.g., portion of the land burnt last year on the North-East side of Bukit Timah, the ground is covered with bracken (*Pteris aquilina*) or *Gleichenia linearis*. This, I believe, to be due to the more sandy nature of the ground at this spot. It is noticeable that *lalang* will not grow on sandy or wet soil or under shade.

In a few spots, the *lalang* grounds might be flooded for a time, and the plant thus destroyed, but owing to the configuration of the island this can rarely be done.

The treatment of the soil by chemicals such as salt, sulphate of iron, &c., apart from the heavy expense connected with it, is liable to have a very injurious effect on the plants with which the ground is afterwards afforested even for many years.

The introduction of some more actively growing plant to combat and destroy the *lalang* has been proposed, and the well-known lantana (*L. mixta*) was suggested for this purpose. In every way this would be a most undesirable proceeding. To substitute for one noxious weed which, by its strength of constitution and vitality, is most injurious to cultivation, a plant yet stronger is merely to go from bad to worse, and as far as lantana is concerned the question has long been settled. In many places the lantana may be seen holding a precarious tenure in the midst of a *lalang* field and quite unable to compete with it.

The most hopeful plan for dealing with it lies in mechanical means. The plant must be hoed up and burnt and the ground re-planted. *Lalang* reproduces itself not only by its feathery seeds, but more constantly by its underground rhizomes. Hoeing it merely breaks these rhizomes into bits, and unless every bit is destroyed, the plant will reproduce itself from pieces of rhizomes left in the soil. Hence it is always said that *lalang* requires to be hoed up three times before it is destroyed.

To fire the plant as it grows, apart from the risk of injury to the timber-forests, only makes matters worse, for the fire merely burns the foliage and does not hurt the underground rhizomes, and the plants after burning usually bear fruit, which is carried by the wind all over the country again.

By constant clearing of the ground for a few years and at the same time planting with trees, the land may be eventually re-afforested with timber, but the expense of doing this on a large scale will be very great. When the trees are tall enough to throw a shade upon the ground, the *lalang* quickly disappears, nor can it penetrate even into forest glades if but a few trees bar its progress.

The question really resolves itself into one of expense. To re-afforest the whole of the *lalang* country in the forest reserves with timber would entail the employment of a large number of men for several years in clearing the *lalang* and re-planting the trees. The military reserve is an instance of this. It was commenced in 1885, and consists of 100 acres on which a band of 10 men has been employed each year for at least a portion of the year, and even previous to that plants likely to destroy the *lalang* had been planted there. Even at present it requires a constant clearing to prevent the recurrence of the *lalang*. The plan I would suggest for combatting the *lalang* is to plant gradually patches of ground at first with shade trees and bushes, perhaps of little or no value for other purposes, but which would form a compact but spreading head of foliage so as to shade the ground, then keeping down the weeds will be a comparatively easy matter. The present staff of watchmen will form little nurseries of trees in this manner round each of their quarters which they will be able to develop according as they have time from their other works. As the shade trees kill down the weeds, more valuable timber trees will be planted among them and in time a piece of valuable forest will be the result.

During my inspection of the forest reserves, I have noted the chief trees and shrubs which will grow through *lalang* both indigenous and introduced. Many plants will not grow in it at all, others grow through it eventually when assisted but do not kill it, while some with a little assistance will grow through and kill it.

Section (I).—Trees and shrubs that will grow through *lalang* without killing it:—

Adinandra dumosa.

Teop-teop (*Mappa javanica*).

Singapore Rhododendron (*Melastoma malabathricum*).

Teak (*Tectona grandis*), in a very few rich soils.

Andong Cantley (*Dracæna Cantleyi*).

Several species of wild Figs (*Ficus spp.*)

(*Embelia ribes*).

Gutta Jelutong (*Dyera costulata*).

Of section (I), teak, as stated elsewhere, is to all intents and purposes a failure here. *Adinandra* might be used as an accessory in keeping out *lalang*, but though exceedingly common, is difficult to propagate artificially. *Dyera* in certain spots is very common and is well deserving of encouragement on account of the rubber it produces. It gives little shade, being a tall straight tree, but not only can it grow through the grass, but in one spot I found plants which had at some time been under fire, throwing up side shoots, showing that the plant can stand burning. The remaining trees and bushes in this section call for no comment.

Section (II).—Trees and shrubs which grow through *lalang* and kill it:—

Arnotto (*Bixa orellana*).

Croton-oil (*Croton Tiglium*).

Flowering Cassia (*Cassia florida*).

Tembusu (*Fagræa peregrina*).

Tuba (*Derris elliptica*).

Mauritius Hemp (*Fourcroya gigantea*).

Of these, the Arnotto reproduces itself very rapidly and forms a low dense bush, under which nothing can grow. Croton seems likely to do well, but has not yet had a fair trial. *Cassia florida* is very successful, and eventually forms a fairly large tree.

⁶
Tupa (*Derris scandens*) is stated to destroy *lalang* if planted among it, but I have had no opportunity of verifying it. *Fourcroya gigantea* will also grow among and destroy the *lalang* to a certain extent. *Fagraea peregrina*, as mentioned previously, is also a success. Besides which, I hope to try the purple *Jatropha* and some species of *Erythrina*.

Of course, it will be understood that in any case the process will be a slow one, and it will be a long time before the injury caused by the early destruction of the forests throughout the Colony is healed, but we may hope that as years go on it may be found possible to work more rapidly.

H. N. RIDLEY,
Director of Gardens and Forests, S.S.

*Revenue and Expenditure of the Forest Department, Singapore,
for the year 1888.*

REVENUE.		EXPENDITURE.	
	\$ c.		\$ c.
Government vote available, ...	2,500 00	Salaries—Forest Watchmen, Experimental Nursery, Tang- lin,	1,582 18
		Transport,	450 59
		Allowances,	248 74
		Miscellaneous and Petty Ex- penditure,	16 60
		Balance,	165 88
			36 01
	\$2,500 00		\$2,500 00

H. N. RIDLEY,
Director of Gardens and Forests, S.S.

ANNUAL REPORT ON THE FORESTS OF PENANG, FOR THE YEAR 1888.

I.—Forest Reserves.

1. No addition has been made to the reserved forests during the year, but the areas demarcated in previous years have been surveyed, and prove to be of greater extent than the original estimate by 1,321 acres.
2. The total area under protection in the Island of Penang is 10,226 acres, or a little less than 16 square miles; the total area of the Island being 107 square miles.
3. The greater portion of these forests are on the hill ranges at altitudes varying from 800 ft. to 2,750 ft., and although containing many excellent kinds of timber, would not at present pay for working; consequently the duties of the Department are for the present mainly protective.
4. During the early part of the year, these duties were not satisfactorily performed, but the appointment of Mr. I. ABRAMS to the post of Sergeant of Forest Guards in June resulted in a decided improvement.
5. Twenty-four persons were prosecuted for forest offences during the year, mainly for illicit cutting of timber, sixteen of whom were convicted, and eight discharged. The total amount of fines inflicted amount to \$105, which, with the exception of \$5, were all paid.
6. The boundaries have been kept clear at a cost of \$128.35.
7. New quarters for the Sergeant of Forest Guards have been erected, at a cost of \$240, and alterations to the Assistant Superintendent's bungalow cost \$329.32.
8. A fire occurred in the village reserve at Kubang Ulu in January, which destroyed 10,000 young Mahogany trees planted out the previous season. The origin of this fire was not clearly ascertained, but from an examination of the spot immediately after, I am of opinion that it was owing to carelessness on the part of some person using the public foot-path at some distance from the reserve. It is worthy of note in connection with this that a clear path, fourteen feet broad, was useless in arresting the progress of fire travelling through *lalang* grass, and it is doubtful whether double that width would have been of any use.
9. The vacancies caused by this fire have been filled up to the extent of the remaining stock of young Mahogany plants in the Nursery, but judging from the progress made, both here and in Penang, this tree is not likely to be of great value in this Settlement.
10. In accordance with instructions received from His Excellency the Governor, the Assistant Superintendent visited the Dindings in January and July, with a view to obtaining information as to the condition of agriculture, and to assist in settling approximately the forest areas to be reserved. Copies of the reports submitted as the result of these visits are annexed. (Appendices *B C D*.)
11. As this district supplies a large proportion of the timber used in Penang, and contains the only large workable forests of the Colony at this end of the Settlement, no time should be lost in putting them under proper management.
12. The total expenditure in connection with the maintenance of Forest Reserves is \$1,690.36, as shown in statement of expenditure annexed. (Appendix *A*.)

II.—Kubang Ulu Nursery.

13. Little new work has been undertaken in this nursery, as it was hoped that a more suitable site would have been acquired and laid out during the year, in accordance with the suggestion put forward in last annual report, but unfortunately the year closed without this being carried into effect.
14. I would again point out the necessity of acquiring suitable land on which to test the value of new and little cultivated vegetable products.
15. Through the kindness of THOMPSON LOW, Esquire, of Calédonia Estate, I am enabled to give the result of an analysis of twelve varieties of the sugar-canes referred to in last year's report as having been introduced from the Mauritius. (Appendix *E*.)
16. Some of these promise to be in advance of any kind at present cultivated in this Settlement, but their real value cannot be estimated until they have been grown on better land than is at my command.

17. A large number of Liberian coffee plants were raised from seeds ripened in Pérak, some of which have been planted in the Dindings. Plants were offered free of cost to the Malays and Achinese in the neighbourhood, but they did not avail themselves to the extent that is to be desired.

18. A few pepper plants put out in 1885 were bearing a good crop of fruit at the end of the year, but there is no necessity for experimenting with this, as its cultivation is thoroughly established at Ara Kuda, from whence thousands of cuttings and plants are now sold to the Native States.

19. One thousand eight hundred and twenty (1,820) trees for planting the road-sides in Province Wellesley have been supplied from this nursery during the year.

III.—Hill Nursery and Bungalow Garden.

20. The special grant of \$1,000 for the improvement of the Bungalow Garden admitted of much necessary work being done. The working of the nursery and garden together, instead of from separate votes as in previous years, is also an advantage.

21. The top of Gun Hill has been cleared, levelled, and laid out as tastefully as the site would admit. A rustic summer-house, and a temporary plant shed, have been erected, and the latter filled with plants requiring a lower temperature than is obtainable in other gardens. Most of the *Cattleyas*, *Odontoglossums*, *Rhododendrons*, &c., have been removed to this shed, as being not only cooler, but easier of access to persons occupying the bungalows.

22. The "Round," near the entrance to the Convalescent Bungalow, has been cut down six feet, and the area of the site enlarged with the soil removed. *Grevillia robusta* and *Juniperus virginiana* have been planted around the outer edge, and this site is now available for tennis, &c.

23. The approach to the Convalescent Bungalow, which was in an untidy condition, has been cleared, dug over, sloped and turfed.

24. The long continuous flower beds on the terraces have been broken up into irregular groups, and entirely re-planted, the intervening spaces being turfed.

25. The rose beds have been deeply trenched, and, as far as possible, re-planted with grafted or budded plants propagated on the spot, and these are doing much better than plants on their own roots. Many new varieties have been introduced from Calcutta, and it is hoped that by the end of another year the garden will be well stocked with young thriving plants.

26. The area available for vegetable cultivation has been greatly extended during the year, by cutting away the jungle and forming additional terraces. The cultivation of vegetables will, in future, be principally confined to this garden as it is in close proximity to the stables and piggery, the latter having been put up for the express purpose of obtaining manure.

27. The five pigs purchased in December, 1887, have increased during the year to twenty-one; the total cost of food being \$76.01.

28. The general up-keep of roads, paths, &c., always an important item where the rainfall is heavy as in Penang, has been well attended to by Mr. CHANDLER, as well as the supervision of coolies employed on the various improvements already detailed. It is to be regretted that this Officer is leaving, as it takes at least a year for a man with no previous experience of working coolies or gardening, to acquire the knowledge necessary for carrying on the work economically and expeditiously.

29. The capabilities of this garden have never been fully developed, no one with a practical knowledge of the cultivation of plants having been stationed on the spot, and the Officers appointed to the post of Signal Sergeant leave, or are removed, by the time they begin to take an interest in this subject.

30. In the Experimental Nursery there has been a greater amount of fever than usual among the men employed, and very frequent changes.

31. Since the promotion of Mr. P. NIEUKEY to the post of Overseer, Waterfall Garden, in June last, no competent man has been in charge of this nursery. Applications were made to the Singapore and Calcutta Botanic Gardens, but in neither case could a man be spared. An advertisement was then inserted in the local newspaper, but the applicants were none of them of the class to be desired. Eventually a Ceylon man, whose testimonials as to general character were satisfactory, but with no previous knowledge of garden work, was taken on probation, but during the absence on leave of the Assistant Superintendent in November he left under the plea of ill-health.

32. In spite of this difficulty, the general up-keep has been fairly maintained, and the young stock made satisfactory progress.

33. The tree tomatoes continue to bear, and one of the apple trees from Australia produced eight fruits of large size and fair flavour. The oranges and citrons should commence bearing next year.

34. The olives continue to make progress, one tree having attained a height of twelve feet, with a circumference of six inches at the base, but there is no sign of its producing fruit.

IV.—Waterfall Garden.

35. The result of the labour and thought expended in the formation of this garden is only now beginning to be realised, and I have no hesitation in saying that the community, both European and Native, appreciate the change that has been wrought in four years.

36. In addition to the benefit of a public garden to the community, the clearing of the Waterfall Valley has, I think, had a beneficial effect on the climate of the neighbourhood. The late Mr. HOGAN, who at one time owned this property, and attempted to grow nutmegs and cloves on a portion of it, informed me that he could get no one to remain on the spot on account of the fever.

37. Owing to the poor gravelly nature of the soil, the expense of preparing holes for specimen trees, &c. is greater than in most other places, but the natural advantages of the surroundings, from a landscape gardening point of view, in a great measure compensate for this defect.

38. The works of extension and improvement have been steadily pursued during the year, as means and circumstances permitted, but the greater portion of the money available for these purposes has been absorbed in the construction of a substantial bridge, forty-eight feet long, at the top of the grounds. This work was kindly undertaken by the Public Works Department, and cost \$2,336.80.

39. One area of land has been cleared and added to the garden on the east side of the stream, near the entrance, and a site for a band-stand provided by cutting down and terracing a natural mound on this land.

40. The area laid out at the end of the year is thirty-five acres; out of a total of seventy-five acres acquired from the Municipal Commissioners.

41. The narrow strip of land between the band-stand and stream has been acquired by purchase, and will admit of a great improvement being made in 1889.

42. An unsightly swamp above the Office has been converted into an irregular-shaped pond, one hundred and twenty feet long by twenty to forty feet broad, and planted with the *Victoria regia* and other lilies. The only difficulty in connection with this is the large quantity of sand brought down by the rains from the hill road, and I see no way of preventing this.

43. A bridge, 25 feet long, on the contour road, which was put up temporarily in 1885 with materials obtainable on the spot, has been replaced by substantial beams and planks that will last for many years. The material cost \$100.07, and the work, as in all other cases with the exception of the large bridge mentioned in para. 37, was executed by the garden coolies.

44. An extra shed for the cultivation of ferns, has been erected in the nursery, close to the stream, and answers its purpose well. The plants have improved greatly since being removed to this site.

45. As many of the plants and trees as circumstances would admit, have been labelled with strong Chengal labels, but this can only be attended to at odd times, as other and more pressing work is generally on hand.

46. The grounds of the Assistant Superintendent's quarters, overlooking the garden, have been laid out and planted, and with the building form a prominent feature in the landscape. The house has been occupied since the 1st February.

47. Thinning out the jungle in the ravine above the upper plant shed was commenced in November, in order that the formation of a natural rockery might be commenced early in 1889.

48. The usual routine works of mowing, sweeping and attending to roads and paths, have been carried out at a considerable expenditure in labour, especially during the months of September and October, when the heavy rains did some damage to the roads.

49. There is still great difficulty in obtaining suitable labourers at a reasonable price, and this will probably continue so long as there is a large demand in the Native States at a high rate of wages.

50. The stock of plants in pots has greatly increased during the year, and some of those previously obtained have grown into good specimens.

51. The Assistant Superintendent while on leave towards the end of the year obtained over six hundred plants and trees, chiefly of an ornamental nature, from Burma and India; a large proportion being from the Royal Botanic Gardens, Calcutta. Many interesting plants were also obtained from the Agri-Horticultural Societies of India and Burma, and from Mr. C. MARIES, Superintendent of State Gardens, Gwalior.

52. The plants in pots are housed in temporary sheds of various kinds, according to the requirements of the plants cultivated, but it is hoped that the time is not far distant when means will be provided for erecting more substantial and elegant shelter.

53. The light structures of T iron in the Botanic Gardens and Nurseries of Calcutta are, for elegance, economy and durability, preferable to anything I know of, and, with slight modification, quite suited to the requirements of plant cultivation in this climate.

54. In July, the use of the Government Steam-launch was granted for four days, for the purpose of visiting the Langkawi Islands to collect orchids and other plants suitable for cultivation in the garden, and for exchange. A copy of the report on this trip is annexed (Appendix F.)

55. The idea of forming an ornamental lake at the top of the grounds, suggested in my last annual report, remains in abeyance, the Municipal Commissioners being uncertain whether this site will be required in connection with the water supply or not. Its unsightly appearance will be brought still more prominently into view when the approaches to the new bridge are completed.

56. The total cost of maintenance of this garden for the year is \$3,496.43, and the construction of bridge and other new works \$2,500.

V.—General.

57. Four hundred species of Penang plants have been added to the herbarium, and duplicates of each forwarded to the Royal Gardens, Kew, for determination. Two hundred and seventy surplus specimens have been presented to other botanical establishments, and eighty received in exchange.

58. One thousand one hundred and twenty-two plants, and sixty-three packets of seeds, exclusive of those obtained by purchase, were received during the year; and two-thousand five hundred and forty-one plants, and sixty-one packets of seeds distributed, exclusive of those supplied for road-sides. A list of the principal donors and recipients is given in Appendix G.

C. CURTIS,
Assistant Superintendent of Forests, Penang.

Penang,
31st January, 1889.

APPENDIX A.

Revenue and Expenditure of the Forests and Gardens Department, Penang, 1888.

REVENUE.		EXPENDITURE.		
Grant for Maintenance of Forest Reserves, ...	\$4,000.00	<i>Salaries of Establishment.</i>		
		Assistant Superintendent of Forests, ...	\$ 1,500	c. 00
		Overseers of Waterfall Garden, ...	300	00
		" of Hill Nursery, ..	154	00
		Sergeant of Forest Guards, ...	192	25
		Total, ...	2,146	25
		<i>Salaries.</i>		
		Forest Guards, ...	426	00
		Office Assistant and Messenger, ...	202	33
		Coolies—Up-keep of Nursery and Planting Waste Land, ...	255	10
		Coolies—Clearing Boundaries, ...	128	25
		<i>Bills.</i>		
		Tools and Materials, ...	12	02
		Alteration of Assistant Superintendent's Bungalow, ...	329	32
		Construction of Quarters for Sergeant of Forest Guards, ...	240	00
Grant for Improvement of Bungalow Garden, ...	\$1,000.00	Freight on Plants, ...	18	52
		Forest Guards' Transport, ...	15	75
		Petty Expenses, ...	23	42
		Oil for Forest Guards' Station, ...	13	50
		Purchase of Stoppered Bottles, ...	12	00
		" Drying Paper, ...	4	75
		Advertising, ...	3	40
		House-rent for Coolies, ...	6	00
		Total, ...	1,690	36
		Balance, ...	2,309	64
		Grand Total, ...	4,000	00
		<i>Salaries.</i>		
		Coolies, ...	749	41
		<i>Bills.</i>		
		Tools and Materials, ...	85	81
		Purchase of Flower Pots, ...	27	29
		Carrying up Manure, ...	86	45
		Cartage, ...	3	25
		Bone Dust, ...	41	33
		Petty Expenses, ...	4	94
		Total, ...	998	48
		Balance, ...	1	52
		Grand Total, ...	1,000	00

*Revenue and Expenditure of the Forests and Gardens Department,
Penang, 1888,—Continued.*

REVENUE.		EXPENDITURE.		
		<i>Salaries.</i>	\$	c.
		Coolies and Tindal, Bungalow Garden and Experimental Nursery,	1,435	50
		<i>Bills.</i>		
Grant for Maintenance of Expt. } Nursery and Bungalow Garden, }	\$1,750.00	Tools and Materials (for Plant Shed, &c.),	119	06
		Rice for Cattle,	76	01
		Cartage,	2	00
		Purchase of Plants,	101	00
		Repairs of Overseers' Quarters,	9	00
		Total, ...	1,742	57
		Balance, ...	7	43
		Grand Total, ...	1,750	00
Grant for laying out of Waterfall } Garden, }	\$2,500.00	To Purchase of Land,	160	30
		" Materials,	147	78
		Construction of Bridge,	2,191	92
		Total, ...	2,500	00
		<i>Salaries.</i>		
		Coolies and Gardeners,	2,629	85
		<i>Bills.</i>		
Grant for Maintenance of Water- } fall Garden, }	\$3,500.00	Manure,	150	40
		Cartage,	46	05
		Tools and Materials (new Plant Sheds, &c.),	301	30
		Purchase of Plants and Seeds,	76	51
		" Pots,	40	61
		" Plant Tubs,	62	50
		Petty Expenses,	75	31
		Materials for Bridge,	100	01
		Chicks for Plant Sheds,	13	83
		Total, ...	3,496	37
		Balance, ...	3	63
		Grand Total, ...	3,500	00
Grant for Travelling and Person- } al Allowances, }	\$700.00	Pony Allowance,	396	00
		House-rent (one Month),	35	00
		Cost of Botanical Tours,	105	77
		Inspection Duty, Dindings,	68	10
		Transport and Field Allowances,	36	14
		Total, ...	641	01
		Balance, ...	58	99
		Total ...	700	00
Total Revenue from Sale of Grass, Plants, &c., (paid in to Revenue Account),	\$245.44	Total Expenditure of the Department, ...	\$13,215	04

31st January, 1889.

C. CURTIS,
Assistant Superintendent of Forests, Penang.

APPENDIX B.

REPORT ON THE FORESTS OF THE DINDINGS.

As pointed out in my report on the agricultural condition of this District, the timber and other forest produce constitutes a most valuable crop, in many places of greater value, all things considered, than anything that could be put on the land were the existing forests destroyed.

2. The District has not been surveyed, but the approximate area is two hundred square miles, of which, so far as I can judge from a hurried visit, at least two-thirds are more or less covered with forests containing a large proportion of valuable timber trees, such as, *Chengal*, *Damar laut*, *Tampenis*, *Měřěbau*, *Měřanti*, and others of more or less value; which, properly managed, will prove a permanent source of revenue.

3. The population is scanty, and consequently there are but few of the difficulties to be met with that have been encountered in demarcating and settling the reserved areas in other parts of the Straits Settlements.

4. The facilities for removing and marketing the produce in Penang are greater than in any other Crown forests at this end of the Settlement.

5. Local steamers call regularly at Pangkor for fire-wood, and as the trade between Penang and Lower Pérak increases, the demand for fire-wood is certain to increase also, thus affording a market for produce that is often wasted or of little value.

6. Other sources of revenue are, damar, wood-oil, rótans, gětah, bertam, &c., all of which will have to be taken into consideration in the future administration of these forests.

7. The present system of allowing Chinese to cut where and how they choose, on payment of royalty to the Government varying from three to nine cents per cubic foot for logs up to twenty feet in length, and a proportionally higher sum for greater lengths, will, in a few years, destroy all the more valuable timbers. In some places this is already the case, as I am informed by the District Officer, who remarks, and my own observations agree, that one of the most valuable timbers—chengal—will soon be exhausted unless protection and a different system of working be applied.

8. The same thing has happened in Penang with the best form of damar laut, (*Shorea* sp.) which is specifically distinct from, and vastly superior to, the timber now generally known under that name.

Old Malays inform me that the best form of damar laut, known as *No. satu* was plentiful thirty or forty years ago, but I know from experience that at the present time it is difficult to find a single tree.

9. The revenue derived from forest produce in the Dindings during the past three years amounts to \$20,611.01, but I have no information what proportion of that sum is derived from minor products. I think, however, it may be safely assumed that for this sum half a million cubic feet of timber have been removed, and a large quantity wasted, as there is under the present system no incentive to economy in working.

10. The suggestions I have to offer are that a large proportion of this District,—

- (a) be declared Forest Reserve, and worked on a system that will ensure natural reproduction from seed, and also ensure that the quantity of timber removed does not exceed the annual yield of the forest;
- (b) to do this the reserved area must first be marked out in blocks, and compartments, for convenience in working, the boundaries surveyed, and suitable maps prepared;
- (c) by careful examination the contents of each compartment should be ascertained, the kinds and proportion of timber trees and other revenue-yielding produce noted, and the approximate normal yearly increase ascertained;
- (d) trees to be removed during the year from the compartment or compartments to be operated on should be marked by a competent person, and then sold by auction standing, removed by Government agency, or under a modification of the present system, as experience may prove best;
- (e) restriction should be placed on the manufacture of "Sagors" by which process the greater portion of a whole tree (generally Chengal) of the first class is entirely wasted, to form the bottom portion of a native boat;
- (f) the cutting of certain valuable trees that are becoming scarce, to be specified after careful examination, to be entirely prohibited for a number of years;

- (g) the protection of gëtah trees, rôtans, and other minor products, should receive attention, and artificial reproduction resorted to, if necessary, though immediate protective measures will probably render this unnecessary except in the case of very scarce and valuable trees, &c.;
- (h) separate reserves for fire-wood should be established on the banks of the rivers, where the vegetation is principally bakau.

11. The need of a small protective staff in order to check the illicit removal of timber, &c., is already felt by the District Officer, and the system I have ventured to suggest cannot be carried out without the assistance of intelligent men.

12. The object should not be to obtain the greatest possible immediate revenue, but to bring the forests into the condition in which they will produce the best kinds of timbers, and prove a permanent source of wealth.

C. CURTIS.

Assistant Superintendent of Forests, Penang.

APPENDIX C.

Penang, 30th July, 1888.

SIR,—I have the honour to report that, in accordance with the Governor's instruction to visit the Dindings and assist the District Officer in settling the area and position of Forest Reserves, I left Penang on the 7th instant and returned on the 14th instant.

2. Mr. MEREWETHER was ready to start immediately on my arrival in Pangkor, and we proceeded at once in the Steam-lanuch to Tělok Sěra.

3. On the following day we took a sampan, and went up the Bruas River in order to examine the mangrove swamps in which much of the fire-wood used by local steamers is cut. Landed at Pangkalan Báru and walked across to the Pérak boundary near Sungei Tuntong.

4. On the third morning we started from Tělok Sěra, and walked over nine miles of excellent new bridle-path which passes through some of the best land in the District. Took a sampan and went down the river to Kota Siam and joined the launch, which had been sent around by the Dindings River, and proceeded up the Rája Itam River.

5. The fourth day we walked through abandoned ladang land to Gunong Tunggal, a long isolated hill about 500 feet in height, from the top of which Penang can be seen.

6. The fifth and sixth days were spent in Pangkor examining the forests, and collecting specimens of such trees, &c. as were in flower or fruit, and in deciding as far as possible the position of the areas to be conserved.

7. On a previous occasion I had an opportunity of examining the southern portion of the District, and with the experience gained during these two visits, and from information supplied by Mr. MEREWETHER, I am of opinion that it is desirable to establish reserves in places shown approximately in enclosed plan.

8. Pangkor Island has been cleared of the best timbers wherever it could be worked out with ease, but there is still a great deal high up the hills, and in places more or less difficult of access.

The land has not been cultivated, and there is a good covering of young trees of various kinds, a fair proportion of which will grow into valuable timber. The land is in a condition to receive seeds of the better class of trees if a sufficient number be allowed to remain long enough to arrive at a seed-bearing age, and I, therefore, advise that the whole Island be closed for a time.

9. Tělok Sěra reserve includes the highest range in the District, the greater portion of which is unsuited for agricultural purposes. The roads from Sungei Satal to Kota Siam and Sungei Glam are excellent boundaries, and all the demarcation necessary is to run a line nearly east from the latter place until the Kota Siam Road is reached.

10. Tanjong Búrong is a flat swamp well covered with young mangrove trees, which, if protected, will grow into a valuable crop of fire-wood, for which there is a steady demand. In order to demarcate this reserve, it is only necessary to open one line from near the mouth of the Bruas River to the Pérak boundary.

11. Gunong Tunggai is in the midst of a large area of land suitable for agricultural purposes, but the hill itself is in general too steep for cultivation. It contains a large proportion of damar laut (*Shorea gratissima* Dyer) of a large size, and other good timbers.

There are also a good many climbing gutta plants, "getah grip," (a species of *Willoughbeia*), which the Malays in the neighbourhood requested permission to be allowed to tap. There are no existing boundaries in the form of rivers or paths that can be utilised, and a good forest boundary, by connecting it with Sungei Rája Itam, would serve the double purpose of defining the area to be reserved and providing an opening into the agricultural land around the base of the hill.

12. Tanjong Hantu is a rocky point of land covered with small timber of good quality, and is sufficiently well defined by the road from Simpiti to Tělok Sěra and Sungei Puya on the landward side, and the sea on the other.

13. Lumut Reserve includes a range of low hills covered with small useful timber, the boundaries of which are sufficiently well defined on two sides.

14. It is impossible to state with any approach to accuracy what the acreage of these areas amounts to, as the District has not been surveyed, and the accompanying plan is intended rather to show the relative positions than the areas.

15. There is still a large stock of *Dipterocarpeæ* and other valuable timbers in the Dindings, for which there will be a demand at no distant time, but the Chinese will not go far back, except in the case of valuable trees such as chengal, until they have quite exhausted the forests bordering the streams, and unfortunately in these places they clear out everything of value, leaving none for seed-bearing, and destroying thousands of saplings.

16. All cutting within the reserves should be at once stopped, and as there is a sufficiency of timber for present wants in other places, it will not greatly affect any one. When these areas are worked it must be on a plan that will ensure natural reproduction of the best timbers.

17. A small staff of Forest Guards will be necessary in order to prevent illicit cutting and, no doubt, these can be utilised by the District Officer, under whom they should be placed, to check the produce taken out of unreserved forests under passes issued by his office.

18. No specially qualified Forester is, for the present, necessary; demarcation, survey and protection, being the immediate requirements of the District.

19. Chengal is even scarcer than I had anticipated, and unless the cutting is prohibited there will not be a tree remaining in two or three years.

Ebony is the only other tree that I would at present recommend to be placed in this class, though I may at some future time with a more intimate knowledge of the contents of the forests, have to suggest others.

C. CURTIS,

Assistant Superintendent of Forests, Penang.

APPENDIX D.

Penang, 31st January, 1889.

SIR,—I have the honour to report, for the information of His Excellency the Governor, that, in accordance with instructions, I proceeded to the Dindings on January 19th, taking with me a case of economic plants in pots, the weather being too dry at the time for lifting plants from the open ground.

2. During six days I travelled over as much of the District as was possible without the aid of a steam-launch, which was unfortunately in dock, and examined the state of agriculture and nature of the soil.

3. With the exception of Lumut Estate, on which tapioca and sugar are grown, the principal cultivated products appear to be coco-nuts and patchouly, both of which give a good return. The tapioca crop is looking well, and the machinery for manufacturing flour will be erected shortly.

4. Pepper is being tried on a small scale in three or four different parts of the District, and grows well, especially near the District Officer's house at Pangkor, but the proper method of cultivation is not understood by the owners. The plants have been allowed to grow up to the tops of the supports, instead of being layered as is done by the Achinese planters in Province Wellesley. I explained to them practically, by treating plants in their presence, that when a pepper plant begins to branch it

should be taken down from its support, the lower leaves removed, and the stem up to the junction of the branches layered down in a previously prepared hole as near the support as is consistent with the safety of its roots, and the soil then replaced. Treated in this manner, roots are emitted along the whole length of the stem that has been buried, the plant is better able to withstand drought, and fruit is produced from near the ground up to any height that may be desired.

5. At Rája Itam, which was reached by walking for five or six miles along the boundary line that divides the Dindings from Pérak, I saw near a native house a plant of China grass (*Rhea* or *Ramie*) which has attracted considerable attention of late on account of its valuable fibre. The owner of the garden stated that he was in the habit of cutting it down for the manufacture of fishing lines about once a month. At the time I saw it the shoots were four or five feet high, and as clean as could be desired. The soil at this place is a peculiar clayey loam of a light colour.

6. There are a variety of soils in the District, some of which would produce cloves, nutmegs, pepper, Liberian coffee, chocolate, indigo, coco-nuts, paddy, &c.

7. In order to encourage the cultivation of economic products other than those mentioned in para. 8, which are already established, especially pepper, coffee, cloves and nutmegs, I would suggest the formation of a small nursery in Pangkor, of about an acre in extent, where plants could be raised or planted temporarily on their arrival from Penang or Singapore, previous to distribution to intelligent natives willing to give them a fair trial.

8. After careful examination, in company with the District Officer, we came to the conclusion that the most suitable place for this purpose would be a piece of land near the Recreation Ground, which combines the advantages of fairly good land with an abundant water supply, and is sufficiently near the District Officer's quarters to allow of his personal supervision.

9. This land would have to be cleared and fenced to keep out animals, and a small house put up to accommodate two gardeners, who would be sufficient to carry on the work when it is fairly started.

10. The cost of clearing, fencing and stocking this nursery, including young plants of cloves, nutmegs and pepper to be purchased this year, need not exceed \$500, and the other up-keep would be the salaries of two Javanese at about \$18 per mensem.

I discussed the matter thoroughly with Mr. MEREWETHER, who takes an intense interest in the matter, and one of the first things done would be to raise a quantity of dadap and pepper plants for distribution, a supply of seeds of the former being available on the spot.

11. There is regular communication between Penang and Pangkor, and seeds are easily transmitted, and an Officer of this Department could occasionally run down for a day or two to give practical instruction.

At present there is no accommodation for visitors to the District, which doubtless prevents many persons, who would otherwise do so, from spending a day or two on the Island, and judging for themselves of the capability of the soil, &c. I understand, however, from the District Officer, that it is intended to erect a Rest-house on the beach which will be a great convenience.

12. It should be borne in mind that, while there is great need for developing the agricultural capabilities of the Dindings, the Government possess in the existing forests a most valuable crop, which in some parts of the District, considering the nature of the soil, quality of the timber and the facility with which it can be brought to market, is, if carefully conserved and economically worked, probably of greater value than anything that can be planted, besides the advantages of having a fair proportion of forest land as regards its bearing on climatic changes.

13. These areas should be settled in good time, and their extent and position shown in the map when the contemplated survey of the District is undertaken.

C. CURTIS,
Assistant Superintendent of Forests, Penang.

APPENDIX G.

Principal Contributors and Recipients of Plants, 1888.

CONTRIBUTORS.	RECIPIENTS.
Director, Botanic Gardens, Calcutta.	Director, Royal Gardens, Kew.
Director, Botanic Gardens, Ceylon.	Director, Botanic Gardens, Ceylon.
Superintendent, Botanic Gardens, Hongkong.	Director, Botanic Gardens, Calcutta.
Superintendent, Botanic Gardens, Singapore.	Supt., Botanic Gardens, Hongkong.
Agri-Horticultural Society, Calcutta.	Supt., Botanic Gardens, Singapore.
Do. do., Rangoon.	Agri-Horticultural Society, Calcutta.
Do. do., Madras.	Assistant Superintendent of Forests, Malacca.
Messrs. Jas. Veitch & Sons, London.	Superintendent of Plantations, Pérak.
Hon'ble W. E. Maxwell, C. M. G., Penang.	Hon'ble J. Allan, Penang.
C. W. S. Kynnersley, Esq., Penang.	J. Fraser, Esq., Pérak.
Major Walker, Pérak.	E. M. Merewether, Esq., Pangkor.
Dr. Brown, Penang.	H. C. Johnston, Esq., Singapore.
Mrs. I. Allan, Penang.	C. Wray, Esq., Batang Padang.
Mrs. E. F. Thomas, Penang.	Sir Hugh Low K. C. M. G., Pérak.
C. Wray, Esq., Batang Padang.	L. C. Brown, Esq., Penang.
Mrs. Trotter, Singapore.	G. Péche, Esq., Moulmein.
C. Maries, Esq., Gwalior.	C. H. Swindon, Esq., Calcutta.
G. Péche, Esq., Moulmein.	J. Low, Esq., Caledonia.
H. Krams, Esq., (unknown).	A. C. Stallard, Esq., Pangkor.
S. P. Chatterjee, Esq., Calcutta.	A. W. O'Sullivan, Esq., Balik Pulau.
W. Boxall, Esq., London.	S. P. Chatterjee, Esq., Calcutta.
C. H. Swindon, Esq., Calcutta.	C. Maries, Esq., Gwalior.
H. C. Johnston, Esq., Singapore.	Major Walker, Taiping.

C. CURTIS,

Assistant Superintendent of Forests, Penang.

ANNUAL REPORT ON THE FORESTS OF MALACCA, FOR THE YEAR 1888.

1. The work of the early part of the year was carried out by Mr. FLANAGAN, but on my return from duty in Singapore, in the middle of April, Mr. FLANAGAN was transferred to the same Settlement.

Forest Reserves.

2. The work of the year has consisted chiefly of maintenance. In some districts, small nurseries are being established for raising seedlings of the best kinds of forest trees, for planting up waste lands within the reserves.

3. Much difficulty has occurred in keeping the forest watchmen from frequently absenting themselves from their stations; this is owing to their quarters not being large enough for them and their families.

Quarters similar to the Police barracks are what are required.

4. During the year, one Corporal of forest watchmen has died, and one has resigned.

5. It is satisfactory to note that no fires have occurred within the reserves during the year.

6. In Appendix A is a list of prosecutions for illicit wood-cutting detected by the forest watchmen.

7. The following general notes are made with reference to the forest reserves.

Bukit Brúang Reserve.

8. Six miles from Malacca, situated between the districts of Bátu Běřėndan and Dúrian Tunggal, has eight and-a-half miles of boundaries, and an area of 1,734 acres.

9. The hill-land rises to an elevation of 514 feet, and occupies a large area of the reserve; it is well wooded with young timber, the most abundant and notable being Tampínes (*Slætia sideroxylon*).

10. Conservation appears to be all that is required in this district.

Sungei Údang Reserve.

11. Thirteen miles from Malacca, situated between the districts of Sungei Údang, Sungei Báru and Pangkálán Bálak, has fifteen miles of boundaries, and an area of 4,800 acres.

12. The reserve is well wooded, and includes a fair percentage of first class timber on certain areas.

The most notable are:—

Kayu Mínyak (<i>Dipterocarpus lævis</i>),	...	... abundant.
Kěmpas (<i>Kumpassia malaccensis</i>),	...	... do.
Sěráya (<i>Hopea cernua</i>),	...	... do.
Měranti (<i>Hopea meranti</i>),	...	... do.
Maláka (<i>Phyllanthus emblica</i>),	...	... do.
Kělat (<i>Eugenia zeylanica</i>),	...	... do.
Kranji (<i>Dialum indicum</i>),	...	... fairly abundant.
Árang (<i>Diospyros sp.</i>),	...	... do.

13. All the old Jakun clearings within the reserve are fast becoming re-wooded by natural reproduction.

14. An abandoned estate adjoining the Pangkálán Bálak Road, and near the sea, requires to be assisted by some planting, and this will form part of the operations for 1889.

15. Some young plants of Mahogany raised from seeds received from Kew and planted in this district during the year, have nearly all succumbed to the ravages of ants.

Měrlémau Reserve.

16. Twenty miles from Malacca, situated between the districts of Měrlémau and Chinchin. Boundaries extend eight miles, area computed at 4,000 acres.

17. The northern boundary has been re-opened during the year, but, owing to the deep swamp, it is impossible to keep the boundaries in the direction of the Kěsang River in order.

Much good will be effected in this reserve when the Kěsang River has been cleared.

18. The western portion of the reserve is well wooded, and some first class timber skirts the Chinchin Road, which passes through the centre of the reserve.

The most remarkable are:—

Těmbúsu (<i>Fagræa peregrina</i>),	...	fairly abundant.
Pětáling (<i>Strombosia javanica</i>),	...	do.
Měranti (<i>Hopea meranti</i>),	...	abundant.
Kayu Mínyak (<i>Dipterocarpus lævis</i>),	...	do.
Gambar daun, ...	...	fairly abundant.
Rambei daun, ...	...	do.

Ayěr Pánas Reserve.

19. Fifteen miles from Malacca and situated between the districts of Durian Tunggal and Kěsang. Area 4,000 acres. The reserve is chiefly demarcated by the public roads.

20. Demarcation of the western boundary of the new reserve has been completed during the year.

21. The reserve is wooded chiefly with young forest, except the roadsides, where some first class timber exists.

The most notable are:—

Rěsak (<i>Vatica rassak</i>),	...	fairly abundant.
Sěpěté (<i>Parkia Roxburghii</i>),	...	do.
Jělútong (<i>Dyera costulata</i>),	...	do.
Gambar daun, ...	...	do.
Měranti (<i>Hopea meranti</i>),	...	abundant.
Káyu Mínyak (<i>Dipterocarpus lævis</i>),	...	do.
Kranji (<i>Dialium indicum</i>),	...	fairly abundant.

Bukit Panchur Reserve.

22. Sixteen miles from Malacca, situated between the districts of Machap, Durian Tunggal and Alor Gájah, has eleven miles of boundaries, and an area of 3,640 acres.

23. The hill-chain reaches an elevation of 889 feet, and, besides protecting the the sources of springs in the backbone of the Settlement, it is well wooded with young forest, and is in the centre of a largely cleared district.

24. An abandoned estate now included within the reserve will require some time before re-wooding itself by natural reproduction, and some artificial assistance may be necessary on so large an area.

25. The most notable trees are:—

Měřěbau (<i>Afzelia palembanica</i>),	...	rare.
Kělat (<i>Eugenia zeylanica</i>),	...	fairly abundant.
Pětáling (<i>Strombosia javanica</i>),	...	rare.
Kěmpas (<i>Kumpussia malaccensis</i>),	...	fairly abundant.
Měranti (<i>Hopea meranti</i>),	...	do.

Brísu Reserve.

26. Twenty-five miles from Malacca, and situated between the districts of Sungei Báru, Lúbok Chína, and Brísu. Has nine miles of boundaries, and an area of 2,247 acres.

27. The reserve is principally wooded with young forest.

The most important trees are :—

Sčráya (<i>Hopea cernua</i>),	...	...	fairly abundant.
Měranti (<i>Hopea meranti</i>),	...	...	do.
Kělat (<i>Eugenia zeylanica</i>),	...	...	do.
Káyu Mínyak (<i>Dipterocarpus lœvis</i>),	...	...	do.

28. The demarcation of inhabited lands, and an extension towards the frontier, will form part of the operations for the year 1889.

Jús District.

29. Nothing could be done in the large district of Jús, but demarcation has now commenced.

General Remarks.

30. It has been thought that the time has arrived when some revenue might be raised from the reserves, by supplying timber and general forest produce to the different villages.

31. With this object in view, the principal operations for the year will consist in preparing reliable maps showing all the topographical features, and the reserves marked into blocks.

32. The reserves will be marked into blocks by means of inspection paths, and each block will be dealt with separately. The timber will be classified, waste lands to be planted will be noted, brushwood requiring artificial assistance, either by planting, thinning or sowing seeds, will be marked, and all possible information collected and recorded.

It will then be left to decide what timber can be spared from the different blocks, and, with the necessary information to work on, the fellings can be properly controlled.

Bukit Sabúkur Experimental Garden.

33. The most important work of the year has consisted of maintenance, propagating and planting, and clearing and preparing ground for the reception of plants for experiment and nursery stock.

34. Seeds of forest trees, rotans, &c. have been sown from time to time for general planting.

35. Perhaps the most important work in this direction has been the preparation of seedling fruit trees for distribution. From applications received and notified, it is evident there is a large demand for the principal kinds of fruit, both in the Settlement and Native States, and several thousands will be prepared during the year 1889.

36. The nucleus of a collection of general economic plants has been introduced during the year.

37. The following notes are made on experiments now being carried on.

38. Mauritius hemp (*Fourcroya gigantea*) grows slowly but well, some fibre has been prepared from a few old plants, and has the appearance of good fibre.

39. If kept free from weeds, nothing further appears to be required to ensure success.

40. Virginian tobacco (*Nicotiana tabacum*, var.).—From seeds received from Kew, a fine lot of plants were raised ; but from seeds saved locally, the plants deteriorated so much that the cultivation has been discontinued.

41. Deli tobacco (*Nicotiana tabacum*, var.) has been tried, but this has also proved unsuccessful.

42. Castor oil (*Ricinus communis*).—Seeds were obtained from the Botanic Gardens at Calcutta. The plants have grown vigorously and are now commencing to fruit.

43. Croton oil (*Croton tiglium*) grows freely and fruits abundantly.
44. Annatto (*Bixa orellana*) grows vigorously, and is deserving of a trial on a large scale.
45. Black pepper (*Piper nigrum*) grows well in the Settlement, and might be more extensively cultivated to advantage.
46. Cubebs (*Piper cubeba*) promise well, and are being propagated as largely as possible.
47. Maltese oranges and lemons.—The lemons have grown well and are now flowering.
48. Mahogany (*Swietenia mahogani*).—Seeds were received from Kew in 1886. The plants have grown well, and many are now ten feet high. Unfortunately, few are free from the ravages of ants.
49. Two species of *Eucalypti* have grown with remarkable vigour, and it would be interesting to try these valuable trees on a larger scale.

50. From a sample of Liberian coffee observed to be growing well in the Settlement, and sent to the Kew authorities for report, the London Brokers to whom the sample was submitted, declared it to be the finest sample of Liberian coffee ever seen in the London market.

Roads and Drains.

51. The main drive through the Garden (from the Garden boundary to the Bātu Běřėndan Road) has been widened and maintained, and now admits of a drive through the extent of the Garden.

52. A road, 500 yards in length, has been opened to the Assistant Superintendent's quarters.

Formation.

53. In July, a supplementary vote of \$1,000 and in October a further vote of \$200 was sanctioned, for digging a lake, and levelling the adjoining grounds.

54. The excavations were continued to the end of the year, and 5,000 cubical yards of earth were removed.

55. A dam remains to be constructed, and a vote will be required for the work, which should be completed as early as possible, as an abundant water supply close at hand is absolutely necessary.

56. It may be mentioned that the rainfall for the first four months of the year, taking the average for that time from 1883-86, amounts only to 3.60 inches monthly. Much labour is now lost through fetching water from long distances.

Assistant Superintendent's Quarters.

57. Quarters for the Assistant Superintendent were completed at the end of August, and occupied on the first of September.

58. A statement of Expenditure is appended in Appendix B, and of Revenue collected in Appendix C.

R. DERRY,
Assistant Superintendent of Forests.

Malacca, 11th February, 1889.

APPENDIX A.
Prosecutions for illicit Wood-cutting.

District.	Prosecuted.	Result.
Brísu, ...	2 Malays, ...	Case dismissed.
Bukit Brúang, ...	1 Chinaman, ...	Fined \$25.
Měrlimau, ...	1 Malay, ...	Fined \$10.

APPENDIX B.
Expenditure of the year 1888.

	\$	c.	\$	c.
Government Vote, ...	4,000.00			
Supplementary Vote, ...	1,200.00			
<i>Expenditure.</i>			5,200.00	
Salaries of Forest Watchmen, ...	1,373.32			
Maintenance and Planting, ...	68.70			
Uniform for Forest Watchmen, ...	96.66			
<i>Bukit Sabukur Garden.</i>			1,538.68	
Salaries of Employés, ...	1,380.03			
Manure, ...	4.50			
Purchase of Tools and Implements, ...	186.88			
Do. of Plants and Seeds, ...	2.80			
Cartage, ...	131.59			
General Repairs, ...	40.00			
Miscellaneous Expenses, ...	91.20			
House Rent, ...	160.00			
Transport, ...	331.07			
Field Allowances, ...	105.00			
Personal Allowances, ...	49.20			
Digging Lake and Levelling, ...	1,174.07			
			3,656.34	
Total Expenditure,...			5,195.02	
Balance in Bank,...		\$	4.98	

APPENDIX C.
Revenue collected.

Sale of Fruit, ...	\$42.00
Do. Firewood, ...	4.00
Do. Vegetables, ...	5.89
	<u>\$51.89</u>

R. DERRY,
Assistant Superintendent of Forests.

Malacca, 11th February, 1889.

GOVERNMENT NOTIFICATION—No. 164.

The following report on the Dindings by the Assistant Superintendent of Forests at Penang, is published for general information.

By His Excellency's Command,

A. M. SKINNER,
Acting Colonial Secretary.

COLONIAL SECRETARY'S OFFICE,
Singapore, 8th March, 1888.

Penang, 31st January, 1888.

SIR,—I have the honour to report, for the information of His Excellency the Governor, that, in accordance with instructions, I proceeded to the Dindings on January 19th, taking with me a case of economic plants in pots, the weather being too dry at the time for lifting plants from the open ground.

2. During six days I travelled over as much of the district as was possible without the aid of a steam-launch, which was unfortunately in dock, and examined the state of agriculture and nature of the soil.

3. With the exception of Lumot Estate, on which tapioca and sugar are grown, the principal cultivated products appear to be cocoa-nuts and patchouly, both of which give a good return. The tapioca crop is looking well, and the machinery for manufacturing flour will be erected shortly.

4. Pepper is being tried on a small scale in three or four different parts of the district, and grows well, especially near the District Officer's house at Pangkor, but the proper method of cultivation is not understood by the owners. The plants have been allowed to grow up to the tops of the supports, instead of being layered as is done by the Achenese planters in Province Wellesley. I explained to them practically, by treating plants in their presence, that when a pepper plant begins to branch it should be taken down from its support, the lower leaves removed, and the stem, up to the junction of the branches, layered down in a previously prepared hole as near the support as is consistent with the safety of its roots, and the soil then replaced. Treated in this manner roots are emitted along the whole length of the stem that has been buried, the plant is better able to withstand drought, and fruit is produced from near the ground up to any height that may be desired.

5. At Rajah Itam, which was reached by walking for five or six miles along the boundary line that divides the Dindings from Pêrak, I saw near a native house a plant of China grass (Rhea or Ramie) which has attracted considerable attention of late on account of its valuable fibre. The owner of the garden stated that he was in the habit of cutting it down for the manufacture of fishing lines about once a month. At the time I saw it the shoots were four to five feet high, and as clean as could be desired. The soil at this place is a peculiar clayey loam of a light colour.

6. There are a variety of soils in the district, some of which would produce cloves, nutmegs, pepper, Liberian coffee, chocolate, indigo, cocoa-nuts, paddy, &c.

7. In order to encourage the cultivation of economic products other than those mentioned in para. 3, which are already established, especially pepper, coffee, cloves and nutmegs, I would suggest the formation of a small nursery in Pangkor, of about an acre in extent, where plants could be raised or planted temporarily on their arrival from Penang or Singapore, previous to distribution to intelligent natives willing to give them a fair trial.

8. After careful examination, in company with the District Officer, we came to the conclusion that the most suitable place for this purpose would be a piece of land near the Recreation Ground, which combines the advantages of fairly good land with an abundant water supply, and is sufficiently near the District Officer's quarters to allow of his personal supervision.

9. This land would have to be cleared and fenced to keep out wild animals and, a small house put up to accommodate two gardeners, who would be sufficient to carry on the work when it is fairly started.

10. The cost of clearing, fencing and stocking this nursery, including young plants of cloves, nutmegs and pepper to be purchased this year, need not exceed \$500, and the after upkeep would be the salaries of two Javanese at about \$18 per mensem.

I discussed the matter thoroughly with Mr. MEREWETHER, who takes an intense interest in the matter, and one of the first things done would be to raise a quantity of *dadap* and pepper plants for distribution, a supply of seeds of the former being available on the spot.

11. There is regular communication between Penang and Pangkor, and seeds are easily transmitted, and an officer of this Department could occasionally run down for a day or two to give practical instruction.

At present there is no accommodation for visitors to the district, which doubtless prevents many persons, who would otherwise do so, from spending a day or two on the Island, and judging for themselves of the capability of the soil, &c. I understand, however, from the District Officer, that it is intended to erect a Rest House on the beach, which will be a great convenience.

12. It should be borne in mind that, while there is great need for developing the agricultural capabilities of the Dindings, the Government possess in the existing forests a most valuable crop, which in some parts of the district, considering the nature of the soil, quality of the timber and the facility with which it can be brought to market, is, if carefully conserved and economically worked, probably of greater value than anything that can be planted, besides the advantages of having a fair proportion of forest land as regards its bearing on climatic changes.

13. These areas should be settled in good time, and their extent and position shown in the map when the contemplated survey of the district is undertaken.

I have, &c.,

C. CURTIS,
Assistant Superintendent of Forests.

GOVERNMENT NOTIFICATION—No. 344.

THE following letter from the Director of Gardens and Forests is published for general information.

By His Excellency's Command,

A. M. SKINNER,
Acting Colonial Secretary.

COLONIAL SECRETARY'S OFFICE,
Singapore, 6th June, 1889.

BOTANIC GARDENS,
Singapore, May 28th, 1889.

SIR,—I have the honour to report that I have received a letter from the firm of THOS. CHRISTY & Co., calling attention to the value of certain drugs found or procurable here which are not at present exported hence as they might be. Its terms are:—

“You speak of the reputed value of drugs. I would advise you to make the following standard: Anything that is a *deadly poison* is sure to be of great value, and “if you descend from this standpoint you may get other things which are also valuable.

“At the present time we are getting over the *Antiaris* milk (Ipoh); this is the “most deadly poison we know of.

“*Euphorbia pilulifera*.”—(This is a common garden weed here, known as Kroma Susu.) “This drug has been selling here at 3/6 a lb. We introduced it originally from “Australia, but we have been drawing it largely from India. I want plants when they “are about 14 inches high with fully grown leaves just coming into bud, full of sap. It “wants pulling, the earth knocking off the roots, and then drying in the shade. When “quite dry, it wants to be packed in bales, and if it is quite safe on account of being “dry, and the weather is fairly dry, it may be hydraulic-pressed to save freight. We “shall be glad to receive this in 1 or 2 cwt. at a time at the proper season.

“Papaya yields a milk in the fruit and stem. We have people who collect this “by placing it on glass to dry. It is scraped off the glass when dry, put into bottles, “and sent home, where it fetches from 8s. to 10s. per pound.”

• The subject of native drugs has not here received the attention it merits, and many, I feel sure, might be exported hence at a profit, and form good minor products.

I have, &c.,

HENRY N. RIDLEY,
Director of Gardens and Forests, S. S.

To the Hon'ble
The Colonial Secretary, S. S.

ANNUAL REPORT ON THE BOTANIC GARDENS AND FOREST DEPARTMENT, FOR THE YEAR 1889.

General Introduction.

1. In accordance with a suggestion made last year, the Reports of the three Settlements of Malacca, Penang and Singapore have been this year amalgamated into one continuous report, instead of being published separately. This report is, perhaps, longer than usual on account of its containing more specific summaries of the contents of the forests and of their conditions at present. It is important now to look carefully into the state of the probable future supply of timber, and to see what can be done to replace that which has disappeared or soon will disappear. Wood is now being brought from long distances, and is even getting scarce there. The better class of timber, such as Billion Wangi, Tampines and Ballau, are fetching very large prices, when indeed they can be procured. The consumption of wood is very large, and must increase, as it plays so important a part in agriculture and commerce, and in every way in which the resources of the Colony are to be developed. It is high time to commence re-planting on a large scale, and none of the Settlements is so suited for this as Malacca. The reasons for this are shewn in the section of the Report dealing with that Settlement. Timber is a slow-growing crop; generally speaking the slower it grows the more hard and valuable is the wood. No time is to be lost, therefore, in re-planting, if we are to have an adequate supply of timber in the near future. For smaller timber, such as poles, posts, rollers, &c., there is still a fair supply, but it is rapidly diminishing, and its increased cost is beginning to tell upon the cultivation of pepper and gambier already. For firewood, in Singapore, we must fall back on the mangrove swamps, of which, fortunately, a large portion have been conserved as forests. In Malacca, besides the mangrove, which is far less common, some of the swamp lands produce plenty of Glam, and more is being planted, as it will grow in lands so wet that nothing else will grow there. In Penang, there is no mangrove nor glam swamp, but there is great plenty of forest there from which the needs of the place can easily be supplied.

THE BOTANIC GARDENS, SINGAPORE.

Introduction.

2. During the past year, attempts have been made rather to get the Gardens into a better and cleaner condition than to attempt any large new work, and it now is easier to determine what large works the Gardens will, in future, require. There are several important works which the present staff of coolies and the present grant are insufficient for. A considerable portion of land lying behind the Director's house and in the angle between the new road and Cluny Road is at present waste. The soil is good, and there is a quantity of water in the swamp in the angle. This spot could be made very beautiful and interesting, if taken in hand. There is sufficient water for a lake or small pond here, and a carriage road could easily be made from the upper part of the Gardens through this portion of the ground into the Cluny Road, forming an additional drive in this direction.

It will also be very advantageous to have the Gardens properly fenced in. At present, in many places, there is no partition even to show where the Gardens end, and there is thus no means of keeping out trespassers, or really closing the Gardens at night.

The water supply is another point which requires careful consideration. During dry years in the past, the watering of the Gardens has been most laborious, and some arrangement is wanted by which water can be laid on to all parts of the Gardens.

Further development of the Experimental Garden is urgently required. This is still retained under the Forest Department, but would certainly be better transferred to the Gardens Department, as it has no longer any real connection with the forests.

The present staff, all that can be afforded from the Forest vote, is insufficient to do more than keep the part under cultivation in order. There is a large piece of land which is still waste, which should be put under cultivation, and the whole requires to be fenced in.

As the Straits Settlements produce a great variety of vegetable products in use in commerce, there should be erected a small building of the nature of a Museum, where these could be collected and examined. The room attached to the office which now contains the herbarium barely suffices to hold the collection of dry plants and the garden library. There is no room for specimens of timber, gums, dammars, rattans, guttas, drugs, &c., nor any place to dry and preserve them, still less to examine and analyze them.

For these important works, the annual grant is not sufficient to cover without detriment to the working of the Gardens. It is hoped that extra grants may be provided from time to time to carry out these works.

Visitors.

3. The number of visitors to the Gardens during the day-time was fully equal to that of previous years, but as the Regimental Band did not play during moonlit nights, there were but few evening visitors, and again on Sunday evenings the counter-attraction of the Band which played on the Barrack ground drew away most of those who would otherwise have visited the Gardens. The increase in the zoological collection has proved very attractive.

Plant-houses.

4. During the year, a new orchid-house has been built adjoining the large plant-house. It is a building measuring fifty-four feet in length and forty-five feet wide, and contains four parallel walks with staging on either side. The stages are composed of wooden battens supported upon iron tram-rails which are fixed into masonry pillars so that no part of the wood-work is in contact with the ground, which will prevent risk of injury from white ants, and the paths between are floored with cement, so as to be always dry. The roof, which is of ridge and furrow shape, is sixteen feet high composed of strong wooden laths about one inch apart, over these are roller blinds made of stout canvas varnished, which are easily pulled up and down with ropes and pulleys. During heavy rain and excessive sunshine these are lowered, and being waterproof, prevent any injury to the plants by drip, while at the same time the amount of sunlight can be regulated.

The house is surrounded with an iron railing, and within this is a border of *Vanda hookeræ* and *Arundina chinensis*. In the grass plot outside are several small beds containing large specimens of orchids, such as *Grammatophyllum*.

This house has proved very successful, the plants improving very speedily on being transferred thither, and many curious and beautiful species have been in flower throughout the year. Among those more rarely seen in flower in Singapore the following species have been in bloom:—

Cattleya Triana, *C. speciosissima*, *Dendrobium treacherianum*, *D. metachilinum*, *D. kunstleri*, *D. flavidulum*, *Bulbophyllum macranthum*, *B. pileatum*, *Sarcochilus arachnites* and *lilacinus*, *Eria hyacinthoides*, *acervata*, *musæfolia*, *floribunda*, *pannea*, *Lissochilus speciosus*, *Neuwiedia lindleyi*, *Apostasia nuda*, *Bromheadia aporoides* and two undescribed species, *Calanthe curculigoides*, and *Ceciliæ*, *Cypripedium callosum*, *purpuratum*, *niveum*, *Godefroyæ*, *concolor*, *ciliolare*, *venustum*, *Hookeræ*.

The whole collection of orchids has been very largely increased, by the addition of not only of large numbers of local species, but also of a small number of African and South American species, many of which are doing remarkably well. Among the native species obtained this year, are a number new to science, many of which are well worthy of cultivation. They include several species of *Bulbophyllum*, *Cirrhopetalum*, *Cælogyne*, *Bromheadia*, *Sarcochilus*, *Microstylis cuprea*, *Vrydagzynea tristriata*, from Singapore; and two new species of *Calanthe* of the *Vestita* section, a fine *Habenaria* with large white flowers and ornamental foliage, and a *Pachystoma*, from Langkawi Islands. The collection of foliage orchids has been largely increased also, but these still remain very impatient of cultivation.

The chief difficulty of flowering many species of orchids here consists in the almost permanent dampness of the climate, which does not suit orchids coming from places where at one season they enjoy a period of rest. This permanent rainfall causes the plants to continue growing instead of flowering, and in some cases there is a great tendency to develope leaves and leafbuds upon the raceme instead of flowers. It is especially unfortunate that the dry period of the Burmese region, when the *Dendrobia* usually flower, coincides with our wettest season, so that the culture

of these plants is remarkably difficult. In order to keep the orchid-house as full of flowering plants as possible, other houses and sheds have been built in the Gardens, in which the young plants can be cultivated, and more will soon be put up. Some of the old sheds and stagings have been destroyed, as the planks and posts were quite rotten, and are being reconstructed. The demand for orchids still increases, and it is necessary to have a large number, both for supply to correspondents and also to keep a good show in the house. At present there are upwards of 5,000 orchid plants, exclusive of those planted out on trees or in beds in the Gardens.

5. The large plant-house has been kept well filled, and on the removal of the orchids to the new house the empty tables were filled with pot plants of various kinds, such as annuals, *Bromeliads*, *Sonerilas*, *Ardisias*, *Didymocarpi*, *Acanthaceæ*, &c. A number of succulents, such as *Cacti*, *Agaves*, *Stapelias*, *Hæmanthi*, were obtained from Natal and from the Hongkong Gardens, and have thrived very well. The Gardens were previously very deficient in this class of plants. A plant of *Brugmansia Lowii*, with one open flower and a bud, was sent alive from Borneo by Mr. EVERETT, and was on view for some time. This very rare and extraordinary plant has probably not hitherto been seen alive in any Botanic Gardens. Further attempts will be made to introduce this and others of the order *Rafflesiaceæ* into the Gardens.

I regret to have to state that white ants have attacked and burrowed up the centre of some of the supporting pillars of the house. Attempts are being made to destroy them, and prevent a renewal of their attack. A large number of the plants in this house require already to be re-tubbed. There is great difficulty in getting here any wood suitable for making tubs, other than Seriah, which resists but little the attack of damp and white ants, and very soon decays. An attempt is being made to get larger earthenware pots made capable of containing shrubs in place of tubs.

Buildings.

6. The most important building besides the orchid-house erected this year is a carpenter's shed, which was much needed. It occupies the same ground as the old one, and consists of a shed sixty-five feet long and twenty-three broad with cement floor and pillars formed of tram rails, bent so as to support a tiled roof. At one end is a store-room, in which tools, &c. can be kept under lock and key.

It having been decided that the house occupied by the Forest Overseer was unhealthy, and not worth repairing, it has been destroyed, and the timber utilised for various purposes in the Gardens. The ground thus cleared will be covered with plant sheds and frames.

Beds and Shrubberies.

7. The beds have been replenished, from time to time, and kept as bright as possible, but it will probably always be difficult here to procure plants suitable for making good flower-beds, on account of the heavy rainfall, which injures the flowers so much. The only new beds which have been made are some small additional ones in the Amaryllid beds, to make the design there more symmetrical, and a V shaped bed in a bare-looking spot near the large Meranti tree.

In the Shrubberies, a winding path has been opened through the bushes on the left of the long border looking west, and here a number of shrubs and trees have been planted, both native and foreign.

A walk has been made from the steps near the Amaryllid beds through what was a tangled overgrown bit of jungle, into the fernery. The entrance is through an arch of iron hoops covered with creepers, which are growing well. The sides of the walk are planted with a collection of Aroids, both terrestrial and scandent, and illustrate the various forms in that order. All have grown remarkably well. The jungle there has been cleared, and suitable plants, such as *Ixoras*, *Rattans*, *Clusias* and *Pandani* planted in it. The walk passes through a depression formerly full of rubbish, which has been cleared away, and the whole planted up with *Maidenhair*, *Alsophilas* and other ferns, and *Selaginellas*. Upwards of a hundred tree ferns have been planted about, so as eventually to make a grove of these plants.

A large portion of the creeper *Thunbergia laurifolia* climbing over the trees near the band-stand fell down, owing to the destruction of the supporting tree-stem upon which it grew, by white ants. With much difficulty it was raised again upon an adjoining tree, and though it looked shabby for a time, is now covered again with leaves and young shoots.

A number of the trees in various parts of the Gardens have been cleaned of dead and unnecessary branches and parasitic and epiphytic plants. This work had hitherto been somewhat neglected, and was very much required. Still some remains to be done. At the upper end of the lake, a rockery of succulents and rock

plants has been formed upon what was an unsightly bank. Aloes, Agaves, Sansevierias, Cacti, Bromeliads, ornamental Pandani grow very well here, and some plants which for some time had maintained a somewhat miserable existence in pots, here have grown so rapidly as to require to be well cut back.

In the upper edges of the lake, Nipa palms, *Cassia alata* and Pandani have been planted, which will have a fine effect when more developed. On the west side, a bare dry bank was planted with Nepenthes, ferns, and Lycopodiums; some of the ferns and Lycopods perished, but the Nepenthes is doing very well.

A cutting of the *Victoria regia*, was transferred to the big lake and planted in a small bay beneath the large fig trees. It is now as large as the parent and is constantly in flower.

Palms.

8. The coco-nut beetles did much damage to the palms near the garden office, in spite of the most strenuous efforts to combat their attacks. It was found that the tank which had been used for a receptacle for garden rubbish to be converted into manure, was full of the grubs of the black beetle. It was, therefore, emptied, the grubs destroyed, the manure used in the various beds and the sticks, &c. which could not be thus used burnt. This caused a great diminution of the plague, and although the vermin are not quite exterminated from the Gardens, I hope that very soon they will be extinct.

The dead palms have been replaced by new ones. The Palmetum near Garden Road has never been attacked, but besides the palms by the office those near the band-stand have been much injured.

The plan of keeping piles of cut-grass, leaves and sticks in various spots in the Gardens has proved so objectionable, that a spot has been prepared in an old gravel pit in the garden jungle where this rubbish is burnt, and the ashes used for fertilizing the ground. A large pile by the old night soil pit near the lake has thus been destroyed, and the night soil tank removed to the garden jungle.

A number of trees were planted out in various spots in the lawns which looked bare, and several places where the grass had got thin were re-turfed.

Cut-flowers.

9. A portion of the waste grounds behind the Director's house was cleared and planted with Gardenia, Eucharis, &c., to serve as a supply of cut-flowers, for which there is always a great demand. Indeed so much is this the case that sometimes the garden seems to be almost denuded of flowers. This will have to be prevented as much as possible by growing plants on purpose for cutting.

The whole system of the supply of cut-flowers has been carefully looked into, and a tariff of charges has been drawn up and advertised, and to obviate the difficulty sometimes incurred in collecting small sums for bouquets, &c., the system of cash payments has been introduced.

Flower Show.

10. The exhibition of flowers, fruits and vegetables was held on April 12th and 13th. As the weather was fine and bright, there was on the whole a good attendance, especially in the evening of the second day when the Band of the Regiment performed. In spite, however, of the fact that there was a larger sale of tickets than at the previous show (in 1888), the expenditure incurred was larger than the receipts from visitors and the usual \$250 contributed by the Gardens Committee, there being a deficit of \$88.11. This was due to increase in expenditure in prizes, advertising and covering and lighting the orchid-house, then used as a refreshment room. There was a marked falling off in the three 'great classes of ferns, Begonias and Crotons; and indeed the cultivation by Europeans seems to have retrograded on the whole. Perhaps this is due in part to there being no show last year, and to the uncertainty as to whether the shows were ever to be held again, which deterred many from cultivation.

Garden Offences.

11. There were only two prosecutions for garden offences during the year—one, a Malay for stealing flowers in the Gardens (imprisonment for ten days), the other two Chinamen for cutting wood in the garden jungle (fined \$15 a-piece).

Still I regret to say that this does not at all represent the number of offences committed, a great deal of pilfering of flowers continues, especially at or about native

festivals, and on mail days. Several times also small trees have been cut down in the garden jungle which abuts upon the main road; and a swan was stolen from the lake on the night of December 7th. I cannot say that the Garden Police were at all satisfactory, nor did they render any amount of service in guarding from depredations. For these reasons, I have proposed to re-place them by Malays acting as Forest Watchmen, which I have reason to believe will be much more satisfactory.

Plants Received.

12. The following were the contributors to the Gardens of plants by presentation or exchange:—

		Plants.	Seeds.	
Royal Gardens, Kew,	...	76	6 packets.	
Botanic Gardens, Calcutta,	...	0	13	do.
Do., Ceylon,	...	28	4	do.
Do., Jamaica,	...	50	2	do.
Do., Trinidad,	...	0	13	do.
Do., British Guiana,	...	0	4	do.
Do., Natal,	...	140	0	do.
Do., Mauritius,	...	0	1	do.
Do., Adelaide,	...	0	66	do.
Do., Manila,	...	628	0	do.
Do., Hongkong,	...	64	4	do.
Do., Saigon,	...	21	0	do.
Do., Saharunpore,	...	0	52	do.
Do., Buitenzorg,	...	80	0	do.
Do., Port Darwin,	...	0	15	do.
Agri-horticultural Society, Calcutta,	...	0	1	do.
Messrs. Veitch,	...	33	0	do.
" Bull,	...	66	0	do.
" Hocking, Brisbane,	...	22	10	do.
" Reasoner, Florida,	...	6	15	do.
" Gordon,	...	318	0	do.
Gustav Mann, Esq., Assam,	...	17	0	do.
G. Peche, Esq., Moulmein,	...	61	0	do.
His Excellency the Governor,	...	2	1	do.
Lady Clementi Smith,	...	0	1	do.
G. S. Dare, Esq.,	...	18	0	do.
D. G. Presgrave, Esq.,	...	1	0	do.
J. Gibson, Esq.,	...	20	0	do.
W. Nanson, Esq.,	...	10	0	do.
E. T. Brewster, Esq., Perak,—a large series of Vanda Hookeræ and other Orchids from Perak.				
The Right Rev. Bishop Hose,	...	2	0	do.
C. Robelen, Esq.,	...	104	0	do.
F. G. Davidson, Esq.,	...	1	0	do.
A. Curnow, Esq.,	...	3	0	do.
H. C. Johnston, Esq.,	...	27	0	do.
A. H. Everett, Esq.,	...	100	1	do.
W. Boxall, Esq.,	...	48	0	do.
A. Hale, Esq.,	...	1	1	do.
L. Wray, Esq., Perak,	...	70	0	do.
J. Booth, Esq.,	...	7	1	do.
— Leach, Esq.,	...	35	0	do.
Total,	...	2,052	211	do.

Besides these, a very large number of native plants were brought in from the jungles of Singapore, the Native States, Penang and Malacca. Three hundred and fifty bulbs were purchased from BARR & SONS, 50 plants from CHATTERJEE in Calcutta, 140 packets of seeds from CANNELL & SONS, 600 orchids from Mr. DURNFORD, and 1,600 from TAN BENG SENG, and a few minor purchases were also made. The total being a little over five thousand plants and four hundred and fifty-nine packets of seeds received by purchase, exchange or presentation.

Plants Sent out.

13. The number of plants sent out during the year was 1,891, and 970 packets of seeds.

The chief recipients were the Botanic Gardens of:—Kew, Ceylon, Calcutta, Hongkong, Natal, Buitenzorg, Manila, Brisbane, Mauritius, St. Petersburg, Glasgow, British Guiana, Trinidad, Jamaica, Saigon; the Sultan of Johor, Mrs. TREACHER (Perak); Bishop HOSE (Sarawak); and Messrs. RODGER (Pahang), VENNING (Selangor), LAURIE (Ceylon), HOCKINGS (Brisbane), REASONER (Florida), BULL, VEITCH, WILLIAMS, GORDON (London), and others. Besides which a number were sent to the Gardens of Penang and Malacca.

Aviary.

14. The collection of birds and animals has been much increased by various specimens presented by the several donors mentioned below. Some of the animals were sent by Mr. COPLEY from Malacca, originally for the Museum, but being either in too poor a condition to stuff, or not needed, there were sent to the Gardens. Much annoyance was caused by the rats, which destroyed a number of birds, chiefly pigeons; eventually, however, the aviaries were overhauled and a large number killed, and since then the destruction has been less. Some of the animals sent in some time after being trapped succumbed to injuries then received; others have done very well. They have proved an unfailing source of attraction to the Gardens. It is intended to confine the zoological collection to natives of the Peninsula, and it is hoped to have eventually a fairly good collection of the smaller animals and birds illustrative of the fauna.

Among the more interesting ones recently received, are the Wild Dog of Malacca, an undescribed species; a Mias, on loan; a couple of Binturongs; and the rare Wood Partridge (*Rhizotheres longirostris*).

I regret to say that on the night of December 7th, the only White Swan on the lake was stolen.

The aviary sheds will require much reconstruction this year, and it will be well to have them made of a stronger character in future.

15.

Animals Received.

One Mias (*Simia satyrus*) on loan from Mr. NORMAN.
 Three Golden Monkeys (*Macacus sinicus*) presented by Miss CAVE.
 Two Water Monkeys (*M. cynomolgus*) " "
 One Coco-nut Monkey (*M. nemestrinus*) " "
 One Galago (*Galeopithecus volans*) purchased.
 One Loris (*Loris tardigrada*) purchased.
 Four Javanese Wild Cats (*Felis javensis*) purchased.
 One Fishing Cat (*F. viverrina*) presented by the Hon'ble D. A. HERVEY.
 One Wild Dog (*Canis sp.*) purchased.
 Two Tangalungas (*Viverra zibethina*) purchased.
 Two Musangs (*Viverra malaccensis*) purchased.
 One Mongoose (*Herpestes griseus*) presented by Mr. F. BALFOUR LEES.
 One Binturong (*Arctictis binturong*) presented by Mr. J. P. RODGER.
 One Binturong (*Do.*) purchased.
 One Bamboo Rat (*Rhizomys pruinosus*) presented by Mr. G. LAVINO.
 Four Indian Squirrels (*Sciurus tristriatus*) presented by Mr. E. C. HILL.

Birds.

One Fishing Owl (*Ketupia javanensis*) purchased.
 One Little Owl (*Scops lempigi*) presented by Mr. W. DAVISON.
 Four Hornbills (*Craniorrhinus corrugatus*) presented by Mr. W. DAVISON.
 One Rufous-tailed Pheasant (*Euplocamus erythrophthalmos*) presented by Mr. HENDERSON.
 Two Rufous-tailed Pheasants, female, purchased.
 One Fire-backed Pheasant (*E. vieillotii*) presented by Mr. HENDERSON.
 Four Wood Partridges (*Rhizotheres longirostris*) purchased.
 One Purple Water Hen (*Porphyrio edwardsii*) " "
 One Green Parrot (*Lorius sp.*) " "
 One Red Parrot (*Lorius sp.*) " "
 One Lory (*Lorius sp.*) presented by Miss STANTON.
 Two Roul-rouls (*Rollulus roul-roul*) purchased.
 Twelve Green Pigeons (*Chalcophaps indica*) " "
 Six Mangrove Pigeons (*Osmatreron vernans*) " "

One Pied-fruit Pigeon (*Carpophaga bicolor*) presented by Capt. WOORTMAN.
 One Green Fruit Pigeon (*C. aenea*) " "
 Two Brown Pigeons (*Macropygia assimilis*) " "
 Two Nicobar Pigeons (*Caloenas nicobarica*) presented by Mr. W. NANSON.
 Six Mynahs (*Eulabes javensis*) purchased.
 Two Brown Boobies (*Sula fiber*) presented by Capt. MADGE.
 Three Bali Ducks (*Anas boschas*) presented by Mr. F. BALFOUR LEES.

Herbarium.

16. A considerable advance has been made in the herbarium during the past year. In the end of February, a Curator by name DE WITT was engaged to take charge of it, but proved unsatisfactory, and left after a few months, and TASSIM DAUD was employed, who still remains. He has been constantly at work, drying and mounting specimens, and accompanied me to Selangor in July, and along the East Coast in August, to collect plants.

Hitherto the plants have been roughly stuck to thin sheets of paper, and no covers had been used to keep genera and species separate. I have obtained from England paper of the quality of that used in the British Museum, and thin white double sheets, to contain the separate species, and thicker brown double sheets to separate the genera. The whole herbarium has been re-arranged and cleaned, the arrangement adopted being that of the Flora of British India. The vermin which were very abundant have been destroyed, and camphor and naphthaline placed among the specimens. The duplicates have been taken out, and many sent to various institutions.

It will be well now to give a summary of the herbarium as it now stands, beginning with the earliest portion of it.* Mr. J. COLLINS apparently did not collect any specimens in Singapore, but when in London selected from WARD'S herbarium, then in the possession of the Linnean Society, a number of specimens he thought likely to prove useful. Among the more valuable of these are plants obtained at Penang, Malacca and Singapore, by WALLICH and his collectors, and GRIFFITH; in various parts of India by the same collectors, WIGHT, CAMPBELL and the Moravian Missionaries (in the eighteenth century). Besides these, there are plants from almost all regions of the world, collected by ROXBURGH, CUNNINGHAM, HOOKER, SCHIMPER and many others. These specimens have been much neglected, and have much injured also by careless poisoning. All from the East Indies have been cleaned, repaired and remounted and put into the cabinets. Mr. MURTON appears to have made good collections here and in Perak, but I can only find a very few specimens now. Mr. CANTLEY made and caused to be made very extensive collections in Perak, Singapore, Selangor and Malacca, but it is much to be regretted that very many of the specimens were inadequately labelled, the State merely being recorded, and that incorrectly in many instances. Thus South American plants evidently cultivated in the Botanic Gardens are labelled Singapore. Many plants described from his specimens in the Flora of British India I have been quite unable to find, as there is nothing to show which were the plants sent to Kew. A considerable number of plants also have no labels whatever, so as to be quite valueless.

In a herbarium of a country like this, it is essential to have specimens properly labelled from every district. I am, therefore, attempting to get specimens of every plant from each of the States, and the similarity of the flora induces me to add those of Sumatra, Borneo and the adjacent islands. During the past year many additions have been made to the Herbarium, of which none is more valuable than that of the whole of his fine local herbarium presented by Mr. HULLETT. It contains a large series of good specimens from Singapore, Mount Ophir and Borneo, many of which are types of recently described species.

Dr. KING has sent a large series of plants chiefly collected by Mr. WRAY at Perak; Mr. CURTIS has sent many plants obtained in Penang, Langkawi and Kedah. Mr. DERRY, some from Malacca. In July I visited Malacca, Selangor and Penang, and obtained a very large number of specimens, especially from Selangor. A large series of plants have been collected in Singapore, both by myself and by the Forest Watchmen and Overseer, during forest work. Still many remain to be collected, even in the island. In August, I accompanied His Excellency in a visit in the *Sea Belle* to the East Coast of the peninsula which has never before been visited by any botanist. The vessel touched at Pulau Tioman, Pekan, Cherating River, Rumpin, Tringganu and Kelantan. At every opportunity plants were collected, and the results showed what a field for research still lies on the eastern side of the peninsula, for many plants not hitherto recorded as occurring in this region, and not a few species unknown to science, were here obtained. Many living plants also were collected, and are now in the Gardens.

* The number of specimens now arranged in the cabinets is, roughly speaking, 15,000.

Dr. HAVILAND presented the herbarium also with a collection of 200 plants from Borneo; Mr. HERVEY some from Perak; and Mr. DURNFORD from Kwantan; and the British Museum sent 150 specimens collected by CUMING in Malacca and the Philippines, by LOBB in India and Malacca, and by HORSFIELD in Java, in exchange for a similar number of plants from Singapore. A small number of plants have also been sent to Dr. KING, to Professor ENGLER, in exchange for his collection of Araceæ, and to Kew. Professor HACKEL of St. Polten, has kindly named specimens of grasses, and Mr. C. B. CLARKE and Sir JOSEPH HOOKER have also identified Cyperaceæ and orchids.

Taking the herbarium as a whole, the following States are well represented:—Singapore, Penang, Malacca. From Selangor and Sungei Ujong and Perak, we have a comparatively small number. Johor, Kedah, Pahang, Kelantan and Tringganu are almost blanks. From Sumatra, we have no specimens at all, and from Borneo but few. It is hoped that, with the opening up of the peninsula, specimens may be sent even from the interior.

A few specimens of timbers, fruits, &c. have been collected, but at present there is no place even to prepare specimens of the economic products of the peninsula, which would not only be interesting, but of great importance in a country so rich in vegetable products. It is highly important that a collection of timber, rattans, guttas and dammars, should be formed, in order to investigate their properties and values. The herbarium room contains but little more than the cabinets and a place for the Curator to work. A larger building for other economic products is much required.

Library.

17. The following books have been added to the Library during the last year:—
PIERRE.—“Flore Forestière de Cochin Chine,” presented by the French Government.

BROWNE, F. R.—“Forest Flora of Australia,” Parts 1-3, presented by the Government of Melbourne.

MÜELLER, F. R.—“Systematic Census of Australian Plants,” Part 1 and 1st, 2nd and 3rd Annual Supplements presented by the Melbourne Government.

“Iconography of Australian Species of Acacias,” Decades 1-13.

“Eucalyptographia,” Decades 1-10.

“Index Perfectus ad Caroli Linnœi Species Plantarum.”

WALLICH.—“Plantæ Asiaticæ Rariores,” purchased.

RUMPH.—“Herbarium Amboinense,” purchased.

BEDDOME.—“Ferns of Southern India” and Supplement, purchased.

Dr. KING.—“The Genus Ficus,” purchased.

VEITCH.—“Manual of Orchids” Vol. IV, “Cypripedium,” purchased.

HACKEL.—“Monograph of Andropogoneæ,” purchased.

KURZ, S.—“Forest Flora of British Burmah,” purchased.

KURZ, S.—“Korte Schets van het Eiland Banka,” purchased.

KURZ, S.—“Vegetation of Andaman Isles,” presented by Dr. KING.

HOOKER.—“Species Filicum,” 5 vols., purchased.

HOOKER.—“Illustrations of Floras of Malaya and Africa,” purchased.

———“On Nepenthes” purchased.

HOOKER.—“Icones Plantarum,” for 1889, presented by Benthian Trustees.

BECCARI.—“Malesia,” vols. 1-3, purchased and “Nuove Specie di Palme Alla New Guinea,” presented by the Author.

PRESTON, G.—“Working of Fibre Industry in Yucatan,” presented by the Author.

SCHLICH, W.—“Manual of Forestry,” presented by the Indian Government.

FAWCETT, W.—“Species of Balanophora and Thonningia,” presented by the Author.

HASSKARL.—“Plantæ Javanicæ Rariores,” purchased.

HASSKARL.—“Observationes Botanicae,” purchased.

HASSKARL.—“Catalogus Plantarum in Hort Bogor,” purchased.

TREUB, Dr.—“Annales Botanicae Gardens, Buitenzorg,” presented by Dr. TREUB.

OLIVER.—“Three New Genera of Malayan Plants,” purchased.

JUNGHUHN.—“Plantæ Junghuhnianæ,” purchased.

VETH.—“Midden Sumatra,” purchased.

JACK, W.—“Account of Lansium domesticum,” purchased.

JACK, W.—“Malayan Species of Melastoma,” purchased.

BLUME.—“Enumeratio Plantarum Javæ,” purchased.

BLUME.—“Overeenige Oost Indische Houtsoorten,” purchased.

BLUME.—“Oost Indische Melastomaceæ,” purchased.

TEYSMANN.—“Botanische reise, over Timor; over Celebes; naar de Molukken; Banka, Riów and Lienggi; West Kuste von Borneo: Billiton, Carimata and Landak.”

TEYSMANN and BINNENDIJK.—“Plantæ in Hort. Bogor. Cult.,” purchased.

TEYSMANN and BINNENDIJK.—“Echte Ijzerhout,” (Eusideroxylon Zwageri), purchased.

SCHEFFER.—“Observationes Phytographicae,” purchased.

SCHEFFER.—“Flora van Indischen Archipelago,” purchased.

ZOLLINGER.—“Systematisches Verzeichniss,” purchased.

ZOLLINGER.—“Anonaceen des Ostindisches Archipel,” purchased.

CUMING and ZOLLINGER.—“Description des Elæocarpées,” purchased.

CLARKE, C. B.—“Compositæ Indicae,” purchased.

ROXBURGH.—“Flora Indica,” (Clarke’s edition), purchased.

DYER, W. T. T. D.—“Address to Biological Section, British Association, 1889,” presented by the Author.

ANNALES DEL MUSEO NAC. DE COSTA RICA, 1 No., presented by Dr. ERNST.

BARBER.—“Cacao Planting in Ceylon,” purchased.

Publications of the Straits Asiatic Society, complete, presented by the Society.

Also the following periodicals for the year:—“Illustration-Horticole,” “Florida Dispatch,” “Chemist and Druggist,” “Agricultural Journal”—presented by the Editors. “Gardener’s Chronicle,” “Journal of Botany,” “Botanical Magazine,” “Annals of Botany,” “Indian Forester,” “Tropical Agriculturist,” “Linnean Society’s Journal”—purchased.

And Reports of the Gardens of Durban, Saharunpore, St. Petersburg, Calcutta, Hongkong, Ceylon; the Agricultural Society of Madras, Bangalore, Mysore, Adelaide, Trinidad, British Guiana, Jamaica and the Kew Bulletin; and the Reports of the Forest Departments of India and Australia—have been sent from those institutions.

BOTANIC GARDENS, SINGAPORE.

Statement of the Receipts and Expenditure for the year 1890.

RECEIPTS.			EXPENDITURE.		
	\$	c.		\$	c.
By Balance in Bank,...	1,996	52	<i>Salaries.</i>		
„ Government Grant,	8,500	00	Herbarium Keeper, ..	120	70
„ Sale of Plants and			Chief Mandore, ...	114	63
Flowers, ...	177	04	Carpenter, ...	169	76
„ Municipality (Up-			Printers (label), ...	191	70
keep of Garden			Aviary Keeper, ...	83	99
Road, ...	72	00	Mason, ...	49	80
„ Interests on current			Peon, ...	84	00
account, ...	43	10	Coolies, ...	3,282	19
			<i>Bills.</i>		
			Purchase of Plants and		
			Seeds, ...	164	00
			Manure and Cartage, ...	181	42
			Wood for construction pur-		
			poses, ...	176	04
			Birds’ Food, ...	293	23
			Tools and Stores, ...	446	02
			Flower-pots and Tubs, ...	223	59
			Botanical Books, ...	488	93
			Laterite, ...	902	76
			Freight, &c. on Plants and		
			Seeds, ...	126	10
			Inspector-General of Police,	349	59
			Director’s Petty Expenses,	203	69
			Assistant Superintendent’s		
			Petty Expenses, ...	222	63
			Erection of Orchid House,	500	00
			Erection of Carpenter’s		
			Shop and Tool Store, ...	801	44
			New Boat for the Lake, ...	40	00
			Contribution to Flower		
			Show, 1889, ...	338	00
			Miscellaneous, ...	443	55
					5,900 99
					9,997 76
			Balance, ...		790 90
					\$10,788 66
					\$10,788 66

FOREST RESERVES IN SINGAPORE.

Area.

18. The total area of Forest Reserves now in Singapore amounts to 12,965 acres 1 rood. This increase upon the last year's record is partly due to a revised survey of the forests, for the only addition is that of the Upper Tanglin Reserve, $4\frac{3}{4}$ acres.

It was found on examining the boundaries of several reserves that they had been quite incorrectly opened by the Surveyors. It was, therefore, necessary to have the whole work re-done. The following were found incorrect:—Ang Mo Kio, Chan Chu Kang, Sembawang, Bukit Timah, Kranji, Bakau, Tuas, Murei and Pandan. All these have been re-surveyed, and boundary paths corrected.

Boundaries.

19. The boundary paths of the reserves have been kept in good order, cleared of weeds, and the streams bridged, and constantly inspected by the Forest Overseer and by myself.

Reserves.

20. In the Bukit Mandi and Sembawang Reserve, a large pepper encroachment was found, and the owner prosecuted. The crops were sold for \$60, and the owner, who purchased them, agreed to protect the trees which were planted among the pepper, and to keep the whole clear of lalang till the crops should be ripe. The spot is now planted thickly with many young trees, including 1,095 Para Rubber, 100 Bintangor, 50 Coco-plum, 50 Cæsalpinias, 20 Terminalia Catappa, 30 Aleurites, 400 Jambu Ayer Laut (*Eugenia densiflora*). Most are doing well, and the ground—five acres—will soon be well covered.

In the Bukit Timah Nursery many Arnotto and Croton Oil seeds were planted. These came up very well, and have been planted into the surrounding waste lands to combat the lalang, against which they are making some headway.

Present State of the Reserves.

21. It is now worth while to examine into the timber trees occurring in the various reserves, in order to know what their future may be.

Bukit Timah.—This consists of a patch of very good virgin forest containing Bilian Wangi, Kranji, Meranti, Bintangor, Getah Taban, Rengas, Mahang, and trees of less value, and a large extent of lalang and secondary forest.

Pandan.—Consists of lalang and brush-wood, a certain amount of mangrove swamp and a very narrow strip of forest, abutting on the Tanjong Penjuru village and the Jurong village known as Ayer Terjun.

Furong.—One-third of this is good forest land, but the remainder is lalang and brushwood, and a very large low swamp covered thickly with razor grass (*Scleria sumatrana*).

Bukit Mandi.—Of this one-third is composed of forest containing Bintangor, Meranti, Brangan Babi, Brangan Papan, Kayu Klat, Mahang, Truntang, Pala Hutan, Damar, Rengas, and other trees of more or less value. The remainder is lalang and brushwood.

Sembawang.—Two-thirds of this is composed of lalang and brushwood and secondary forest, the remainder is good swampy jungle. The best trees here are Bintangor, Rengas, Kayu Klat Puteh, Brangan Babi.

Kranji.—Contains a little swampy forest land, but the bulk is mangrove swamp. This is apparently very old swamp, and is remarkable for being exceedingly prolific in orchids, most of the native epiphytic species occurring here.

Sungei Buluh.—Consists entirely of mangrove swamp.

Chan Chu Kang.—About half is very good forest land, the rest lalang, brushwood and secondary forest.

Seletar.—One-eighth of this consists of good forest, the rest is lalang, mangrove and swampy jungle.

Ang Mo Kio.—About one-half is good swampy jungle, the rest lalang and brushwood.

Changi.—This large reserve consists chiefly of lalang and brushwood, one-third only being forest land, consisting of Brangan, Meranti, Kledang, Samah, Rengas, and other trees. This land is very sandy and hot, so that it will be difficult to plant up, but many young Rengas trees can be removed to better reserves.

Bedok.—Is nearly all lalang, with a patch of swamp in which is growing a good deal of sago. This will be a good spot for cultivating sago to supply the waste swamp lands of Malacca.

Tuas.—About a quarter is good forest land, and the rest is lalang, secondary forest and mangrove. The timber here is small and chiefly of a size fit for fishing stakes, rollers and such work.

Muri.—Is composed of mangrove, swampy jungle, lalang and brushwood.

Bukit Panjang.—About three-quarters is lalang, the rest secondary and a little old jungle, in which are Meranti and Bintangor Bungah trees.

Military Reserve.—Has been thickly planted with most kinds of good timber trees, and last year about 555 young Jambu Ayer Laut were planted, and many young Tembusu trees are coming up among the lalang and fern.

Upper Tanglin.—A small hill-side patch of jungle containing a little Tampines, Brangan, and other trees.

Buildings, &c.

22. A new forest station has been built at Kranji, at a cost of \$50, the old one on the sea beach being unfit to live in. A station has also been built at Tuas, where there had not previously been one, at a cost of \$20. The station at Bukit Timah was removed, on account of the prevalence of fever there, to a more healthy situation. The house in the Botanic Gardens, which was tenanted by the Forest Overseer, was condemned as being unhealthy and not worth repairing, so a new house was built in the Military Forest Reserve, and the old one broken up. Three boats were purchased during the year for the reserves at Seletar, Kranji and Tuas.

Forest Watchmen.

23. The total number of men employed in the reserves was eighteen men, four Lance-Corporals and one Corporal. All worked well, with the exception of one Lance-Corporal and two watchmen in charge of Changi Reserve, who were dismissed for taking bribes from a Chinaman.

Fires.

24. Seven fires occurred during the year, three of which were among lalang and brushwood, and four among secondary jungle, of which about 16 acres were destroyed. Three fires took place at Changi, in February, April and August, respectively, one at Pandan, one at Bukit Panjang, one at Ang Mo Kio, one at Sungei Buluh, and one at Jurong. In every case the fire has started from lalang in the day time, most of them from the road side, or on paths. All efforts to capture the persons who have ignited the grass failed, but there is reason to believe that the fire is usually raised by some passer-by throwing a light into the lalang.

Prosecutions.

25. Eighteen cases of prosecution were instituted during the year, fourteen of which were for timber cutting and the rest for encroachments. One case was withdrawn, and seventeen convicted; the fines inflicted amounted to two hundred and sixty-five dollars, of which fifty-five dollars were paid.

EXPERIMENTAL GARDEN.

26. I regret that this has had to suffer a good deal from want of funds, a mandore and six coolies being all that it was possible to afford out of the Forest vote, from which the garden is still paid. This is really inadequate to keep the garden up to its proper level, still less to put under cultivation the large tract of land still waste. As the garden no longer really bears any definite relation to the Forest Department, it seems advisable to put it under the Gardens vote. Of course, this would add to the expenses of the Gardens as they now stand, but I believe that a further development of this experimental and economic department is very much to be desired.

Among other things urgently required, are the fencing in of the whole of this garden and the military forest reserve, at least where it abuts on private property or public roads. An attempt to mark the boundaries by a fence by which, at least, trespassers and cattle can be kept out, will be made this year. To put the waste land included in it under cultivation is another point. Some of the soil is decidedly good, and certain trees grow very well in it. I hope to increase the area under cultivation this year, and, wherever I can, to make the whole an Economic Garden worthy of the Colony.

Economic Plants.

27. *Vitis marteni*.—The Saigon vine has fruited here twice. The grapes are small, black, with rather large seeds, though sweet. They have the great disadvantage, common to most wild grapes, of being full of raphides, which give a rough sensation to the tongue. This could probably be got rid of by cultivation.

Ficus carica.—The figs seem to be getting more fructiferous, but the fruits have but a poor flavour, and are rather dry, probably the position of the few fruiting trees exposed too much to the sun is the cause of this, and further the birds and bats are so fond of them that they have to be covered up before they are ripe, which is injurious to the flavour.

Watercress.—The few scraps of Watercress found here in December of last year, were carefully planted, and the result has been a number of beds which produce large supplies. There has been tolerably regular request to be supplied with it by the public, as soon as it was known that it was on sale in the Botanic Gardens, at 20 cents a bunch. A few persons have purchased plants for cultivation, and as it is very easy to cultivate, it is hoped it may soon become a permanent article of food in the Straits. It can be grown in beds—in good damp soil or in flower-boxes, and in this way the coarseness of the plant when grown in water here may be avoided.

Cloves.—The avenue of clove trees planted along the walk through the experimental garden shewed signs of sickness, and one by one began to die; on investigating the cause of this, it appeared that at about a foot and a-half below the surface of the soil, there is a deposit of clay, and between the two strata the water remains stagnant and unable to drain away through the clay. The trees had put their roots through the soil into the water, and although the roots had turned upwards again and otherwise tried to avoid it, the trees sickened and all began to die. They have been replaced by Glam (*Melaleuca leucadendron*), a tree which is less injured by water at the roots. Many Eucalypti also planted in this portion of the garden have perished from the same cause.

Sugar-cane.—It is to be regretted that Sireh disease has attacked the Sugar-cane, indeed the disease appears to be too well established in the Straits. At present little is known about it, but it appears to be due to a nematoid worm. The disease occurs here also in the stems of Cordyline. I hope to examine carefully the state of the sugar plantations here, and see what steps, if any, can be taken against it.

Gambier.—This important product of Singapore still maintains its high price, but there are many complaints from England that the imported article is heavily adulterated with water, or at least contains an excessive quantity of it. In order to trace, if possible, the origin of this excess, samples of gambier taken from the field, fresh from the boiling-shed, were sent to Mr. EVANS of Bristol, who is interested in the tanning trade. I submit his analysis with that of a sample of block-gambier received by him in the ordinary course of trade:—

Gambier from the field.		Trade Gambier.
Tannin, ..	... 11.48	14.68
Organic matter, ...	30.11	42.26
Water, ...	53.39	31.89
Ash, ...	4.46	6.34
Loss, ...	0.56	4.88
	<hr/> 100.00	<hr/> 100.00

This result shews that there is actually less water in the trade article than in the gambier taken directly from the coolies' hands, and negatives the suggestion that the town *towkay* adulterated the gambier after receiving it in Singapore with water to make it heavier. The other suggestion that the gambier has deteriorated of late years from insufficient inspissation owing to less fuel being used in boiling seems more probable. In earlier years, when there was no attempt made to protect the forests the destruction of firing was very large, and fuel could be had in large quantities. Now the results of wasteful destruction are being felt, firewood is getting more expensive and difficult to get, and the gambier is insufficiently boiled and dried.

Persons interested in the trade recently conceived the idea of forming here a company to cultivate gambier on a large scale, but this has fallen through, and there is an idea that this product may be cultivated more profitably, *i. e.*, with European labour, in others of our colonies. Consequently most botanical establishments have applied to the Singapore Gardens for seeds or young plants this year. A large quantity of seed was carefully collected and dried here and distributed widely, but,

as far as we have yet heard, failed entirely. It seems now certain that gambier seed has a very short duration of life (the Chinese say only 24 hours), that is, it must be sown as soon as ripe. Thus all attempts to send seed to distant colonies must prove futile. Unfortunately, too, young plants are very bad travellers, and though many have been sent out to different establishments, few appear to survive the voyage. More cases of as healthy plants as possible will be sent out this year to the various colonies where it is likely to thrive.

Drugs.—Several plants common or easily cultivatable here are now in some request, as medicines. Among them is *Euphorbia pilulifera*, known here as Kroma susu. The young leaves gathered before flowering are dried, and the extract is used for asthma, bronchitis, influenza, &c. The plant is exceedingly common as a weed in waste grounds and other spots. A notice of the value of this drug by Mr. THOS. CHRISTY, of London, was published in the *Straits Gazette*, but although one cultivator has sent a supply home, no report has as yet been received as to the value of the sample.

There is also a considerable demand for papaya-milk, used for diptheria, wounds, ulcers, &c. To obtain it, slits are made in the stem and young fruits and the milk as it exudes is collected upon glassplates.

Cassia alata is well known to the Malays as a drug of use in skin disease. It has not yet had a fair trial in England, but it is reputed to be valuable in cases of ring-worm, &c. A quantity of dried leaves were sent to England, but no report has yet come to hand as to their value.

Neray bark (*Carapa moluccana*), a common mangrove tree, has a local reputation for dysentery. Some extract made with alcohol, appeared to have no valuable properties according to Mr. CHRISTY, who reported on it. A bundle of bark was sent to him later to examine, but no report has yet been received.

Sarsaparilla.—A case of plants of Jamaica sarsaparilla was received from Jamaica a short time ago. There seems no reason why it should not do well here, but the drug seems falling into disfavour.

Kachubong and *Gadong*.—In answer to a request published in the *Straits Settlements Gazette* for native plants with poisonous qualities, seeds of *Kachubong* and a plant of *Gadong* were received from Mr. LISTER. The former is *Datura metel*, a well known and dangerous poison plant very common here in a half wild state; there is but little demand for it.

Gadong is a species of *Dioscorea*, perhaps *D. dæmonum*, reported very poisonous. The tuber sent though alive shews no signs yet of growth. Nothing is known of its qualities, but the Malays say it is very poisonous.

28. *Revenue and Expenditure of the Forest Department, Singapore, for the year 1890.*

REVENUE.		EXPENDITURE.	
	\$ c.		\$ c.
Government vote,	4,170 83,	Salaries, ...	2,244 44
		Transport, ...	798 77
		Allowances, ...	158 70
		Miscellaneous,	859 51
		Balance, ...	109 41
	<hr/> \$4,170 83 <hr/>		<hr/> \$4,170 83 <hr/>

NOTE.—The salaries of the Forest Watchmen and the Experimental Forest Nursery were paid out of this vote up to November, and December's salaries were paid out of the 1890 vote, the balance \$109.41 being lost.

GARDENS AND FOREST DEPARTMENT, PENANG.

Mr. C. CURTIS, the Assistant Superintendent of Forests, reports as follows:—

“ Waterfall Garden.

29. The laying out and maintenance of this Garden; if not the most important work of the Department, is at any rate the best understood and appreciated by the public, and occupies the greater portion of my time.

30. Besides the usual routine work of mowing, weeding, sweeping, manuring, replanting, maintenance of roads, paths, &c., many new and important works have been carried out by the garden coolies with the occasional assistance of one or two carpenters.

31. Temporary lines for gardeners and coolies have been erected, by permission of the Hon'ble the Resident Councillor, on a plot of Crown land near the Hindoo Temple, about half a mile from the garden.

32. The remainder of this land has been utilised as a Nursery for the propagation of shrubs, shade-trees, &c., for which there is annually a steady demand for Government buildings, Municipal roads, &c., and for which there is no available land in the Waterfall Garden.

33. A temporary plant-shed, forty feet by eighty, and twelve feet high in the centre, has been put up near the entrance gate. The interior of this shed is constructed with soft stones obtained in the course of cutting a portion of new road, and among these the plants are disposed as naturally as possible. Aroids have been largely used and are making satisfactory growth. The roof is of split bamboo laid sufficiently close together to break the full force of the sun, while at the same time affording a sufficiency of light.

34. Plant-houses on this principle, constructed with light T iron and wire netting, are largely used in Calcutta, and are equally well adapted for the cultivation of the majority of plants in this climate. I think, however, that the substitution of Bertam chicks in lieu of wire netting would be an advantage, as being neater, and the distribution of light more equal than that produced by the material laid on the wire netting in India.

35. A new shed one hundred feet long by eighteen feet broad, for the special cultivation of orchids, has been constructed with well-seasoned old timbers from the buildings removed to make room for the new Government Office, and the roof covered with Bertam chicks. The beds on which the plants are set are built eighteen inches, high, of rough stones, and the interstices planted with ferns, Selaginellas, and other small growing plants which have a pleasing effect. Judging from the progress made to date, this is not only the simplest and strongest, but also the most satisfactory as regards growth of plants, and thanks are due to the Deputy Colonial Engineer for the material, without which the work could not have been done.

36. The small octagonal show-house, and two sheds in the Nursery, had to be renewed, as the posts were rotten. Advantage was taken of this opportunity to effect several changes that experience clearly pointed out as being necessary; not the least important being the doing away entirely with wooden stages, and the construction of water tanks in each shed.

37. In the show-house the tank was made large enough to admit a small piece of rock-work, and fountain in the centre, which is a decided improvement.

The upper plant-shed on the way to the Falls, has also been renewed, and the interior entirely re-arranged. All the plants in this shed are now planted out, and require far less attention than when grown in pots.—

A large proportion are local plants, and it is intended eventually to fill this entirely with Malayan plants, of which there are numbers as ornamental as they are botanically interesting.

38. The ravine adjoining this shed has been cleared, and a small portion planted, but the bulk of the work remains to be done this year.

39. Three dams, to supply water to the plant-sheds and Nursery, have been built across small tributary streams flowing into the main one; and are both useful and ornamental. One of these has been constructed specially with a view to growing the Victoria Lily, for which there is not sufficient depth of water in the Lily Pond.

40. Iron pipes for conveying water from the sources above-mentioned, fitted with brass taps for connecting rubber hose pipe, have been fixed, at a cost of \$270.54, and effect a great saving in labour; while at the same time the work is much better performed.

41. The road from the upper plant-shed to main bridge, of which 4,716 superficial feet remained unfinished at the end of 1888, is now complete. It involved a large amount of labour, the whole cutting being through a mass of boulders more or less hard. All the material used for constructing rock-work, beds for plants, metal-ling roads, &c., amounting to several hundred cart-loads, were taken out of this short cutting.

42. The road to the back of the Band Mound, skirting the base of the hill on which the Assistant Superintendent's bungalow is situated, has been widened seven feet, and converted into a carriage road eighteen feet broad. In order to connect this at the entrance gate, and thus complete the circle, a new bridge, twenty-five feet long and eighteen feet wide, has been thrown across the main stream.

43. The whole of this road, amounting to 27,432 superficial feet, has been metalled and put in excellent condition.

The principal item of expense in connecting this road with the entrance gate, as also in laying out the garden generally, is the filling in of holes that have been made by the sale of soil and road metal off this land by previous owners. The full extent of this was not realised until the jungle had been cleared.

44. Altogether, an area estimated at four acres has been cleared during the year, the principal extension being on the north side in continuation of the original scheme; the sloping, turfing and planting of which will form an important item in another year's work.

45. Six new beds have been formed near the entrance and filled, principally with shrubs of an ornamental nature. Those in which annuals and soft wooded foliage plants are grown have been renewed from time to time, as found necessary.

One dozen new garden seats manufactured by the Public Works Department in Singapore, were purchased, and are appreciated, but complaints are still made that the number is insufficient.

46. One plant frame for the raising of ferns and other tender plants was made by a carpenter working in the garden, and is a most useful addition. More of the same kind are much needed for the purpose of establishing newly collected plants.

47. Ornamental and useful plants have been received from correspondents, the largest contributors being the Director of Botanic Gardens, Calcutta, and the Superintendent of Botanic Gardens, Hongkong.

48. The collection of plants in pots have been better grown than in previous years, and many interesting additions made as the result of two short collecting tours, reference to which will be made further on.

49. An increased interest is, I think, being felt in the cultivation of ornamental plants, and as the heavier works of roading, turfing, bridge building, &c. becomes less, more attention is devoted to this branch.

50. The increased number of visitors is very gratifying, and only the distance from town prevents many from oftener enjoying the pleasure of a visit to the garden.

51. Plants to the amount of \$75.35 were sold, and the money paid into revenue account.

52. The total expenditure in connection with the laying out and maintenance of this garden, including all the works of which mention has been made, as well as numerous others equally necessary, amount to \$6,389.23, details of which are given in the Statement of Expenditure annexed (Appendix A).

Government Hill Gardens.

53. The appointment of Mr. A. J. O'KEEFFE, as overseer of these gardens, which took effect from the first of October last, will, it is hoped, at no distant date, result in greater efficiency, both as regards the cultivation of plants and general up-keep of grounds.

54. In accordance with the decision arrived at in July, when the Director of Gardens and Forests visited this Settlement, all pot plants have been removed from the Experimental Nursery to the Bungalow garden, which is 500 feet higher.
55. Vegetables, too, of which many kinds have been tested in this Nursery, will, in future, be grown on the land set aside for this purpose in connection with Government Bungalow, and the Nursery devoted principally to fruit trees and other economic plants.
56. Enough has been done to prove that many kinds of European vegetables can be grown in Penang, but the cost of carrying manure from the foot of the hill, without which nothing can be done, and the lack of a sufficient area of even moderately level land on which fodder could be grown so as to keep cattle, renders it improbable that the cultivation could be made to pay.
57. Chinese market gardeners are the only persons that could possibly grow such things as Tomatoes, Carrots, Parsnips, Lettuce, Beet, Radish and Turnips, (which are the kinds most easily grown), so as to put them in the market at a reasonable price, and these show no inclination to do so, even when supplied with seeds free of cost.
58. Two new plant-sheds have been put up at the entrance to Convalescent Bungalow for the plants removed from the Nursery, and others received from correspondents or collected by myself in Perak at altitudes varying from 2,000 to 6,000 feet.
59. The plant-shed on Gun Hill has been improved by the removal of the wooden stages, and fixing wire netting with a matting of lalang grass to a height of eighteen inches above the new beds to break the force of strong winds, which are trying in this exposed situation.
60. Many interesting plants flowered in this shed during the year, and were in some cases sent to the Waterfall Garden while in bloom. Among these were *Cattleya Mendelli*, and two other unnamed species; an *Anguloa* with six flowers, *Rhododendron multicolor*, *R. Teysmanii*, *Vanda Amesiana*, *Cypripedium Lawrencianum*, *C. bellatulum*, and *Calceolaria mexicana*, from seeds collected by myself at Darjeeling. The latter re-sowed itself and flowered a second time. Many other plants that barely exist in the Waterfall Garden grow quite freely here.
61. Seeds and bulbs of many kinds not previously tried in this Settlement were purchased from Messrs. JAS. VEITCH & SONS at a cost of \$50, but arrived too late in the year to admit of an opinion being yet formed of their relative merits.
62. The Roses obtained from Calcutta in December, 1888, were planted in carefully prepared beds, and have done well. Alterations, consequent on the formation of a tennis court in front of the new building necessitated the transplanting of a portion of these in October. This was carefully done under my personal supervision and the plants are now (January, 1890) in bloom.
63. More plants have been received during the year from Messrs. CHATTERJEE, in exchange for ferns, orchids, &c., collected locally, and those best suited to this climate are being propagated by means of budding on strong growing stocks. The best growers and freest flowering kinds are the Teas; such as Marshall Neil, Celine Forestier, La Marque, Devoniensis, Perle de Lyon, Marie van Houtte, &c.
64. A few new beds have been formed, and the old ones manured, replanted, and kept in fair order, but building operations have necessarily prevented the grounds from being kept so neatly as could be wished.
65. The levelling for new tennis court has been under the supervision of the Public Works Department, but the cost, to the extent of \$268.75, has been defrayed from the vote for Improvement of Grounds, Bel Retiro.
66. A clump of *Juniperus virginianus* has been planted at the entrance to the Convalescent Bungalow, and promise to do well.
67. Rifle Range Hill, which had become overgrown with low jungle, has been re-cleared, and a few trees planted on it. The range is now available for practice.
68. Maintenance of roads and paths has, and always will, owing to the formation and heavy rainfall on the hill, absorbed a large proportion of the amount granted for up-keep of these gardens.

69. The piggery in connection with the vegetable garden has been abolished, partly because complaints were made by occupants of Government Bungalow of an unpleasant smell, but principally for the reason that a fair trial has shown it to be cheaper, all things considered, to carry up the manure required.

70. The sum received for sale of pigs is \$102, which has been spent in the purchase and transport of manure.

71. The total expenditure for maintenance of bungalow, garden and experimental nursery is \$2,492.40, as shown in statement annexed.

Forest Reserves.

72. Pulau Jerejak, having an estimated area of 1,000 acres, has been declared Forest Reserve and placed under this Department, thus bringing the total area under protection in Penang to 11,226 acres.

With the exception of the inmates and staff of the Leper Asylum, Pulau Jerejak contains but few inhabitants, and no cultivation whatever, unless the few coco-nut trees overgrown with weeds and bushes in the neighbourhood of the Malay fishing village can be termed such.

73. The whole area is fairly covered with young trees, which if properly protected will grow into a valuable crop. The most important kinds are Tampines, (*Sloetia sideroxylon*), Damar laut, Meranti (*Shorea* sp.), Bintangor (*Calophyllum* sp.). These are present in sufficient numbers to re-stock the island without the aid of artificial planting.

Eucalyptus planted in this island, in the neighbourhood of the Asylum, at the request of the Medical Department two years ago, have made fair progress, and the Colonial Surgeon is of opinion that these trees have had a beneficial effect as regards malaria.

Prosecutions.

74. Fifty-five persons have been prosecuted during the year, principally for illicit timber cutting, as against twenty-four cases in 1888. The amount of fines inflicted being \$395, as against \$105 in 1888.

The greater number of prosecutions and convictions prove, I think, that the work of protecting the reserved areas, which, as pointed out in previous reports, is an important matter in Penang, has been better performed than in previous years.

Stations.

75. One new guard station has been added, and another re-constructed on a more convenient site than that hitherto occupied.

76. The boundaries and inspection paths of the reserves have been regularly patrolled, and kept as clear of obstructions as the staff and nature of the country admitted.

77. A small plantation of the large-leaved Mahogany (*Swietenia macrophylla*), raised from seeds ripened in Calcutta, has been made at Kubang Ulu, but the success of Mahogany as a timber tree in this Settlement is doubtful.

Fire.

78. During the dry season, a fire occurred at this place, and damaged young trees to the extent of \$25. Owing to the adjoining areas being waste land, largely covered with lalang grass, fires are frequent, and in no single instance has the originator been discovered.

Nursery.

79. The nursery has been maintained, but no new work of importance undertaken, as it was hoped more suitable land and easier of access would have been obtained, as suggested in last year's report.

After careful inquiry, it appears certain that there is no suitable Crown land available for this purpose, and that if experiments in the cultivation of vegetable products are to be conducted in a practical manner, the necessary land must be acquired by purchase.

80. Plants of Liberian coffee, and tops of the introduced varieties of sugar cane, have been distributed to Chinese and others who made application for them.

81. The Cochin China vine (*Vitis marteni*) ripened two bunches of fruit. If this could be crossed with the common vine, it would probably produce something suited to the climate, but of itself is not of much merit.

82. Considerable progress has been made in collecting and determining the trees and other plants within the reserved forests, &c., and it is hoped that before the end of another year this collection will be catalogued.

83. The total expenditure in connection with the maintenance of Forest Reserves, including up-keep of nursery, is \$1,514.97, of which \$1,036.96 were paid as salaries, and \$308.72 in the construction and repairing of station.

General.

84. Two short excursions for the purpose of collecting living plants and herbarium specimens, were made during the year, and in each case many plants not previously represented either in the Singapore or Penang Gardens were obtained, some being quite new.

85. On the first occasion, I was absent from Penang ten days, and collected principally on the hill ranges in Perak, at altitudes varying from 2,000 to 6,000 feet.

Among the interesting plants obtained for cultivation were four species of *Didymocarpus*, two of *Rhododendrons*, a fine *Medinilla*, numbers of *Phaius grandifolius*, *Calanthes*, and a curious aroid, which I believe to be the same collected by me some years ago in Borneo, and described at the time as a new genus under the name of *Podolasia stipitata*.

Numerous orchids and other plants of which the flowers were not seen were collected, some of which have since flowered in the Hill Garden, and specimens preserved for future reference.

86. The second excursion occupied only five days, as the Government steam launch in which the trip was made could not be spared for a longer time. This trip was to the Langkawi Islands situated from sixty to one hundred miles to the north of Penang.

There are but few inhabitants, and dense jungle extends from the water edge to the tops of the highest hills, which are on the larger islands over 1,000 feet in height.

Time did not admit of any attempt being made to reach these hills, but judging from their appearance, the geological formation is not the same as the smaller islands on which most of the plants brought back were obtained.

Short reports on these two collecting tours were submitted to Government immediately on my return, and it is therefore unnecessary to say more than that this collection bears out the opinion ventured in my last Annual Report, that the flora of the Langkawi Islands is nearer allied to that of Burma than that of Malaya.

87. A complete set of all dried plants obtained during these excursions, and collected in Penang during the year, have been mounted and forwarded to the Director, Singapore. Surplus specimens are either sent to the Director, or other Botanists after consultation with him.

The greater number this year have been sent to Dr. KING, who is at present engaged on the Flora of this region. The whole of the Penang herbarium is also being sent to Dr. KING, a few orders at a time, on loan.

Altogether, more than 1,000 herbarium specimens have been distributed during the year, and about 500 added to the Penang collection.

Named surplus specimens, from the collections made by the two deceased Botanists SCORTECHINI and KUNSTLER, and by Mr. WRAY of the Perak Museum, have been presented to the Gardens by Dr. KING, who is working out these collections.

88. The usual system of exchanging plants and seeds has been kept up during the year, about 1,300 plants and 93 packets of seeds being received; and 3,126 plants and 25 packets of seeds distributed.

The disproportion between the numbers received and distributed is accounted for partly by the fact that some five hundred plants were obtained during my visit to India in 1888 for which it was impossible to make any acknowledgment in kind in that year, and partly by the despatch of a greater number than usual of local plants to Singapore.

89. At the request of the Hon'ble the Resident Councillor, Kedah has been twice visited ; the first occasion being to take over the land presented by H. H. the Sultan of Kedah as a building site for the British Consulate, and the second in connection with the clearing and preparing it with a view to ornamentation as soon as the building is completed.

On the first occasion, having a day to spare, a visit was made to the caves, and some plants obtained, but the neighbourhood of Alor Star, the capital of Kedah, is an uninviting field for botanical research.

At the request of the Acting District Officer, a short visit was paid to Lumut, the new Settlement in the Dindings, in November, to advise on the spot on matters connected with Forestry and Agriculture.

Immediately on my return to Penang, two hundred and fifty large plants of Nutmegs and Cloves were shipped to the District Officer for planting at the new Settlement, and the latest account of this consignment is very encouraging.

The soil at the new Settlement appears to be well suited for the cultivation of spices, and no pains should be spared to make the present plantation a success.

90. Other matters recommended, especially the formation of a small nursery on cleared land at the back of the District Officer's Quarters, for raising plants for distribution could not, for want of a sufficiency of labour, be accomplished within the year, but will, I hope, be taken in hand as soon as possible.

91. Clearing, fencing, and preparations for laying out the grounds in connection with the new Residency, Penang, have been proceeded with, and a belt of quick-growing trees planted to screen off the native houses adjoining this land. The formation of beds, planting ornamental trees, &c., will come into another year's work.

92. Supervision of the Municipal Garden, and the planting of shade trees within Municipal limits, has been undertaken from the first of January, 1889, at the request of the Commissioners, and by permission of His Excellency the Governor.

93. The total expenditure for the year, including Salaries of Establishment and Allowances of all kinds, amount to \$13,454.22 ; and the amount received for sale of plants, &c., to \$94.70, which has been paid in to Revenue account."

*Revenue and Expenditure of the Forest and Gardens Department,
Penang, 1889.*

REVENUE.		EXPENDITURE.		
GOVERNMENT GRANT.				
	\$	SALARIES OF ESTABLISHMENT.	\$	c.
Maintenance of Waterfall Garden, ...	3,900	Asst. Superintendent of Forests, ...	1,800	00
		Overseer, Waterfall Garden, ...	300	00
		Overseer, Hill Nursery, ...	87	48
		Sergeant of Forest Guards, ...	240	00
			2,427	48
		Salaries, ...	2,788	99
		Material for renewing Plant-shed, ...	195	20
		Chicks, ...	25	74
		Planks for Plant Cases, &c., ...	26	45
		Glass for Plant Frames, ...	9	13
		Tools and Materials, ...	291	97
		Manure and Cartage, ...	100	95
		Material for Repairs, ...	35	64
		Purchase of Plants, ...	13	90
		Purchase of Pots, ...	15	00
		Plant Basket, ...	27	00
		Rubber Hose, ...	50	25
		Garden Seats, ...	196	46
		Petty and Miscellaneous Expenses, ...	113	43
			3,890	11
		Balance,...	9	89
	3,900		3,900	00
Laying out Waterfall Garden, ...	2,500	Salaries, ...	1,382	33
		Balance due on Main Bridge, ...	144	88
		Manure and Cartage, ...	152	45
		Material for new Plant-shed, ...	176	36
		„ for new Bridge, ...	89	66
		„ for Water Tanks, ...	52	25
		„ for Cooly Lines, ...	63	06
		„ for renewing Foot Bridge, ...	97	31
		Laying on Water, ...	270	54
		Lowering Water Pipes, ...	12	37
		Dynamite, ...	22	55
		Tools, ...	8	40
		Bricks, ...	26	96
			2,499	12
		Balance,...	0	88
	2,500		2,500	00
Maintenance of Hill Nursery & Bungalow Garden, ...	1,750	Salaries, ...	1,535	20
		Rice for Cattle, ...	123	4
		Tools and Material, ...	75	24
		Purchase of Seeds, ...	11	6
		Miscellaneous, ...	0	90
			1,745	44
		Balance,...	4	56
	1,750		1,750	00

*Revenue and Expenditure of the Forest and Gardens Department,
Penang, 1889,—Continued.*

REVENUE.		EXPENDITURE.	
GOVERNMENT GRANT.			
Improvement of of Grounds "Bel Re- tiro,"	\$ 750	Salaries,	\$ 199 48
		Salaries by Public Works Department,	268 75
		Seeds and Bulbs,	50 00
		Manure,	35 90
		Tools,	11 29
		Wire Netting,	52 50
		Material of Plant-shed and Frames, ...	89 89
		Flower Pots,	38 65
		Cartage, ... ..	... 50
			746 96
		Balance, ...	3 04
	750		750 00
Maintenance of Forest Reserves, ...	1,550	Salaries, ... ..	... ..
		Forest Guards,	437 34
		Office Assistant and Messenger, ...	199 37
		Maintenance of Nursery and planting Trees,	229 50
		Up-keep of Reserve Line, ...	105 75
		BILLS.	
		Re-construction of Forest Guard Station, Telok Bahang,	112 82
		Construction of new Station, Pulau Jerejak,	180 00
		Repairs to Station, Penara Bukit, ...	15 90
		Forest Guards' Transport,	42 25
		Paper and Chemicals for Herbarium, ...	20 48
		Botanical Books,	3 56
		House Rent,	16 00
		Purchase of Plant and Seeds,	10 32
		Manure and Cartage,	9 84
		Tools and Material,	42 89
		Miscellaneous,	23 95
			1,514 97
		Balance, ...	35 03
	1,550		1,550 00
Travelling & Per- sonal Allowances, ...	700	Assistant Superintendent's Pony Al- lowance,	414 04
		Personal Allowance and other Expens- es in connection with journey to Perak,	57 70
		Ditto Langkawi and Dindings, ...	42 40
		Ditto Kedah,	16 62
		Transport and Field Allowance, ...	26 77
		Director's (Annual Inspection) visit, ...	72 65
			630 14
		Balance, ...	69 86
	700		700 00
Revenue from Sale of Plants,	94.70		

Principal Contributors and Recipients of Plants and Seeds, Penang, 1889.

CONTRIBUTORS.	RECIPIENTS.
Director of Botanic Gardens, Calcutta.	The Director of Botanic Gardens, Calcutta.
" " " Ceylon.	" " " Hongkong.
" " " Singapore.	" " " Singapore.
" " " Melbourne.	The Agri-Horti. Society, Rangoon.
The Secretary to Government, Perak.	" " " Madras.
Major WALKER, Perak.	The Superintendent of Government Plan-
Superintendent Government Plantations, Perak.	tations, Perak.
T. FRASER, Esq.	T. FRASER, Esq., Perak.
S. P. CHATTERJEE, Esq., Calcutta.	H. H. the Sultan of Kedah.
C. MARIES, Esq., Gwalior, India.	The Hon'ble W. E. MAXWELL, C. M. G.
STANLEY, PRICE & Co., Calcutta.	C. WRAY, Esq., Perak.
G. PECHE, Esq., Moulmein.	S. P. CHATTERJEE, Esq., Calcutta.
P. HONSTON, Esq., Pangkor.	Messrs. JAS. VEITCH & SONS, London.
A. STALLARD, Esq., Do.	Assistant Superintendent of Forests,
A. T. BRYANT, Esq., Do.	Malacca.
T. DRYSDALE, Esq., Timor.	C. MARIES, Esq., Gwalior.
The Agri-Horti. Society, Madras.	The Hon'ble J. M. B. VERMONT.
" " " Rangoon.	The Municipal Commissioners, Penang
C. WRAY, Esq., Perak.	P. HONSTON, Esq., Pangkor.
Messrs. JAS. VEITCH & SONS, London.	Major WALKER, Perak.
W. BOXALL, Esq., London.	G. PECHE, Esq., Moulmein.
The Hon'ble J. M. B. VERMONT.	District Officer, Bukit Mertajam.
	J. G. OLIFANT, Esq., Calcutta.

C. CURTIS,
Assistant Superintendent of Forests."

THE FORESTS OF MALACCA.

Mr. R. DERRY, Assistant Superintendent of Forests reports as follows:—

"Experimental Garden, Bukit Sabukor.

94. The garden has been maintained in good order throughout the year, and much propagating, preparing trees for road side, and general planting has been done, altogether 12,000 young trees of thirty kinds have been prepared for planting, the principal of which are:—

Tembusu, <i>Fagraea fragrans</i>,	...	...	4,460
Sena <i>Pterocarpus indicus</i>,	...	...	2,500
Merebau, <i>Afzelia palembanica</i>,	...	...	1,000
Bintangor, <i>Calophyllum inophyllum</i>,	...	...	460
Champedak, <i>Artocarpus champedak</i>,	...	...	300
Pulai, <i>Alstonia scholaris</i>,	...	...	230
Large-leaved Mahogany, <i>Swietenia macrophylla</i>,	...	...	700
Kempas, <i>Kumpussia malaccensis</i>,	...	...	120
Bintangor lumut, <i>Calophyllum</i> , sp.,	...	...	150
Rotan manan, <i>Calamus</i> sp.,	...	...	800 *
Miscellaneous,	...	...	1,780

* L. has. This figure is 300.

Fruit trees and other economic plants have also been largely propagated, but the failure of the fruit-crop prevented so large a stock being prepared as might have been desired.

A collection of ornamental and flowering shrubs has been maintained, to supply the needs of the town.

Works.

95. The following works have been done in the Gardens. The ground adjoining the lakes has been temporarily planted with Arnotto, Assam Tea and Patchouli; two-thirds of an acre have been cleared, and holes dug for Liberian coffee, two hundred and three of which plants have been planted, and a stock prepared for next rainy season; and two acres have been cleared and holes dug for the reception of timber and other trees. The poorer soils of the Gardens will be planted up with timber-trees, nibong and bamboos.

Economic Plants.

96. The common Mahogany, *Swietenia mahogani*, has proved here as elsewhere in the Straits a failure. The large-leaved species, *Smacrophylla*, apparently a more robust plant, is growing well here, seeds were obtained from Calcutta in March, and the plants are now two feet tall.

Camphor (*Cinnamomum camphora*) a small stock of plants has been raised from seeds received from Hongkong in February.

Cloves are growing vigorously, most of the seedlings planted eighteen months ago are now five feet tall, and very healthy. Two trees which were in the Gardens when transferred are now fruiting. It is evident that they might be profitably cultivated here.

Maltese Lemons, are doing very well. Two trees have borne fruit of good size and quality.

Castor Oil (*Ricinus communis*).—Seeds received from Calcutta have grown well and fruited freely, and a stock is now being raised for more extensive planting.

Patchouli (*Pogostemon patchouli*) is growing very well and fast, but the demand is limited.

Kroma Susu (*Euphorbia pilulifera*).—Plants received from Singapore have grown well, and it has also been found wild near Bukit Bruang. There has not yet been received any report as to the value of the drug as grown here.

Arnotto (*Bix orellana*), Tapioca, six varieties from Singapore, Black Pepper, Assam Tea, Liberian Coffee and Nutmegs have all been doing well.

Roads and Drives.

97. The main drive through the Gardens has been maintained in good order, and the entrances from the Bukit Bruang and Batu Berendam Roads have been much improved by the erection of pillars. When the dam across the lake has been erected, a drive round the whole extent of the Gardens can be made.

A cutting of some feet in depth which would be necessary for this, is being made by the Public Works Department to supply material for roads in the neighbourhood.

Lake.

98. Nothing has been done to this during the year. It is hoped that a vote will be sanctioned for damming it and finishing it next year, as the want of a proper water supply is being felt.

Forest Reserves.

99. The Forest watchmen have worked well, but much difficulty exists in preventing their absenting themselves from their station on account of their quarters not being large enough for their families, and two men were dismissed for this. The quarters at three stations will be enlarged during the ensuing year, and it will be necessary to enlarge the remainder in order to accommodate the men's families at an early date.

Prosecutions, &c.

100. Two cases of timber cutting occurred during the year. In one case a fine of 10 dollars was inflicted, the other was settled by the defendant paying 4 dollars, the value of the wood which had been taken by mistake. A fire broke out in the early part of the year on some waste land at Sungei Udang, but no harm was done.

Bukit Bruang Reserve.

101. The boundaries of the reserve have been re-cleared, and the swamps bridged, and a path has been made over the highest spur. On some waste land 1,099 trees of different kinds, chiefly Merebau, Bintangor, Champedak, have been planted. And on the adjoining swamp a clearing has been commenced for the culture of sago. Three acres have been cleared, the soil thrown into ridges and 45 sago-cuttings planted.

Sungei Udang Reserve.

102. The boundaries having become overgrown have been cleared by the watchmen with the aid of a gang of six coolies. Fifteen miles of boundaries have been put in order, and six miles of inspection-paths opened. The central compartment has been divided into blocks by the inspection-paths. About a mile remains to be done.

Merlemau Reserve.

103. The western boundary, two miles long, has been opened during the year, and an inspection path, two miles long, has also been opened. The southern boundaries running westwards and those west of the Chin-Chin Road are in good order, and where swampy made passable. The eastern swampy boundaries remain to be rendered passable, and the demarcation of the western compartment into blocks is requisite in order to make a valuation survey. This will be done in the ensuing year.

Ayer Panas Reserve.

104. The boundary of the new reserve has been maintained by the watchmen and an inspection-path opened by a band of coolies for three-quarters of a mile.

Bukit Panchor.

105. The maintenance of the boundaries here is very heavy owing to the large extent ofalang and swamp. All the boundaries, eleven miles in extent, have been cleared and put in order, a band of coolies having been employed from the end of October to December on them. Some timber has been supplied for building Government quarters from this reserve.

Brisu Reserve.

106. The demarcation of private properties, and of an extension of the reserve occupied most of the time of the watchmen, with the addition of some coolies. The extension consists of the addition of 1,000 acres situated between the Brisu and Sungei Siput main road and the frontier between Bukit Jelutong and Bukit Putus. It is well wooded and includes some large timber, especially near the frontier, Serayah and Meranti being most abundant.

Jus District.

107. The reserves have been divided into three here, viz., Bukit Sadanan, Bukit Batu Tiga, and Batang Malaka; of these the former has been completely demarcated and the second commenced.

Bukit Sadanan Reserve.

108. Lies between the districts of Machap, Tebung, Batang Malaka and Selandar, and comprises about 9,000 acres. It is undulating, well watered and for the most part is exceedingly well wooded with fine timber and a considerable number of rattans. The highest point (Bukit Sadanan) is 1,094 feet altitude. On the western side the reserve is demarcated by the Machap-Tebung Road, on the eastern by the Batang Malaka and Selandar Road. The north and south boundaries have been demarcated.

The most valuable timbers here are:—Seraya (*Hopea cernua*), Gombang (*Dipterocarpus crinitus*), Meranti (*Hopea meranti*), Kayu Klat Merah (*Eugenia* sp.), all abundant; Kayu Minyak (*Dipterocarpus lœvis*), Tembusu (*Fagrea fragrans*), Kambang Sa'mangko, Jelutong, Berombong, Penaga, Kempas, Rambei Daun (*Shorea acuminata*), fairly abundant; Merebau, Resak, Petaling, Kranji, Bilian Wangi, rare.

Bukit Batu Tiga.

109. Towards the close of the year this demarcation was commenced, and four miles opened; the reserve will contain about 6,000 acres. When this and the Batang Malaka reserve are opened, quarters will be built for the Forest watchmen at Gapis, if possible, a central position for both reserves.

GENERAL REMARKS.

Distribution of Reserves.

110. The original plan of distribution of reserves has been carried out, and when the two unfinished reserves have been demarcated, the requirements of the Settlement will probably be met. The larger area is in the south, but it may be possible to increase the northern division by adding to the Brisu Reserve where a much larger area is desirable, and considering the importance of firewood reserves near the town and in the open country towards Alor Gajah, it is worth consideration whether the Cheng hills should not, in part at least, be conserved.

Transport of Timber.

111. Although the distance from some of the reserves to Malacca is long and the transport difficult, yet it hardly appears to make much difference in the value of the timber. Most of the timber in use in the Settlement comes from Muar, and the distance from the depôt there to the jungle and from the town by sea to Malacca is quite as far and inconvenient as from any Malacca reserve to the town. When the reserves in Malacca are capable of supplying timber, each district can be easily supplied from its own reserves.

Conservation and Re-production.

112. At present there is a very large proportion of secondary growth, included in the reserve, and only in a few reserves, viz., Bukit Sadanan, some parts of Merlemau, Sungei Udang and Ayer Panas that the forest is dense and old enough to cut from. The area of lalang is small, nor is it necessary to deal with it till it has become covered with brushwood, which is rapidly happening. There is, however, much land covered with secondary growth, and older forest, which is in a fit state for planting.

Where the soil is good, such timbers as Merebau, Kempas, Meranti and Penaga, could be planted in the form of seed, and Gombang, Kayu Minyak, and seedlings and young plants of Tampines, Serayah, Petaling and Kranji would also be planted.

Special Vote for Planting.

113. The present staff is not able to do more than to conserve and keep up the boundaries of the existing forest, and I would suggest a vote which would cover the whole of the planting expenses being given.

Many of the best timber trees, especially *Dipterocarpus*, only fruit periodically, and when this happens, or when an unusually heavy crop of fruits occurs, they must be collected and planted without delay in as large quantity as possible. For this reason the vote should be made available till the work was completed.

Though the best large timbers would, of course, take a long time to grow to full size, some return would be obtained in from four to six years. Land which had been thickly planted would by that time require thinning, and the timber cut out would be of a class which is highly marketable for use as stakes, rollers, posts, beams, etc., for which there is always a large demand. I would point out that the present available high forest cannot safely be worked unless planting is put in hand on a large scale. As it is required to serve for the natural reproduction both in the forest and also for the production of seeds for planting other land.

The reserves at present cannot do more than supply the wants of the Settlements. With the increased development of the Colony, both by agriculture and commerce, the demand for timber close at hand is increasing. And the failure of the supply of timber, even in the form of posts for pepper cultivation, may have a most injurious effect on the future resources of the Colony.

114. Revenue collected during 1889:—	\$	c.
Sale of seedling fruit-trees,	46.70	
Minor produce from Reserve,	11.95	
Value of Timber supplied for Government use,—		
For Government Quarters, Alor Gajah, ...	182.60	
For repairing Bathing-shed, Tanjong Kling, ...	100.00	
	25.00	
Total,	\$366.25	

115. *Expenditure of the year 1889, Gardens and Forests Department, Malacca.*

	\$	c.	\$	c.
Government Vote,			5,500	00
Expenditure (Reserves):—				
Salaries of Forest Watchmen,	1,457	13		
Demarcating Bukit Sadanan Reserve,	185	25		
" Brisu Reserve,	258	50		
Sungei Udang Reserve,	199	50		
Bukit Bruang Reserve,	157	25		
Merlemau Reserve,	105	25		
Bukit Batu Tiga Reserve,	88	10		
Bukit Panchor Reserve,	125	00		
Ayer Panas Reserve,	26	75		
Uniform for Watchmen,	120	00		
			2,722	73
Bukit Sabukur Garden:—				
Salaries of Kebuns,	1,350	08		
Purchase of Plants and Seeds,	41	46		
Purchase of Tools and Implements,	61	39		
General Up-keep,	31	75		
Herbarium Expenses,	75	10		
Building Plant-houses,	35	80		
Manure,	100	00		
Cartage,	257	92		
Incidental Expenses,	37	49		
Transport,	21	00		
Personal Allowances,	38	00		
Pony Allowance,	387	18		
Field Allowance,	166	50		
Director's Travelling Expenses,	99	75		
			2,703	42
Total Expenditure, ...	\$5,426	15		
Balance, including Crown Agents \$50.00,			\$ 73	85 "

R. DERRY, *Malacca.*

H. N. RIDLEY,

Director of Gardens and Forests, S. S.

Singapore, 15th February, 1890.

ANNUAL REPORT ON THE BOTANIC GARDENS AND FOREST
DEPARTMENT, FOR THE YEAR 1890.

BOTANIC GARDENS, SINGAPORE.

Although during the past year the funds did not permit of any very large works being undertaken, yet a number of minor improvements were made, which have added to the interest and beauty of the Gardens. While staying for a few days at Buitenzorg on the occasion of my visit to Coqos and Christmas Islands, I carefully examined the methods of working and general arrangement of the Botanic Gardens there under the direction of Dr. TREUB. The Botanical establishment is one of the largest and best appointed in the world, but though it is impossible to compete with it here, I observed several points which might well be imitated. The great feature is the grouping of all the plants of one natural order together, attempts being made to complete the series as much as possible. To do this artistically is not at all easy, for in many of the natural orders, such as *Cupuliferæ* or *Myrtaceæ*, a large series of the different species presents to an ordinary visitor a monotonous appearance owing to their similarity. At the same time if the plants of the different orders are kept in special places set apart for each order, it is easy for any one interested in botany or who wishes to see a particular plant to find it in its proper place. I hope, however, to introduce this system, at least to a certain extent, into the Gardens, without injuring their present picturesque appearance.

Of certain orders the plants have already been grouped or collected together in various parts of the Gardens, and it is proposed to continue this so that the various orders may be well represented and may be easily found and studied.

The following orders have thus been treated:—

Leguminosæ.—A bare piece of grass on the further side of the lake has been selected for these, and planted with *Calliandras*, *Bauhinias* and various other plants of this order. They are doing well, and the *Bauhinias* especially are flowering well already though only recently planted. *Bignoniaceæ* have been grouped round one of the slopes near the main entrance near a fine *Stereospermum* belonging to this order. The *Coniferæ* and *Cycadeæ* are to be found on the hill near the aviary. A long border running from the *Amaryllid* beds to the entrance of the fernery is filled with *Scitamineæ*. A path behind and parallel to this in the shrubbery contains a series of *Aroids*. A collection of *Bromeliaceæ* has been arranged in a long bed running parallel to the road from Tyersall into the Gardens behind the row of sugar-palms. This ground was formerly occupied by a series of oblong beds representing various orders, but which were unsuitable and unsightly, owing to the soil and exposure not suiting many of the plants, while the stiff lines of the beds were very unpicturesque. The upper part of this piece of ground has been terraced and planted with roses, which there is reason to believe will do well there, and a long border has been made on the side nearest the Tyersall road and planted with plants useful in supplying cut-flowers for decoration, etc.

Other orders will be similarly arranged gradually, the less showy ones being located in less conspicuous ground, so that eventually we shall have a real botanical garden as well as a picturesque one.

Among other improvements is the conversion of a waste piece of ground behind the orchid house into a series of rockeries. This place was formerly an orchard of rambai trees (*Baccaurea dulcis*). Some of the trees were cleared out, and pathways left between the others, the spaces between the trees along the paths were filled with coral rock, and each mass was planted with plants of some group or groups such as naturally grow on shaded rocks. Thus, one is covered with *Begonias*, another with *Calathea*s and *Phryniums*, another with *Pellionias*, etc., and so on. These plants have grown remarkably rapidly, and many such as *Anæctochili* grow here better than in any other way. Between the rockery and the main road are some banks of *Arundo*, *Acalypha* and such like plants, and the whole of this portion of the Garden from the orchid house to the end is fenced in with barbed wire fencing. Two small rockeries have also been placed at the turning point of the road near the orchid house, beneath the bamboos.

Two very shabby looking beds close to the fine row of *Thrinax*, near the lake, have been removed, which has much improved the appearance of the spot.

Many of the trees in the Garden have been pruned and cleaned, a coolie being kept almost exclusively for this work.

Roads.

During the year, the new road from Tyersall to Cluny Road between the Gardens and Mr. BURKINSHAW'S property was completed and taken over by the Municipality. A new cart-road was made into the Garden from Garden Road to the plant-sheds so that cart traffic may not be required to go through the Gardens as formerly.

Lakes.

On July 15th, owing to the very heavy rainfall of 6.65 inches in the day, the large lake overflowed to such an extent that a portion of its bank was washed away, and it was only by strenuous exertions that the dam was saved from being broken through. The bank was afterwards raised to such a height that there is no likelihood of this accident occurring again. The *Nelumbiums* in the Nelumbium Lake having got very weak, the lake was drained and cleaned out, and the plants, with some additional ones, re-planted.

Plant-houses.

The large plant-house has been kept bright and full of interesting flowers. During the year there were good shows of *Gloxinias*, *Achimenes*, *Caladiums* and *Camellias*, as well as the ordinary annuals. Among the more unusual plants in flower were several species of *Didymocarpi* from Langkawi:—*Stauroanthera grandiflora*, *Carex scaposa*, *Lilium Harrisii*, *Crinum* (new species, Pekan), *Ouvirandra fenestralis*, *Anthurium Andræanum*.

Orchid House.

The Orchid House has been very successful this year, and has been a source of great attraction, a great variety of local and exotic orchids having been in flower. For some weeks there was a very fine show of *Phalænopsis grandiflora*, of which over three hundred plants were in bloom at one time. There were also a fine lot of *Calanthe veratrifolia*, *Sarcochilus lilacinus* and other commoner plants in bloom most of the year. Among the less frequently seen orchids in flower were *Dendrobium Dalhousieanum* (from a plant collected in Singapore), *D. hercoglossum*, *D. tuberiferum*, *D. metachilinum*, *Liparis venosa*, *Eria armeniaca*, *E. Lindleyi*, *Claderia viridiflora*, *Cirrhopetalum elegans*, *concinnum*, *medusæ*, and several undescribed species. *Calanthe rubens*, *C. Cecilæ*, *Cattleya eldorado* (with four flowers), *C. Trianae*, *C. Gaskelliana*, *Arundina densiflora*, *Spathoglottis Wrayii*, *Renanthera histrionica* and *Lowii*, *Aerides Lawrenceiæ*, *Arachnanthe* (new species from Pekan), *Sarcochilus arachnites*, *S. notabilis*, *S. unguiculatum*, *carinatifolius* (a new species from Christmas Island), *Oncidium lanceanum*, *Dipodium pictum*, *Saccolabium giganteum illustre*, *Goodyera* (new species from Singapore), *Geodorum purpureum*, *Coelogyne mayeriana*, *C. Cumingii*, *Plocoglottis javanica*, *Thecostele zollingeri*.

An interesting lot of orchids was received from Trinidad, and though they suffered a good deal from their long journey, many of them are doing well. Among these were species of *Catasetum*, *Epidendrums*, *Oncidium lanceanum*, *O. papilio* and *Lockhartia elegans*.

A number of orchids are found to grow much more readily out of doors than in pots in the Orchid House. Chief among these are the *Renantheras*, *Vandas*, *Arundina*, *Spathoglottis*. A bed of the larger kinds of these was made on one of the terraces below the band-stand, and seems to be doing very well. The *Anæctochili*, *Microstylis cuprea* and such soft-leaved plants grow better here in open rock work, though they are very subject to the attacks of snails here. A number of orchids have been planted on the trees and are doing very well, and often in flower.

Police.

It having been found, as stated in last year's report, that the Indian Police supplied to the Gardens were worse than useless, it was decided to replace them by Malays. These have, on the whole, worked better, partly from their being a more respectable set of men and partly from their being properly under control. There have, however, been a certain number of petty thefts of flowers and plants which were undetected.

There was only one prosecution, that of a Kling for cutting firewood in the Garden, who was convicted.

Coolies.

There was a good deal of sickness among the coolies in the early part of the year, chiefly from influenza and its sequelæ, and from the constant wet weather. In July, the Javanese, who had for some time betrayed an insolent and quarrelsome demeanour, became riotous and refused to work. They were immediately expelled the Gardens, and a month's wages due to them forfeited. In a few days several returned and implored to be taken on again, which, however, was refused. The experiment was then tried of using entirely Kling labour, but it was found that on the whole they were not so satisfactory. The better class were very well suited for weeding and trimming the beds and very speedily learnt the use of the scythe, but, with a very few exceptions, were almost useless at potting plants, and the more delicate plant work. Added to which the difficulty of finding any who could speak or understand Malay properly, made it difficult to communicate with them. Eventually Javanese were taken on again and are working more satisfactorily. From the large number of applicants of all races for employment in the Gardens immediately it was known that the Javanese had left, it is clear that there is no difficulty in procuring any number of coolies more or less capable of undertaking gardening work at a very short notice.

Buildings.

The only additional building of any importance erected this year was a house for the Artist, Mr. DE ALWIS, which was put upon the hill in the Military reserve adjoining that of the Forest Overseer.

A small glass frame was built on the site of the old house belonging formerly to the Forest Overseer, which was pulled down. It has proved very useful in germinating seeds and establishing delicate plants, and it is intended to build some more similar ones.

Aviaries.

The following animals and birds were presented or purchased at the Gardens this year:—

- One Orang Utan (*Simia satyrus*) presented by Lieut. KELSALL, R.A.
- One Wawa (*Hylobates agilis*) presented by Mr. W. DAVISON.
- One Black Monkey (*Semnopithecus niger*) purchased.
- One Silver Monkey (*S. Phayrei*) purchased.
- One Common Monkey (*Macacus sinensis*) presented.
- Two Marbled Cats (*Felis marmoratus*).
- One Binturong (*Artictis binturong*) presented by Mr. W. DUNMAN.
- One Sambur Deer (*Rusa equina*) presented by Mr. G. E. STEELE.
- One Kedjang (*Cervulus sp.*) presented by Mr. W. HUTTON.
- Three Mouse Deer (*Tragulus kanchil*) purchased.
- One Large Mouse Deer (*T. napu*) purchased.
- One Porcupine (*Hystrix longicauda*) presented by Professor VAUGHAN STEVENS.
- Two Raffles' Squirrels (*Sciurus Rafflesii*) purchased.
- Two Common Squirrels (*Sc. hippurus*) caught.
- One Little Squirrel (*Sc. tenuis*) caught.
- One Galago (*Galeopithecus volans*) caught.
- Two Musangs (*Viverra malaccensis*) one caught, one purchased.
- Two Slow Loris (*Loris tardigrada*) purchased.
- One Honey Bear (*Helarctos malayanus*) presented by His Excellency Sir CECIL C. SMITH, K.C.M.G.
- One Honey Bear (Bornean variety) presented by Mr. W. NANSON.
- One Manis and young (*Manis javanica*) purchased.

Birds.

- One Eagle, (*Aquila sp.*) presented by Mr. J. E. CLARKE.
- One Javanese Jungle Cock (*Gallus varius*) purchased.
- Two Small Green Parrots (*Loricula sp.*) purchased.
- Two Nicobar Pigeons (*Caloenas nicobarica*) presented.
- Two Wood Partridges (*Rhizotheres longirostris*) presented by Dr. MUGLISTON.

Reptiles.

- One *Python curtus*, presented by Mr. W. DAVISON.
- Two *Python reticulatus*, presented by Mr. S. DOWN, and Mr. CAULFIELD.
- Two Green Vipers, (*Trimeresurus Wagleri*) caught.

There was a good deal of mortality among the animals this year, partly due to the excessive wet, which is very dangerous to birds during moulting, and due also to a certain amount of difficulty in getting a satisfactory aviary keeper in place of the former one who left during the strike of the coolies. The two greatest losses were the wild dog (*Cyon javanicus*), which there is reason to believe was poisoned, and the crowned pigeon, which died of an attack of diarrhoea. This bird had been over eleven years in the Gardens and was full grown when obtained. The large Orang-Utan, presented last year by Mr. NORMAN, also died of an attack of cholera, to which disease the anthropoid apes seem very subject. The whole of the aviaries were repaired and a new shed was made for the mouse deer.

Flower Show.

The Flower Show was held on March 25th and 26th, during the visit of H. R. H. the Duke of CONNAUGHT, who, with the Duchess, visited the exhibition on the evening of the first day. There were a larger number of exhibitors than on previous years, and in addition to the exhibits from Singapore, Johor, Penang and Malacca, a large series of fruit, rattans, coffee and other produce was sent down from Perak. The orchid exhibits were particularly noteworthy and the agricultural products were better than any that have been shown before.

Experimental Garden.

This garden, which was formerly under the Forest Department, is now transferred to the Gardens, which is a more satisfactory arrangement, as it had long ceased to be solely used as a nursery of forest trees, but during the last year it was kept as in former years. A small band of men alone could be afforded out of the forest votes, and they were not able to do much more than keep the beds and walks clean, and do a small amount of propagation. The *Lygodium* and other climbing plants which were smothering the young trees in the nursery, were cleared off, and the whole ground cleared of unnecessary bushes and grass. The sugar canes, which had showed signs of suffering from Serch-disease, were cut down and replanted in a different spot where they are thriving.

A large number of cuttings of *Dendrocalamus strictus* were made and planted and seem to be doing well. There is a great demand for this (the male bamboo) for lance handles for the cavalry and it seems to be increasingly difficult to procure. The plants in the Botanic Gardens seem to be of good quality, and if propagated on a large scale will be in all probability a profitable cultivation.

The Para-Rubber trees continue to thrive in the damper spots, and those that are old enough to cut, produce a considerable quantity of rubber, which appears of good quality. Samples have been sent to England for analysis. If the quality is satisfactory, this plant will be well worthy of cultivation in many spots of damp waste land in which few other crops can be grown without great expense in draining.

Treculia africana.—The African bread-fruit fruited several times last year, which hitherto it has not done. The fruits were, however, perfectly worthless and quite uneatable.

The Maltese lemons fruited well, for the first time. The fruits were of good size and flavour, but the soil is very poor at the place in which these trees are planted.

The Figs also fruited again, but scantily.

The Gayam (*Inocarpus edulis*) fruited more largely this year than in previous years. The seeds boiled resemble chestnuts and are very good to eat.

Gambier.—The seed, sent out the previous year as described in last year's report, and stated to have failed, I have since heard, were not by any means failures in all cases. The Royal Gardens, Kew, raised some hundreds of young plants which were carried to Jamaica by Mr. MORRIS, for introduction there. Young plants were also sent this year to Ceylon where they appear to be thriving.

Renghas (*Gluta renghas*).—A large number (over a thousand) seeds of this plant were obtained from Pahang, by the aid of Mr. BELFIELD. The seeds germinated readily and a number of plants raised, which are being planted out in the Forest Reserves. The timber is of very fine quality, but the poisonous resin which exudes from the tree when broken or cut makes it a difficult plant to handle safely.

Billion (*Eusideroxylon Zwageri*).—A number of seeds were obtained from Borneo and planted. Hitherto seeds received have refused to germinate though tried in various ways and under various conditions, but of the last lot received, a number have germinated and become small but healthy looking plants, their growth is very slow, and, like other hard-shelled fruits, seem to be quite irregular in the time they take for germination. The seeds are very expensive owing to the great difficulty of obtaining them.

Professor VAUGHAN STEVENS brought down to Singapore a number of plants used by the wild tribes in Kemaman for preparing the arrow poison—Ipoh. Some of these have been identified. They include two species of *Strychnos* (*S. tieute*) and another species, Gadong (*Dioscorea daemonum*), *Laportea crenulata* (the fire-nettle), *Cnesmone javanica*, and two species of rattans. The different tribes use, some one, some others, of these plants in the preparation of the Ipoh, and some use no plants at all but certain portions of some of the poisonous fishes, but all use the juice of *Antiaris toxicaria*, yet it appears from samples of the juice of this plant sent to Kew that there is no poison at all in it: whether the samples forwarded to Kew deteriorated on the way or whether the plant is only poisonous in combination with certain other substances remains to be seen.

Vegetables.

One hundred and thirty-nine (139) packets of vegetable seeds were received from the firm of DAMANN of Naples. They included different forms of most of the ordinary vegetables. The lettuces and radishes grew fairly well and were superior in flavour to the ordinary Chinese kinds, but the latter were rather tough and hot. The dandelion thrived very well and makes a good salad plant besides being medicinal. The chicory has also grown very well and strong, and though very bitter would make a good addition to a salad. There is here always the difficulty of making these vegetables set seed, and so continue their propagation. Without which even if they can be layered or reproduced by cutting, they sooner or later deteriorate. The pumpkins grew to large size, but it was found impossible to get them completely ripe, as they fell off just before ripening or, if supported, ceased to ripen and showed signs of decay. They were, however, very good but did not cook quite soft enough. The melons germinated well but the young plants were eaten down to the ground by crickets during the night. The ordinary vegetables so often tried here before were no better than in previous year. The tomatoes failed to fruit and the carrots, except the short-horn variety, were poor and stringy.

Herbarium.

A very large number of plants were added to the herbarium this year and the herbarium keeper was constantly employed in mounting them and they were arranged in the cabinets when done. In order to facilitate the drying of the specimens, a small and simply constructed drying-room was built on the outside of the office, which proved of the greatest success. It is heated when required by chatties full of charcoal placed on the ground, above them is a platform of corrugated iron on which the specimens are laid to dry, the whole is enclosed with brick walls and roofed with wood, above which is a higher roof of tiles continuous with that of the office. Its use has saved a great deal of time, as the plants and other specimens dry much more rapidly than they otherwise would, and look better when done. Of herbarium specimens, an extensive series has been collected in Singapore by myself and by the Forest Overseer and watchmen, and collections have also been made in Johor, Pulau Tekong and Pulau Ubin. From Malacca, Mr. DERRY sent in 290 specimens, and the Hon'ble D. F. A. HERVEY presented about 100. During a fortnight's expedition to Pahang, I obtained about 600 plants from the district round Pekan, and Kwala Pahang, among which were several new and rare species of interest. Dr. HAVILAND also sent some from the same region. In April and May a collector was employed in obtaining specimens in Selangor, along the new line from Kwala Lumpur. Mr. CURTIS went up first to examine the place and start the collector and obtained a large number of plants, but the collector when left to himself was not very satisfactory. It seems to be very difficult to get a native collector who will work without European supervision.

From Perak and India, Dr. KING sent 584 named and mounted plants, chiefly from the collection of WRAY and SCORTECHINI, and Mr. WRAY himself presented 7 specimens.

From Kedah, Langkawi Islands, Perak and Penang, Mr. CURTIS sent a large collection containing very many of interest.

Dr. KEITH presented 611 specimens from Siam.

Mr. GUSTAVE MANN sent a valuable collection of named ferns from Assam, in exchange for a number of Straits ferns.

Professor VAUGHAN STEVENS sent a small number of specimens of the plants used in the manufacture of Ipoh arrow poison, by the Sakeis of Kemaman.

From Borneo, Dr. HAVILAND sent 157 plants, and Mr. HULLETT 110.

Through the kindness of Dr. BURCK of Buitenzorg Gardens, I obtained a good series (108) of specimens of the *Dipterocarpaceæ* and *Sapotaceæ* of the Malay Archipelago, and three specimens of orchids of interest.

Baron F. VON MUELLER sent 446 plants from Australia in exchange for Straits plants.

During a short visit to Christmas Island, I obtained a few specimens of the flora peculiar to that Island, and also a few at Angier Point in Java, including a new and curious species of *Panicum*.

Of other botanical specimens, Mr. COCK, of Perak, presented a collection of prepared rattans, and a series of rattans was also obtained in the island of Singapore with the native names.

Datoh MELDRUM presented a number of specimens of timber from the Johor Sawmills, and other specimens were collected as opportunity offered.

The collections of guttas, resins, fruits, timbers, etc., formerly preserved in the Museum, are being transferred to the Gardens, where they will be of more use and available for study.

It is still found very difficult to keep down mould in the collections, as there is no means of drying in the herbarium and office during heavy rains, and even specimens previously thoroughly dry often become mouldy on these occasions.

Specimens were sent to Dr. KING, Calcutta; the British Museum; Baron F. VON MUELLER (in exchange for Australian plants); Sir JOSEPH HOOKER, Mr. C. B. CLARKE, and Mr. BAKER, at Kew, and Prof. HACKEL, of St. Polten.

Outside Work.

A large number of trees consisting of *Pterocarpus indicus*, *Inga saman*, *Eugenia grandis* and *Poinciana regia* were planted along the face of the Esplanade, where the ground has been enlarged. The *Pterocarpi* and *Poinciana* have grown well but the *Eugenias* for some reason have not been so successful. They were badly attacked by beetles at first but are now mostly recovering.

In the Government House grounds the trees have been pruned, and additional ones planted, while a number of old and worthless ones have been removed.

Artist.

In March, Mr. DE ALWIS arrived from Ceylon and was employed out of the vote for the publication of the Malay Flora, in making drawings of the rarer and more interesting plants of the Peninsula. He executed seventy-eight highly finished and accurately coloured drawings.

The Coco-nut Trees Preservation Ordinance.

In the early part of the year an Ordinance was passed, the object of which was to prevent owners of coco-nut trees and others from permitting the beetles, so destructive to the coco-nut trees, to breed in their property, and to infect that of others. A report was published by myself in the Journal of the Asiatic Society in Singapore on the subject, and the outcome of this was the above-mentioned Ordinance. The greatest amount of injury inflicted on the cultivators was due to the small holders of a few trees to whom the destruction of these trees by beetles was of little moment and it was evident that steps were required to prevent these persons from inflicting injury on others. On the passing of the Ordinance, in July, a coco-nut trees inspector was employed at a salary of 15 dollars a month, who, with two coolies, inspected all the plantations of coco-nut trees, and all places where it was probable that there were accumulations of cow-dung, tan-bark or other refuse in which the coco-nut beetles might be breeding. In every case where trees were found badly infected and where old decaying stumps or rubbish suited for the development of the black beetle were found, notices were served upon the owners, requiring them to destroy this material at once. In almost every case the proprietors willingly complied, but at first it was found requisite to summons a number of persons who ignored the notices served on them. With the exception of one or two, all on receiving the summonses immediately complied with the requirements, and were dismissed on paying the cost of the summonses. Since this it has been not found necessary to summons any one.

During the year two hundred notices were served and 4,854 trees and stumps condemned to be destroyed and thirteen piles of rubbish, manure and tan bark to be removed.

In most cases the timber of the trees was used as firewood, in some cases it was utilised by burying at a considerable depth to form a substratum for roads. Although it was understood that in cases of poverty the Government were prepared, on the explanation of the state of the case, to destroy the trees at its own expense, in no case did the owner plead that he was too poor to perform the work.

It is naturally difficult at first to see the effects of legislation in this matter, but there is little doubt but that the disease has received a check which could not otherwise have been brought about. In the Botanic Gardens, notably at one spot near the office, it was almost impossible to grow any palms at all. Those liable to attack were destroyed often within a day or two of their being planted; a small avenue of the rare and beautiful *Verschaffeltia splendida* by the aviary was perishing tree by tree, till the Act came into force. A large plantation near the Gardens, but not visible from it, together with a small number of trees in the Barrack-grounds, was cleaned, and the decaying trees removed, and the destruction rapidly diminished. At the end of the year, many of the palms which had been attacked were no longer subject to the injuries by the beetles, and now it is rare to find any among the palms. I may mention, as showing the futility of merely trusting to coolies employed on a plantation as beetle-killers, that on the plantation which did so much damage to the Botanic Gardens, there were two, and sometimes three coolies employed only in keeping the trees clean of beetles, yet it was in as bad a state as almost any neglected one in Singapore.

In looking over the whole results of the passing of the Ordinance, I believe that a very large amount of benefit has accrued to the Colony at a very small cost and without any friction.

Expenditure.

	\$	c.		\$	c.
Salaries, ...	131	44	Grant, ...	350	00
Transport, ...	33	84			
Removal of dead trees, ...	5	00			
Uniforms, ...	24	00			
	<hr/>				
	\$	194.28			

Plants and seeds were received during the year from the following contributors:—

	Plants.	Seeds.
Royal Gardens, Kew, ...	105	16 packets.
Botanic Gardens, Calcutta, ...	...	3 do.
Do., Ceylon, ...	53	2 do.
Do., Trinidad, ...	15	22 do.
Do., British Guiana, ...	...	2 do.
Do., Mauritius, ...	...	9 do.
Do., Adelaide, ...	...	18 do.
Do., Hongkong, ...	34	9 do.
Do., Saigon, ...	58	1 do.
Do., Saharunpor, ...	6	26 lbs.
Do., Buitenzorg, ...	153	37 packets.
Do., Port Darwin, ...	22	16 do.
Do., Melbourne, ...	...	24 do.
Do., Hainan, ...	...	1 do.
Do., Bangalore, ...	...	2 do.
Agri-Horticultural Society, Calcutta, ...	...	5 do.
Baron von Mueller, Melbourne, ...	...	27 do.
Messrs. Veitch & Son, London, ...	79	... do.
„ Sander, St. Albans, ...	17	... do.
„ Paul & Son, England, ...	52	... do.
„ Cannell & Son, England, ...	59	82 do.
„ Damman & Co., Italy, ...	...	139 do.
„ Reasoner Bros., Florida, U. S. A., ...	...	1 do.
Mr. Johnston, Sierra Leone, ...	...	48 do.
Mr. C. Laurie, Ceylon, ...	61	... do.
Dr. Keith, Siam, ...	40	... do.
Messrs. Chatterjee, Calcutta, ...	150	3 do.
Mr. Peter McClean, Brisbane, ...	...	1 do.
Mr. Gustav Mann, Assam, ...	20	... do.
Mr. Peché, Moulmein, ...	118	... do.
Rt. Revd. Bishop Hose, Borneo, ...	40	1 do.
Mr. Robelin, Singapore, ...	25	... do.
Mr. Ravensway, do., ...	50	... do.
Mr. McCan, West Coast Africa, ...	...	3 do.
Mr. Venning, Selangor, ...	12	... do.

	Plants.	Seeds.
H. E. the Governor, Malacca, ...	...	1 packet.
H. E. the Acting Governor, Singapore, ...	1	do.
Mrs. Barugh, Singapore, ...	...	2 do.
Mr. Wray, Perak, ...	...	1 do.
Mr. Belfield, Pahang, ...	...	10 sacks.
Mr. E. Koek, Singapore, ...	...	5 packets.
Mr. J. Purvis, do., ...	...	12 do.
The Hon'ble E. E. Isemonger, Singapore, ...	2	do.
Mr. Balfour Lees, do., ...	1	do.
Prof. Vaughan Stevens, Tringganu, ...	34	6 do.
The Hon'ble D. F. A. Hervey, Malacca, ...	...	1 do.
Mr. W. Nanson, Singapore, ...	12	do.
Mr. R. W. Hullett, do., ...	3	do.
Mr. Hilty, do., ...	32	do.
Dr. Leask, do., ...	1	do.
Mr. Pryer, Borneo, ...	...	1 do.
Mr. Justice Goldney, ...	...	1 do.

Plants and seeds were distributed to the following recipients:—

	Plants.	Seeds.
Royal Gardens, Kew, ...	63	9 packets.
Botanic Gardens, Calcutta, ...	80	10 do.
Do., Trinidad, ...	24	12 do.
Do., Jamaica, ...	...	1 do.
Do., Mauritius, ...	...	13 do.
Do., British Guiana, ...	20	11 do.
Do., Ceylon, ...	129	11 do.
Do., Hongkong, ...	80	10 do.
Do., Manila, ...	33	do.
Do., Saigon, ...	40	do.
Do., St. Petersburg, ...	30	do.
Do., Port Darwin, ...	14	12 do.
Do., Sydney, ...	...	3 do.
Do., Durban, ...	...	10 do.
Do., Bangalore, ...	...	10 do.
Do., Adelaide, ...	...	11 do.
Do., Buitenzorg, ...	25	do.
Do., Saharunpor, ...	...	2 do.
Do., Melbourne, ...	...	13 do.
Baron von Mueller, Melbourne, ...	...	2 do.
Under Secretary for Agriculture, Brisbane, ...	...	9 do.
Rt. Rev. Bishop Hose, Borneo, ...	13	do.
Mr. A. Ross, Christmas Island, ...	80	do.
Colonial Secretary, Sandakan, ...	86	2 do.
Dr. Collier, America, ...	...	3 do.
Professor Lawson, Madras, ...	17	do.
Mr. F. Griffith, Nilgiris, ...	26	do.
Mr. Huxley, Ceylon, ...	52	do.
Messrs. A. L. Johnston & Co., Pahang, ...	...	6 do.
„ Reasoner Bros., Florida, ...	...	3 do.
„ Dammann, Italy, ...	...	36 do.
„ Veitch, London, ...	9	do.
„ Bull, „ ...	265	do.
„ Sander „ ...	270	do.
„ Williams, „ ...	31	do.
„ Williams Bros., Ceylon, ...	12	do.
Professor D. Scott, Glasgow, ...	...	1 do.
Mr. F. McCan, W. Africa, ...	17	do.
Mr. E. Koek, Singapore, ...	14	do.
Mr. Ravensway, Singapore, ...	270	do.
Mr. Justice Goldney, „ ...	2	do.
His Excellency the Governor, Singapore, ...	50	do.
Mr. G. Peché, Moulmein, ...	105	do.
Mr. Venning, Selangor, ...	50	do.
Supt. Education, Penang, ...	120	do.
„ „ Malacca, ...	34	do.

Library.

The following books have been added to the Library during the year:—

- GARDENER'S CHRONICLE from 1866 to 1877, purchased.
 FLUCKIGER & HANBURY.—"Pharmacopœa," purchased.
 WALLICH.—"Magnoliaceæ," purchased.
 KING, Dr.—"Artocarpeæ and Quercus,"
 KURZ.—"Flora of the Andamans,"
 ——"Flora of British Burmah," } presented by Dr. KING.
 WATT.—"Dictionary of Indian Products," purchased.
 FILET.—"Plantkundig Woordenboek," purchased.
 VEITCH.—"Orchidaceous Plants," Part V and Part VI, purchased.
 WILLIAMS.—"Orchid Album," Part 101, purchased.
 BECCARI.—"Malesia," Vol. III, Part V, purchased.
 MIQUEL.—"Systema Piperacearum," purchased.
 ——"Observationes de Piperaceis et Melastomaceis," purchased.
 ——"Mantissa Piperacearum," purchased.
 GRIFFITH.—"Indian Balanophoræ," purchased.
 KURZ.—"Preliminary Forest Report of Pegu," purchased.
 LABILLARDIÈRE.—"Memoire sur deux espèces de Litchi cultivées dans les
 Moluques," purchased.
 REINWARDT.—"Plantæ Indiæ Bataviæ," Fasc. I and II, purchased.
 WIGHT.—"Indian Botany," Vols. I and II, purchased.
 ——"Illustrations of Indian Botany," purchased.
 ——"Do. do., Supplement," purchased.
 MARSHALL-WARD.—"Diseases of Timber Trees," purchased.
 JUNGHUHN.—"Über Javansche Balanophoreen," purchased.
 ZOLLINGER.—"Systematisches Verzeichniss," purchased.
 HOOKER.—"Icones Plantarum," Vol. XI, Part I, 3rd Series, presented by the
 Benthām Trustees.
 DANA, J. D.—"The American Journal of Science," Vol. 37, No. 218, presented.
 TREUB, Dr.—"Annales du Jardin Botanique de Buitenzorg," Vol. }
 VIII, 2nd part, do. do., Vol. IX, 1st part, } presented.
 WOOD MEDLEY.—"Catalogue of Plants in the Natal Botanic Gardens, Durban,"
 presented.
 ROSCOE.—"Monandrian Plants," purchased.
 HORANINOW.—"Prodromus Monographiæ Scitaminearum," IV, 1862, purchased.
 BROVSMICHE, ED.—"Étude sur la creation d'un Jardin d'acclimatation au Tonkin,"
 presented.
 KRUGER, D. W.—"Berichte der Versuchsstation für Zuckerrohr in West Java,"
 presented.
 BOERLAGE.—"Flora van Nederland Indie," Part II, purchased.
 KING, Dr.—"Materials for a Flora of the Malayan Peninsula," No. 2, presented.
 BAKER.—"Handbook of the Bromeliaceæ," purchased.
 RIDLEY.—"On the method of Fertilization in Bulbophyllum Macranthum and allied
 Orchids," presented.
 MUNSON.—"Classification and Generic Synopsis of the wild Grapes of North
 America," presented.
 ——"List of Chinese Medicines," Nos. 8 and 17, purchased.
 GRESHOFF.—"Nededeelingen 'S Lands Plantentuin," VII, presented.
 ——"Verslag 'S Lands Plantentuin te Buitenzorg," 1889, presented.
 FAWCETT.—"Bulletin of the Botanical Department, Jamaica—Fibres," presented.
 REGEL, Dr.—"Acta Horti Petropolitani," Vol. XI, fasc. I, presented.
 RILEY & HOWARD.—"Insect Life," Vol. 2, Nos. 7, 8 and 9, presented.
 WHITEHEAD.—"Third Annual Report on Insects and Fungi injurious to the crops
 of the farm, the orchard and the garden," 1889, presented.
 PRAIN, Dr.—"Directions for drying specimens of plants for a herbarium,"
 presented.

The annual Reports of the following Gardens have been received:—Hongkong, Ceylon, Calcutta, Trinidad, British Guiana, Jamaica, Adelaide; also the Gardener's Chronicle, Journal of Botany, Linnean Society's Journal, Tropical Agriculturist, Chemist and Druggist, Indian Forester, Botanical Magazine, Florida Despatch, Illustration Horticole, Orchid Album.

BOTANIC GARDENS, SINGAPORE.

Statement of Receipts and Expenditure for the year 1890.

RECEIPTS.		EXPENDITURE.	
	\$ c.		\$ c.
By Balance in Bank, ...	789 90	<i>Salaries.</i>	
„ Government Grant, ...	8,500 00	Herbarium Keeper, ...	180 00
„ Sale of Plants and Flowers, ...	559 54	Chief Mandor, ...	174 00
„ Interest, ...	35 34	Carpenter, ...	167 00
		Assistant Carpenter, ...	82 00
		Printer, (label), ...	120 00
		Assistant Printer, do., ...	55 40
		Peon, ...	87 00
		Aviary-keeper, ...	76 29
		Mason, ...	120 20
		Garden Police, ...	283 09
		Coolies, ...	3,049 99
		<i>Bills.</i>	
		Purchase of Plants and Seeds, ...	560 71
		Manure and Cartage, ...	265 58
		Wood for construction purposes, ...	164 03
		Food for Birds, etc., ...	494 01
		Tools and Stores, ...	778 19
		Flower pots and tubs, ...	364 30
		Botanical Books, ...	178 09
		Laterite, ...	764 90
		Repairs to Buildings, ...	472 87
		Inspector of Police, ...	47 40
		Coral Stone for Rockwork, ...	138 89
		Director's Petty Expenses, ...	378 80
		Assistant Superintendent's Petty Expenses, ...	179 98
		Wardian cases and plant cabinets, ...	159 00
		Rent of Quarters for Mandore, ...	63 00
		Miscellaneous, ...	316 40
			4,394 97
			5326-15
			9,026 15
			9,720 12
		Balance,	73 46.
	\$9,884 78		\$9,884 78

REPORT OF THE FOREST DEPARTMENT OF SINGAPORE.

Area.

The total area of the Forest Reserves now in Singapore is 14,518 acres, 2 roods, 23 poles. This gives an increase of 1,553 acres, 1 rood, and 23 poles over that in last year's report. This is due to a revised survey completed this year and to the addition of a small patch of good virgin jungle and a little mangrove swamp at Toas and Tengek river.

Boundaries.

The boundaries are now completed and are kept clear of lalang and fern, and the stream and swamps bridged. They have been constantly inspected by myself and by the Forest Overseer.

Forest Watchmen.

The total number of Forest Watchmen employed was twenty-three; comprising 1 Corporal, 5 Lance-Corporals and seventeen men. All worked well, and there were no complaints against them. They were supplied with uniforms during the year.

Buildings, &c.

Five new Forest Stations have been built or re-built at a cost of \$25 each. Two new boats were purchased in December, one for the Changi Reserve, the other for the Jurong and Pandan Reserve.

Farming.

The experiment of letting the few still existing cultivated encroachments on the plan adopted by the Dutch in Java, has met with a certain amount of success. The lessee receives the crops at a fair rent, undertaking to protect and cultivate the young timber trees planted among the crops and to keep the whole free of lalang and fern, so that after the lapse of a few years, the ground formerly covered with crops of pepper or gambier is covered with timber trees, at a very small cost to the Government. If when an encroachment is found the crops are merely destroyed, the ground would speedily be covered with lalang and it would be expensive work to clear it again for planting. The lessee of the crops keeps this down for the benefit of his cultivation, and at the same time manures the plants to a certain extent, the advantages of which are reaped by the young trees.

The Dutch in Java, I am informed, have adopted this plan to a very large extent, all the land which is let by the Government to cultivators, is let on these terms, and it might be worth while, when opening up new country in the Peninsula, to planters to ensure a future supply of timber by adopting this plan on a large scale.

By the letting of cultivated encroachments and the sale of produce, a revenue of \$142 was obtained as stated below:—

Gambier encroachment, Bukit Mandi, let for	...	...	...	\$15
Two pepper encroachments, " "	...	...	...	60
Durian trees, Bukit Mandi, crops let,	...	...	...	5
" Forest Nursery, " "	...	...	...	7
" Bukit Timah, " "	...	...	...	50
Lalang, three acres, let, " "	...	...	...	3
Sale of pepper from small encroachment.	...	...	...	2
				<hr/>
				\$142

Planting.

At Chan Chu Kang a batch of eight coolies was employed in planting ten acres of waste ground with Renghas seedlings (*Gluta Renghas*), and two men planted two acres of the same seedlings at Bukit Mandai. In both places the seedlings are very healthy and strong and growing well. The timber of Renghas is very valuable as it is hard and of a fine red colour, like mahogany, but the very poisonous black resin which exudes from the tree when cut makes it difficult to work. A fire-guard has been commenced along the edge of the Bukit Mandai Reserve at the 12th mile on the Kranji Road, and a large number of seedlings of various trees have been planted. There is a large tract of lalang here which abuts on the main road, which has been fired more than once by passers-by, so it was found necessary to clear this and plant it with trees in order to prevent this occurring again.

There is still a good deal of difficulty in getting seeds of the better class of timbers. Many of the trees rarely fruit, and of some such as kranji (*Dialium indicum*), tampenis (*Slætia*) and oaks and chestnuts, as well as the Gutta grips (*Willoughbeia*), the fruits are devoured by the monkeys before they are ripe. Again, in Singapore and other accessible places, almost all the valuable timber trees have been in past time so extirpated that it is difficult to find now any old enough to give fruit. Consequently it is necessary to procure seeds from far distances, from country less opened up, as Pahang.

Fires.

The total number of fires which occurred this year within the reserves was 12, one at Jurong burnt down three acres of lalang, another at Pandan and Jurong destroyed about 30 acres of lalang and brushwood. At Bukit Timah some brushwood and some newly planted seed lines were burnt. At Seletar about 30 acres and at Ang Mo Kio about 70 acres and at Bukit Panjang, Chan Chu Kang, Kranji and at Bukit Mandi smaller patches were burnt, all consisting of grass fires, with which in some cases small trees and bushes were destroyed. The rapid and easy ignition of grass on hot days, makes it exceedingly difficult to detect the offenders or to prevent the destruction.

Prosecutions.

There were nineteen prosecutions in all instituted in the year, for cutting and removing timber from the reserves; of these, two were withdrawn, and in seventeen cases the persons arrested were convicted and fines to the amount of \$451 inflicted, of which \$76 was paid.

Expenditure for 1890.

Vote,	\$4,000.00
Salaries,	\$3,044.22
Buildings,	125.00
Boats,	55.00
Uniforms,	161.00
Miscellaneous,	473.11
	<hr/>
	\$3,858.33
Balance,	141.67
	<hr/>
Total,	\$4,000.00

H. N. RIDLEY,

Director of Gardens and Forests, S.S.

APPENDIX A.

GARDENS AND FOREST DEPARTMENT, PENANG.

Mr. C. CURTIS, the Assistant Superintendent of Forests, reports as follows:—

Forest Reserves.

The reserved Forests in this Settlement being mainly on hill ranges in situations where the working of timber is, for the present, undesirable, and planting to any great extent unnecessary, the principal duties of the department consist in protecting these areas from the encroachment of timber cutters, squatters and fire; and this has been satisfactorily performed during the year.

2. Fifty prosecutions for cutting timber, and three for setting fire to Crown forest, were instituted, and fines to the amount of \$360 imposed on the offenders.

3. Confiscated jungle produce in connection with the above cases sold for \$41.18, which was duly paid in to revenue account.

4. One mile of new boundary line and inspection paths have been opened and thirty miles of old boundaries re-cleared, at a cost of \$358.

5. In order to keep a better watch on the Island of Pulau Jerejak, declared Reserved Forest in 1889, it was found necessary to purchase a native boat for the use of guards stationed there, as this and the north-west reserve, which includes the point on which Muka Head light is built, will, if properly protected, prove future sources of revenue.

6. The present timber supply is principally derived from the Dindings and Native States, and so long as it is maintained at its present point there is no necessity to draw on the small, and until recently over-worked, forest in Penang.

7. Much additional information as to the composition of the Forest Flora has been collected, a great number of specimens added to the herbarium, and upwards of two thousand specimens distributed. Dr. KING, in parts 1 and 2 of his "Materials for a Malayan Flora," has described several new trees from Penang.

8. The small herbarium of Penang plants, consisting of about three thousand sheets, on which practically nothing had hitherto been spent, has been mounted on white paper of the same size and quality as that used in Singapore and the whole systematically arranged in six cabinets at a total cost of \$201.10.

9. A catalogue of these, with the addition of those mentioned in the Flora of British India as having been collected in Penang by former collectors, but which are

not in this collection, has been compiled, and will, it is hoped, stimulate local Botanists to hunt for the missing ones, several of which are but imperfectly represented in any existing herbarium.

Waterfall Garden.

10. As in previous years the supervision of this garden occupied the greater portion of the Assistant Superintendent's time and it is satisfactory to note that (unlike most things in Penang) there is, year by year, an increased interest taken in its progress.

11. Owing to the unusually heavy rainfall the general work of maintenance, especially of roads and paths, absorbed a larger amount of labour than usual, and in addition to this two land-slips in the steepest part of the grounds occupied all hands many days in repairing the damage; on the whole a fair state of efficiency has been maintained and a considerable number of new works and improvements carried out by the garden staff, as detailed below.

12. Want of space in which to grow the rapidly increasing collection of plants necessitated the erection of an additional plant shed in the nursery, mainly for the cultivation of palms; this is a span roofed shed, 120 by 20 feet, the supports being hardwood scantling 5.6 inches in diameter, and the roof of Bertam chicks painted green.

13. To provide for a want that has often been pointed out by visitors a summer house capable of sheltering from rain or sun twenty or more persons has been put up near the band-stand, where it will be equally useful on band nights. The back and sides of this are built of rough rock-work and planted with a variety of ferns and other ornamental plants.

14. The construction of a new cascade in the main stream is not only an additional feature of interest but serves to check the rapid wearing away of the banks on either side which has been going on for years.

15. A dam, fifty feet long thrown across the entrance to an old stone quarry in a secluded part of the garden, forms an excellent swimming bath, sixty-eight feet long by fifty-six in breadth, with an average depth of about five feet, and also supplies the plant sheds with water. At a meeting of the Garden Committee it was decided that a caretaker be placed in charge and that an annual subscription fee of one dollar be charged to residents and ten cents for each visit to strangers; and although the dressing shed was not quite finished on the 31st December, residents commenced using it and up to the present (January 10th) more than one hundred have notified their intention of subscribing.

16. One of the old sheds in the nursery which was in a bad state has been re-built and the beds on which the plants are set built of rough stone. There is now no wooden staying remaining in this garden.

17. The large plant shed near the entrance, the interior of which is built of rock-work and planted with a great variety of ornamental plants, has been re-roofed with jungle rollers and "chicks." The doing this without damaging the specimen plants was a matter of some difficulty, and I would again point out the desirability of **T** iron being substituted for wood in the construction of plant sheds. Under the present system of temporary wood structures, plants barely attain to perfection before some portion of the building requires repair, in effecting which more or less damage is always done.

18. Two small bridges on the main circular drive originally built of wood have been permanently replaced by granite slabs, so that there now remains but the construction of new bridge over the main stream, for which provision is made in the Estimates for the current year to complete this portion of the grounds.

19. The side drains in the steeper parts of the garden are much damaged every year by heavy rains, and a commencement in the direction of remedying this has been made by constructing about seven hundred lineal feet in stone and cement, with the intention of continuing this as labour can be spared for the purpose.

20. Sloping, turfing and planting four acres of steep land on the north-west side, the clearing of which had been commenced in 1889, has been completed, and

the carriage road at the base made up and metalled.

21. The dense jungle in the ravine adjoining the plant nursery and extending parallel with the road to the garden bungalow has been thinned out and planted with a variety of plants suited to the various exposures, whereby the appearance of this portion of the grounds has been greatly improved. I regret to say that wild pigs did much damage not only here but in other parts of the garden, especially to aroids.

22. Clumps of palms and other ornamental trees have been planted in various portions of the garden, most of which had been grown to a moderate size in pots, but the soil is such that I fear there is little probability of this garden ever possessing such magnificent specimens as are to be found in some other botanical gardens and I have, therefore, aimed rather at developing it in another direction. A group of tree ferns collected in Perak and Selangor have been planted in partial shade by the stream near upper bridge and are doing well. These are the only two species I have observed growing in full sun at or near sea-level.

23. Several plants of great interest flowered in the grounds and plant sheds during the year, the South American orchids such as *Cattleya*, *Anguloa*, *Peristeria*, &c., specially attracting the attention of local orchid growers whose acquaintance with the order is principally confined to kinds obtainable in the Malayan Islands and the Peninsula. The interesting *Calanthe* from Langkawi recently described by Mr. RIDLEY, under the name of *C. rubens* flowered abundantly, as did also a new *Impatiens* from the same Island, but the latter has only one or two flowers open at a time. Plants were sent to Kew where it has recently flowered and been figured for the Botanical Magazine.

24. Although there has been during the whole year a number of more or less interesting plants to attract the attention of visitors, the finest show was *Calanthe vestita* and *Limatodes rosea*, of which about two hundred were in bloom at one time. Beautiful flowers are so much more difficult to obtain in this climate than fine foliage, and so many inquiries have been made as to the cultivation of this orchid that it may not be amiss to mention the system adopted. The most important point to be observed is to give the plants a long rest after flowering. From the time the flowers are fully open until the plant shows signs of commencing to grow again, a period of about three months, not a drop of water is necessary. As soon as the growths are from half to three-quarters of an inch long they should be shaken out of the old soil and repotted in a mixture of leaf-mould, broken bricks, chopped moss and cow manure, and water applied sparingly until the pseudo bulb begins to swell, when more liberal watering, and even manure water is beneficial.

25. The labelling of plants in pots with indestructible zinc labels, a work much needed but one that had to be postponed from time to time on account of more pressing matters, has at length been commenced and will, I hope, be pushed on during the current year.

26. Two performances by the Austro-Hungarian band were given on moonlight nights in the beginning of the year when the grounds were illuminated with Chinese lanterns, the cost of which as well as the band was provided by subscription.

27. Arrangements were made for the reception of His Royal Highness the Duke of CONNAUGHT by erecting triumphal arches at the entrance to the garden, &c., but unfortunately His Royal Highness did not arrive in Penang until evening and proceeded to Singapore the same night.

28. I regret to say that theft of plants has been by no means uncommon and although three persons were arrested and punished for removing plants of no great value, in the more important cases no arrests were made.

29. The revenue from sale of plants increased from \$75 in 1889 to \$220.08 in 1890, and there is every probability of this sum being exceeded during the current year.

30. The total expenditure in connection with this garden, including new works and improvements, the more important only of which have been referred to, amounts to \$5,494.51 as shown in the statement of expenditure annexed.

Government Hill Gardens.

31. The removal of coolies from the Experimental Nursery in 1889 proved beneficial, there being now very few cases of fever as compared with previous years. The appointment of Mr. O'KEEFFE as Overseer has not, however, resulted in improvements to the extent anticipated; and in saying this I do not in any way reflect on Mr. O'KEEFFE, who is, in many respects, an excellent man but lacking the practical knowledge of gardening that can only be acquired by long experience where plants and vegetables are well grown. Nothing less than a good practical working gardener will bring these gardens to the point they are capable of attaining.

32. Mr. O'KEEFFE reports, and my own weekly visits confirm his opinion, that the Chinaman in the vegetable garden have worked well, and the result has been a constant and fairly good supply of such European things as carrots, lettuce, celery, &c., as well as some of the best native kinds, so that occupants of the bungalow have never been short, while a fortnightly supply was, for some months, sent to Singapore.

33. Rose beds have from time to time been lightly pruned and manure applied about every two months, and the supply of blooms constant throughout the year. In this climate where there is neither a cold nor a dry season to induce rest, these and many other plants, natives of more temperate regions, wear out rapidly, and can only be kept up by frequently renewing the stock.

34. Owing to the presence of a great number of workmen and litter of material consequent on construction of new wing to Government Bungalow, the grounds and flower beds have not been so neatly kept as would otherwise have been the case. The formation of tennis court and many improvements in connection with this part of the grounds will fall into another year's work.

35. Since the removal of pot plants, &c. from Experimental Nursery to top of Government Hill, on account of severe and frequent attacks of fever among the men employed, the cultivation of fruit trees is the most important work in this nursery. These have been cleaned, pruned and manured twice with cow manure, burnt earth and bone dust. A few of the lemons and oranges introduced from Malta and Australia have borne fruit, but the quality, so far, is indifferent. Olives are looking healthy, but show no sign of fruiting. Avocado pear grows luxuriantly and should commence bearing soon. Peaches grow well, but this year there has not been a single fruit, owing, I think, to the excessive rainfall, amounting to about 160 inches for the year.

Coco-nut Trees.

36. In October, Mr. XAVIER was appointed Inspector under the Ordinance for Preservation of Coco-nut Trees, and although but few prosecutions have yet been instituted, a great number of dead trees and rubbish likely to prove breeding places have been destroyed. It is satisfactory to find that the majority are inclined to comply with the terms of the Ordinance and only ask for more time, but there are, as might be expected, some whom it will be necessary to compel to perform the work.

37. The greater number of dead and badly affected trees belong to small owners, while the large estate containing tens of thousands have scarcely a bad tree. This is attributable to two causes, first the greater care and attention bestowed, and second the absence of suitable breeding places when at some distance from human habitations.

38. The Inspector has gone over the whole of Penang Island and compiled a list of owners and the number of dead or affected trees belonging to each, the approximate total number being about 3,000.

39. The total number of healthy trees in full bearing is approximately 2,852,000; and the lowest estimate of value I have had from a competent judge is thirty cents per annum per tree, while in certain places one dollar is not considered too high. Taking the lowest figure for the basis of an estimate the annual crop of Penang Island alone is worth \$8,556 without taking into consideration Province Wellesley which has not yet been estimated.

General.

40. Excursions to Selangor, Perak and Langkawi Islands, for the purpose of collecting herbarium specimens and plants for garden cultivation, &c., have been undertaken; the three trips occupying twenty-nine days. A large number of both living and dried plants were obtained on each occasion and the latter have been distributed to the Botanic Gardens of Singapore, Calcutta, Kew, &c., only one set being preserved for reference in Penang. Many interesting *Gesneriaceæ* and other plants, both living and dried, were collected in Langkawi, some of which appear to be new, but owing to other duties it was not possible to find time to arrange the dried specimens for distribution until near close of the year, and the living plants were not sufficiently established to travel.

Langkawi is a delightful place and the botanical collector who is fortunate enough to visit these Islands at the most favourable season will reap a rich harvest. The most intelligent natives say that the large trees flower during the dry season, which is, no doubt, true, but I suspect, as in Penang, good flowering season only occur at intervals of from three to five years or more. I noticed on one of the smaller islands a gigantic *Bassia*, and on Gunong Raya the natives quickly collected a quantity of dammar for torches from a species of *Dipterocarpus*; but in both cases the specimens are too imperfect for determination.

41. At the request of the Director specimens of gutta were forwarded from the Dindings, and subsequently efforts were made to obtain a supply of seeds for planting, without success. The kind of which seeds are particularly wanted is *Payena Leerii*, known as "Getah SundeK." It appears to be a free flowering tree, but seeds are difficult to obtain and the only one I have ever seen was kindly sent me by Mr. L. WRAY of the Perak Museum. There is a species closely allied to this in Penang, which I have carefully watched for two seasons, and although flowers were abundant not a single fruit formed.

42. The planting community in Province Wellesley having shown considerable interest in the raising of sugar cane from seed, two considerable sowings in boxes and pots in various situations were made, but a very small germinated, I should say one in millions; and several of these have since dried off.

43. Liberian coffee planted at Kubang Ulu in the nursery where it has received no particular attention has done well and is undoubtedly a cultivation that would pay on some of the land in that district now laying waste; one thousand young plants have been distributed free to natives who made application for them.

44. The usual interchange of plants and seeds has been continued, the number of plants received being 1,264 and seeds 64 packets; while the numbers distributed are plant 6,213 and seeds 10 packets.

Thanks are herewith tendered to correspondents who have so kindly contributed plants and seeds to the Gardens.

*Revenue and Expenditure of the Gardens and Forest Department,
Penang, 1890.*

REVENUE.	EXPENDITURE.	
	SALARIES OF ESTABLISHMENT.	\$ c.
	Assistant Superintendent, ...	1,800 00
	Overseer, Hill Gardens, ...	600 00
	Overseer, Waterfall Gardens, ...	360 00
	Sergeant of Forest Guards, ...	360 00
		\$ 3,120 00
	Salaries of Forest Guards, ...	625 80
	Maintenance of Kubang Ulu Nursery and Reserve, ...	284 99
	Office Assistant and Messenger, ...	202 33
	Maintenance of Boundary Lines, ...	358 00
	Purchase of Sampan, ...	25 00
	Removing Timber, ...	8 50
	Oil for Forest Stations, ...	13 80
	Rent of Temporary Quarters, ...	6 00
	Freight on Plant Cases, ...	14 00
	Manure for Nursery, ...	12 00
	Collecting Botanical Specimens, ...	60 14
	Materials for Herbarium, ...	201 10
	Miscellaneous, ...	52 94
		1,864 60
	Balance, ...	535 40
		\$ 2,400 00
	Salaries of Gardeners and Coolies, ...	2,923 26
	Purchase of Plants, ...	74 38
	„ „ Pots, ...	58 36
	Freights, ...	10 30
	Cartage, ...	17 50
	Material for repairing Plant Shed, ...	95 22
	„ „ new Plant Shed, ...	156 36
	„ „ Swimming Bath (part), ...	31 65
	„ „ new Potting Shed, ...	50 91
	Granite for permanent Bridge, ...	107 01
	Material for new Summer House and Shelter, ...	43 83
	Tools and Miscellaneous Materials, ...	320 93
	Petty Expenses, ...	98 30
	Miscellaneous, ...	9 26
		3,996 97
	Balance, ...	3 03
		\$ 4,000 00
Government Grant-Maintenance of Forest Reserves, \$2,400.		
Government Grant-Maintenance of Waterfall Gardens, \$4,000.		

*Revenue and Expenditure of the Gardens and Forest Department,
Penang, 1890,—Continued.*

REVENUE.	EXPENDITURE.	
		\$ c.
Laying out Waterfall Garden, \$1,500.	{	Salaries, 1,090 33
		Cartage, 162 45
		Manure, 42 80
		Material for Dam, 129 19
		„ „ Bridge Rail, 72 77
		1,497 54
		Balance,... 2 46
		\$1,500 00
Maintenance of Grounds of Government Bungalow and Experimental Nursery, \$2,000.	{	Salaries, 1,663 75
		Manure, 253 43
		Seeds, 13 57
		Tools and Materials, 66 76
		Miscellaneous, 1 89
		1,999 40
		Balance,... 0 60
		\$2,000 00
Travelling and Personal Allowance, \$850.	{	Pony Allowance, 432 00
		Transport and Field Allowance, 21 36
		Expenses in connection with Botanical Tours in Selangor; 126 43
		Do. do. in Perak, 58 78
		Do. do. in Langkawi, 89 60
		Do. do. Visit to Singapore on duty, 71 43
		799 60
		Balance,... 50 40
		\$850 00
Expenses in connection with carrying out Ordinance for Preservation of Coco-nut Trees, \$350.	{	Salaries from 1st Oct. to 31st December, 129 31
		Transport, &c., 30 50
		159 81
		Balance,... 190 19
		\$350 00
		Total Expenditure for the year, ... \$13,437 92

APPENDIX B.

GARDENS AND FOREST DEPARTMENT, MALACCA.

Mr. R. DERRY, Assistant Superintendent of Forests, reports as follows :—

Bukit Sabókor Garden.

1. The principal work of the year has consisted of maintenance, general nursery work and planting, experimental cultivation, and clearing land.

2. The main drive has been kept in good repair by the Garden staff, and the entrance from the Batu Berendam Road has been raised so as to be above the water level during the rainy season.

3. An avenue of specimen local trees is being formed on the part of the drive which entirely belongs to the Garden, and a specimen of Penaga, Petaling, Kayu Minyak, Bilian Wangei, Gombang, Kudang, Meranti and Seraya, has been planted during the year.

4. A collection of ornamental shrubs and flowering plants for supplying Government grounds, and for general distribution, has been maintained throughout the year.

5. The Nursery work may be shown by the following analysis :—

Seeds sown.	Cuttings planted.	Seedlings transplanted.	No. of Kinds.	Trees prepared, box-planting.	No. of Kinds.
No. of Kinds. 74	4,000	12,681	26	11,381	75

6. Altogether 18,790 * trees have been planted during the year, which leaves a balance at the close of the year as follows :—

Forest trees ready for planting,	...	...	...	3,385
Fruit trees and other economics,	...	...	...	1,489
			Total, ...	4,874

7. An area of about 5 acres has been cleared at Bukit Sabókor Garden and the following trees planted :—

<i>Swietenia macrophylla</i> ,	Indian Mahogany,	...	...	767
Local bamboo,	Buluh akar,	...	...	82
<i>Fagraea peregrina</i> ,	Tembusu,	...	...	3,517
<i>Afzelia palembanica</i> ,	Merebau,	...	...	63
<i>Artocarpus chempedak</i> ,	Chempedak,	...	...	262
<i>Cinnamomum camphora</i> ,	Camphor,	...	...	58
			Total, ...	4,749

8. All the available land suitable for experimental cultivation has been cultivated throughout the year.

9. Egyptian cotton, annatto, tea and castor-oil, have been grown on the land adjoining the lake.

10. Egyptian cotton (*Gossypium arboreum*) gave a moderate crop, and a sample has been submitted to the Director of Gardens and Forests for report. Cotton could, doubtless, be grown as a first crop on freshly cleared land, but the soil of the Settlement generally is not rich enough for its cultivation.

11. Annatto (*Bixa orellana*) has grown well, and could be cultivated readily in almost any part of the Settlement.

12. Hybrid Assam Tea (*Thea chinensis*, var).—Tea has grown well, but is not yet old enough to experiment with. Towards the end of the year some havoc to the plants was done by white ants, frequent watering with Mauritius-hemp water had the effect of driving the ants away for some time.

* 12,283 brought forward from previous year.

13. Castor-oil (*Ricinus communis*), Calcutta variety, grows well and fruits freely. A sample of the oil prepared by boiling the seeds has been sent to the Director for report.

The oil had not any odour.

14. A piece of land has been cleared and partly planted with varieties of South American tapioca, but the stock is not yet large enough to experiment with. I do not think it probable that any of the varieties will equal the local variety as a tapioca producing plant, but some of the varieties are excellent for cooking.

15. Liberian Coffee.—Coffee planted on the ordinary soil of the Garden without manure has not proved a success. Coffee requires freshly cleared land or very liberal manuring.

16. Cloves (*Eugenia caryophyllata*).—The best success of any experiment has been with cloves. Some of the plants are now 10 feet high which shows a growth of 5 feet for the year. None of the plants have been manured beyond the admixture of a little burnt earth when first planted. The dry red soil of the Settlement suits cloves admirably.

17. Maltese lemons, nutmegs, Indian mahogany, camphor, West India crab-wood, and Mauritius hemp, reported on last year as growing well, have all made favourable progress during the year.

18. A stock of patchouli and croton-oil are kept, but extensive cultivation has been discontinued as the demand for these products is limited.

19. Towards the close of the year a large supply of seeds of the common fruit trees, such as rambai and rambutan, were sown. The duku crop was a failure, and mangosteens were not plentiful, so that a supply of these desirable fruits could not be obtained.

Forest Reserves.

20. The principal work of the year has consisted of preservation and maintenance of boundaries, planting, opening inspection-paths, and demarcating the Bukit Batu Tiga and Batang Malaka forest reserves.

21. The work of opening inspection-paths has proceeded as far as time and funds have been at my disposal, and two reserves have been completed, and two others commenced during the year.

22. The watchmen have worked well.

No fires have occurred, and two arrests for illicit wood cutting have been made.

23. Bukit Bruang Reserve.—An extension of the reserve has been made on the eastern side, as shown on plan A,* from the boundary to the road, between Bukit Kuau and the watershed of Ayer Keruh.

24. This extends approximately 300 acres, is chiefly bluker and contains a large proportion of young Tampines and Kledang.

25. The watershed of the proposed waterworks has also been added to the reserve, this extends about 500 acres, is chieflyalang, but contains a rich soil.

26. Planting up the watershed with useful timbers has been commenced and 8 acres have been planted as follows:—

<i>Fagraea peregrina</i>,	...	...	Tembusu,	...	4,026
<i>Slætia sideroxylon</i>,	...	...	Tampines,	...	2,280
<i>Pterocarpus indicus</i>,	...	...	Sena,	...	2,140
<i>Kumpussia malaccensis</i>,	...	...	Kumpas,	...	42
<i>Afzelia palembanica</i>,	...	...	Merebau,	...	340
<i>Artocarpus chempedak</i>,	...	...	Chempedak,	...	370
<i>Parkia Roxburghii</i>,	...	...	Sepeter,	...	40
<i>Phyllanthus emblica</i>,	...	...	Kayu Malaka,	...	388
<i>Calophyllum sp.</i>,	...	...	Mentangor bunut,	...	66
	...	...	Penaga,	...	11
<i>Hopea cernua</i>,	...	...	Seraya,	...	8
	...	...	Chindarahan,	...	9
<i>Diospyros sp.</i>,	...	...	Kayu arang,	...	18
	...	...	Minyak brok,	...	47
<i>Antiaris toxicaria</i>,	...	...	Ipoh batang,	...	16
Total,...					9,801

* Not printed.

27. Some planting has also been done near the Sago ground (point *A* plan *A*) and the following trees planted :—

<i>Hevea braziliensis</i> ,	...	Para rubber,	...	397
<i>Afzelia palembanica</i> ,	...	Merebau,	...	1,170
<i>Pterocarpus indicus</i> ,	...	Sena,	...	718
<i>Calophyllum sp.</i> ,	...	Mentangor bunga,	...	104
<i>Calophyllum sp.</i> ,	...	Mentangor bunut,	...	51

At the Sago ground.

<i>Sagus lævis</i> ,	...	Rumbia sagu,	...	1,600
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At Bukit Bruang.

<i>Calamus sp.</i> ,	...	Rotan manau,	...	200
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Total, ... 4,240

28. Root cuttings of sago plants were purchased in the Settlement, but planting cuttings is expensive. At the end of the year, I was able to purchase seedling plants from boatmen trading with Siak, and I would recommend planting seedling plants as being cheaper and more successful.

29. About 1,000 forest trees were planted near sago ground at the close of the preceding year and all have grown well.

30. It has been found that the boundary of the reserve passed through some private rights near to the Trigonometrical Station, and the face of the hill (Bukit Bruang) is now excluded from the reserve.

31. For practical preservation it would be well if the whole of the hill land was included in the reserve, and I would suggest that sufficient land be purchased to take in the hill land.

32. It has been proposed to take in the Bukit Kuau and Bukit Katil hill chain (plan *A*) into the reserve. Bukit Kuau is fairly well wooded. The total extension would be about 500 acres.

33. Sungei Lédang Reserve.—Marking the central compartment into sections by inspection-paths has been completed during the year.

34. The boundaries which extend 15 miles as well as inspection-paths were in excellent order at the close of the year.

35. Merlémau Reserve.—The forest watchmen have been assisted by a band of coolies in filling and laying timber so as to make the swampy boundaries passable. Six miles has been made passable and about 2 miles remains to complete the work. The work of maintenance at this reserve is exceptionally heavy.

36. Inspection-paths have been commenced on the dry land in the upper compartment of the reserve.

37. Ayer Panas Reserve.—Inspection-paths, extending 6 miles, have been opened in the new reserve during the year and the boundaries maintained in good order.

38. Bukit Panchor Reserve.—The watchmen have been employed exclusively on maintenance and preservation. The boundaries extend eleven miles.

39. Brisu Reserve.—Some private rights still remain to be excluded from the reserve, and it is contemplated to extend the reserve in the direction of Sungei Bharu, but owing to more pressing duties this work has had to stand over.

40. Bukit Sadánan Reserve.—The boundaries have been kept in good order and an inspection-path, extending about 3 miles from the Selandar Road, over the hill, to the Tebung Road, opened.

41. Bukit Batu Tiga Reserve.—This reserve has been demarcated during the year and boundaries, extending 14 miles, have been opened. The reserve is situated between the districts of Bukit Senggeh, Gapis, Nyalas, Chabau and Jasin, and comprises about 8,000 acres.

42. The reserve includes the hills, Bukit Kemendor, Bukit Batu Tiga (1,500 ft.) Bukit Hulu Rejang, Bukit Hulu Chembong and Bukit Hulu Blankong (800 ft.). All the hills are very steep, chiefly granite, and covered with large boulders. Several springs and streams have their sources in these hills.

43. The low land is well wooded. The most abundant timbers are Kayu Minyak, Gambang, and Minyak Kuing, but here, as elsewhere, much of the valuable timber, such as Merebau and Kranji has been worked out.

44. Batang Malaka Reserve.—Towards the close of the year this reserve was commenced and a boundary extending $3\frac{1}{2}$ miles opened. The reserve will extend from the frontier to Jus, taking in Bukit Punggor, Bukit Batang Malaka, Bukit Bemban (1,600 ft.) Bukit Nyalas and Bukit Gapis.

45. The reserve will be entirely high land, and of considerable importance, as the Malacca River as well as other streams have their sources in the hills.

Botanical Tour.

46. During the month of May, a botanical tour was made to Mount Ophir, and although not the flowering season a fair collection of specimens as well as a supply of interesting plants and orchids were obtained.

The most notable orchids were:—

Cypripedium barbatum.

Spathoglottis aurea and *I. Wrayi.*

Arundina densiflora, large plants.

Bromheadia sp.

Exchanges.

47. Plants and seeds have been exchanged largely with the Botanic Gardens, Singapore, and also with Botanic Gardens, Penang, and E. KOEK, Esq., Singapore, C. D. RAVENSWAY, Esq., Singapore, TAN TEK GUAN, Malacca, and TAN HUN GUAN, Malacca.

Total exchanges inwards, plants, 1,142, seeds, 8 kinds; outwards, plants, 1,231, seeds, 17 kinds.

48. Attached are statements of Revenue collected and Expenditure for the year under review.

*GARDENS AND FOREST DEPARTMENT, MALACCA.
REVENUE FOR THE YEAR 1890.*

Revenue collected during 1890:—

	\$	c.	\$	c.
By Sales from Bukit Sabókor Garden,	11	00		
" " Government Reserves,	123	07		
			134	07
Timber Supply for use of P. W. D.,	112	81		
Trees supplied for Government Grounds & Buildings,	62	63		
			175	44

Total, \$309.51

Expenditure for the year 1890.

	\$	c.	\$	c.
Vote,	5,500	00		
Additional Vote for planting Sago,	300	00		
			5,800	00
7 Watchmen,	1,778	19		
Garden,	1,266	89		
Batu Tiga Reserve,	388	35		
Ayer Panas Reserve,	156	25		
Merlémau "	218	75		
Bukit Benang, Planting,	201	05		
" " Boundaries,	41	00		
Bukit Malaka Reserve,	117	49		
Sungei Udang "	40	00		
Pony Allowance,	432	00		
Field Allowance,	153	00		
" " Mandor,	12	81		
Cartage,	270	09		
Freight and Shipping,	24	15		
Incidental Expenses,	38	11		
Herbarium Expenses,	64	95		
Personal Allowance,	37	79		
General Maintenance,	48	07		
Tools and Implements,	78	69		
Purchase of Plants and Seeds,	71	00		
Manure,	59	00		
			5,498	63
Planting Sago,			300	00
				37
Balance,			\$5,800	00

R. DERRY,
Assistant Superintendent of Forests, Malacca.

REPORTS ON THE GARDENS AND FOREST DEPARTMENTS,
STRAITS SETTLEMENTS.

BOTANIC GARDENS, SINGAPORE.

General Introduction.

1. The changes in the staff consequent on sickness have, to a certain extent, interfered with the progress of the Department. Mr. CURTIS, the Superintendent at Penang, left for 12 months' leave on a medical certificate in January, Mr. DERRY came from Malacca to relieve him, and it was necessary to employ Mr. HOLMBERG, of the Land Department, Malacca, in his place.

Mr. DERRY himself suffered a good deal from fever during his stay at Penang, and it will be a question whether the Superintendent's bungalow there should not be moved, as there are signs of the locality being malarious.

2. In the Botanic Gardens at Singapore, too, there was much sickness. The Chief Mandor, VINCENT CONIS, became seriously ill early in the year, and finally broke down in May with hemiplegia, and has, I regret to say, been pronounced incurable by the Senior Medical Officer.

The second Mandor, MOHAMMED ANIFF, in charge of the Experimental Gardens, was attacked with beri-beri, and was absent on sick leave for nearly three months.

The Herbarium Keeper, TASSIM DAUD, contracted a bad form of fever while with me in Pahang which incapacitated him from work, not only at that time, but for some time afterwards.

Notwithstanding the unhealthiness of the year, a considerable amount of progress was made in all branches of work in Singapore, while the establishments at Penang and Malacca were kept well up to their last year's standard.

Visitors.

3. The number of visitors to the Gardens was as large as on former years, and there were an unusual number of Botanists, and Curators of other Botanical Establishments, who visited the Gardens. It is still found difficult to prevent visitors from gathering the flowers in the plant-houses and elsewhere. The depredators are mostly mail passengers, but there are not wanting residents in Singapore who have done damage in this way.

Aviaries.

4. The aviaries stand much in need of repair, and a large portion should be reconstructed on a more solid basis. I hope to do this shortly. A number of very interesting animals and birds were obtained during the year, and though some did not live long, owing to the poor condition in which they were received, others have adapted themselves well to their confinement, and are thriving well.

Among the more interesting mammals received, by purchase or presentation, were:—A new species of mouse deer (*Tragulus*) from Borneo; the small kind known as *pelandok* from Singapore—(a distinct species, the existence of which has been doubted by some Naturalists); the wawa (female) (*Hylobates agilis*), presented by Lieut. KEISALL; a distinct black species of *Hylobates*; a remarkable black *Scenopithecus*, stated to have come from Celebes; a pair of the large black and white squirrel (*Sciurus bicolor*), for whom a new round aviary cage was built; a pair of wild dogs from Pahang, presented by Mr. CLIFFORD, the male of which unfortunately died owing to an injury received when caught; several specimens of the slow loris; and a kangaroo rat, presented. Two common monkeys were bred in confinement.

5. Among the birds, a fine female of the Celebes cassowary was presented by Mr. ALFRED LEA, of Mindanao; a rare serpent eagle, presented by Miss WOODWORTH; a pelican (*Pelicanus philippinensis*), purchased; a Javanese wild cock (*Gallus varius*). Another species obtained last year, which is still living, has been shewn by Lieut. KELSALL to be undescribed, and he proposes the name of *Gallus atroviolaceus* for it. It is supposed to have come from Borneo.

6. Of reptiles, a large specimen of the monitor (*Hydrosaurus salvator*) was caught at Blakang Mati by Lieut. KELSALL, and presented to the Gardens. A python was also presented by Major ALEXANDER. A fine example of the deadly *Bungarus fasciatus* was captured by Mr. HOLE, at Pekan, and safely brought to Singapore.

Buildings.

7. A new plant-house, 100 feet long and 15 feet broad, was put up for the culture of pot-ferns at a cost of \$50. The middle house used for culture of seedlings was entirely reconstructed at a cost of \$75, and the potting and packing sheds rebuilt at a cost of \$50. The coolie lines were repaired at a cost of \$20, and new quarters for the Mandores were built at a cost of \$198.83 in the Experimental Gardens. The large plant-house will evidently require a very large amount of repair, many of the beams being rotten, although they are of ballow wood. It would be much better, and really more economical, to replace these and the posts with light spiral iron columns, although the primary outlay would be larger than the Gardens vote could stand.

8. The plants in this and in the orchid-house have done very well and looked bright all the year. The following are among the rare species seldom or never flowered in Singapore:—*Protanomum*; a new genus of *Scitamineæ* from Pahang; *Cattleya Trianae*, *C. intermedia* and *C. speciosissima*; *Lycaste Deppii*; *Lockhartia elegans*; *Catasetum tridentatum*; *Catasetum Bungei*; *Mesospinidium vulcanicum*; *Aspasia epidendroides*, from South America; *Cælogyne tomentosa*, *Cumingi*, *macrobulbon* and one or two new species; *Trichoglottis fasciata* and a new species from Kuala Lumpur; a fine new *Phalaenopsis* near *Luddemanniana*, from the Philippines; *Cypripedium insigne* var. *exul*, a new plant from Bangkok,—were, among the Eastern orchids, rarely or never in flower here before.

Among other pot-plants of other orders of interest were:—*Didymocarpus quinquevulnerus*, a very fine new plant from Pahang, and *D. pyrolæflorus* (Mount Ophir); *Trichopus zeylanicus*; *Bragantia tomentosa*; *Pomazota sylvestris*; *Justicia*, new species from Pahang; *Schizocapsa*, from China; *Carex divaricata*; *Chamæcladon Griffithii* var. *argentea*, from Pahang; *Cryptanthus Beuckeri* and *Anthurium Dechardi*; and *Hippocrisum solandriiflorum*, from South America. Among foliage plants, a very beautiful *Strobilanthes*, introduced by Mr. BOXALL from Burma, attracted general attention.

Fernery.

9. This required reconstruction, as the roots of the shade trees had become too numerous, and usurped the soil intended for the ferns. It was, therefore, entirely re-made, a few trees cut out, and others thinned, and fresh ferns, with *Cypripediums* and other plants introduced, the result being that the rockery is much more picturesque and interesting.

Lake.

10. The island in the lake was thoroughly cleaned and replanted. The large fig tree in the centre was found to be quite dead, and its removal made so large a gap in the centre of the island that the whole of the plants on it were removed, and replaced by palms and pandanus, which will, when grown, produce a fine effect.

Palmetum.

11. A number of additional palms have been planted here, and there are now representatives of one hundred and sixty species, belonging to one hundred and two genera.

Propagation.

12. Another glass frame, larger than the previous one, has been built for striking cuttings and establishing newly imported plants. It has proved very successful, and seems especially suited to *Cattleyas* and other South American plants.

The large plant-nursery by the new lake has been enlarged, the soil here being exceptionally suited for nursery plants.

Flower Beds and Borders.

13. These have been replanted and manured and kept in good order, as have been the lawns. A small mowing machine was obtained in the early part of the year, and has proved very useful.

14. Some new round and crescent beds were made on the old herbaceous ground, and planted with shrubs illustrating the order *Rubiaceæ* (*Ixoras*, *Gardenias*, *Mussaendas*, etc.), and a little circular bed was made near the scitamineous border to contain the few plants of the order *Iridææ*, which thrive here.

Experimental Garden.

15. This garden has hitherto been under the Forest Department, and has suffered much from want of funds to develop it properly. It has now received a grant of \$1,000 for its maintenance, and consequently it is possible to develop it steadily and much progress has been already made in it. Samples of all the economic plants have been arranged in beds parallel to the main walk, and properly labelled. They are classified according to use. The first group consists of beverage plants:—Teas—Chinese, Assam and Paraguay, coffees, chocolate. Then follow groups of spices, gums, resins, guttas, dye plants, fibre plants, etc.

16. Above this the hill, formerly covered with grass and brushwood, has been cleared for a considerable space, and paths suited for riding or walking have been made. This hill, it is proposed to convert into an arboretum, containing examples of all kinds of trees arranged in natural orders, in the same manner as the arboretum of the Gardens at Buitenzorg. Already the early orders of the *Polyptalæ* are thus planted, spaces being left for additional trees, and the work will be continued as rapidly as possible.

17. During the year, many economic plants were sent out to various private persons and Botanic and other Gardens, besides a considerable number of seedlings of various plants raised for planting in the Singapore forests.

18. Among the more interesting introductions this year were the Bilian (*Eusideroxylon Schwageri*), of which a number of seeds were raised; Kapayang (*Pangium edule*), the true Sarsaparilla (*Smilax sarsaparilla*), and the English blackberry (*Rubus fruticosus*), which is doing very well, but has not shewn signs of flowers yet.

The Avocado pear fruited this year, but the fruits were poor in flavour.

19. As much interest is being taken in gambir just now, I made visits to various Chinese and Malay factories and plantations in Singapore and Malacca, and, with the aid of Dr. BOTT, Government Analyst, made experiments in preparation of the product, an account of which has been published in the *Bulletin of Agriculture* of the Straits Settlements. Experiments were also made in extracting the essential oil of the Sumbong plant (*Blumea balsamifera*) by distillation. A green camphoraceous oil was extracted, which may have a commercial value.

Reclaiming Waste Land.

20. In previous reports, I urged the reclamation of the waste swampy ground lying close to the Tyersall Road, and the Government granted \$1,000 to be expended in reclaiming and utilising this. The ground being low-lying and wet, a lake has been excavated to a depth of three or four feet, the excavated material having been used in the formation of the banks and a drive across the narrow portion of it. A brick overflow drain covered with slabs was made at a cost of \$50. There is also a walk round the lake shaded by a collection of bamboos of different kinds. A bridge will have to be made in the drive across to permit of the connection of the two parts of the lake, and the materials for this have been provided. A further grant was asked for the ensuing year in order to complete the work, but was refused. It will, however, in any case be necessary to finish the work, up to a certain point at least, and the funds for this must come out of the annual grant, which indeed can hardly afford it.

Flower Show.

21. A flower show was held in June last in the large plant-house as usual, but it was by no means as successful as in previous years, for not only were the exhibits poor both in quantity and quality, but the attendance, owing to repeated and prolonged deluges of rain, was very small. The result being a deficit of \$429.15, which had to be defrayed out of the Gardens vote.

22. It is obvious that, unless more interest is taken in horticulture by the residents in Singapore than at present, the show as an annual institution will have to cease. The Government would be hardly justified in spending so much money on an exhibition attended with so little beneficial result.

Outside Work.

23. In the early part of the year, the Department designed and planted some ornamental beds on a piece of public ground called Robinson Quay, after which the Public Works Department took it in charge.

Herbarium.

24. The work of incorporating the various collections made in the Straits has gone on as speedily as possible, and a very large number of specimens have been added to the herbarium. The largest and most important addition was that of the collection made during the expedition in Pahang, when upwards of two thousand specimens were obtained, among these are representatives of several new and interesting genera and many new species, besides many not hitherto known to occur in the Peninsula. A large number of specimens were also collected in Singapore, Johor, and Malacca, by myself. Mr. HOLMBERG acting for Mr. DERRY, who was superintending Penang in place of Mr. CURTIS, absent on leave, sent a number of specimens from Malacca, and a small number were presented by the Hon'ble D. F. A. HERVEY. From Borneo, Dr. HAVILAND sent 209 specimens, and Mr. R. W. HULLETT 91. Dr. KING sent 345 specimens from Perak and India. The Royal Gardens, Kew, presented 177 specimens from various Indian and other collectors. Baron F. VON MUELLER presented 440 Australian specimens.

25. A number of rattans with the native names, timbers and fruits were also collected during the year, but the absence of any place to store and preserve these specimens precludes at present any great strides being made in this direction.

26. Of specimens distributed to various collectors, 800 plants were sent to Dr. KING, 443 to the British Museum, a small number to the Royal Gardens, Kew, to Dr. BURCK, Buitenzorg, Professor HACKEL, and others.

27. Collecting apparatus was sent to several persons in Borneo and the Straits Settlements, who had promised to preserve specimens for the Herbarium.

Artist.

28. The Botanical Artist continues his drawings of plants of importance and interest in the Malay Peninsula. It is hoped shortly to prepare lithographic plates of some of the apocynaceous gutta-producing plants—the Willoughbeias, Alstonias, Dyera, etc.—and eventually also of the Palms and Pandani of the Malay Peninsula.

Expedition.

29. During the year, an exploring expedition visited Pahang with a view of reaching the lofty range of Gunong Tahan in the interior. The party failed, however, to reach the desired point, owing partly to sickness and partly to the difficulties of the route, which so delayed the expedition that the supply of provisions ran out. A large number of plants, both alive and in the form of herbarium specimens, were obtained, including very many rare and new species of much interest.

Coco-nut Trees Ordinance.

30. During the year, 128 notices were served on various owners of trees and plantations, requiring the destruction of decaying trees and rubbish. The owners complied with the notices without delay, and it was not found necessary to summons any for not doing so. The worst affected district was that of Kalang, where neglected, unhealthy plantations, and piles of old tan-bark were producing much damage to the more careful planters. The number of trees destroyed was 1,364, and 1,737 old stumps and fragments of coco-nut timber were removed and burnt or buried. There is still some work to be done in the Kalang district, but most of the other portions of Singapore are clean.

31. At the close of the year, evidence was received that the Inspector under the Ordinance—MUSAFFER ALI—had been receiving illegal gratifications, and otherwise acting fraudulently. He was summoned and found guilty on one count, was fined by the Magistrate, and dismissed from the service. The coolies under him worked well throughout the year.

32. The expenses in connection with the working of the Ordinance during the year were as follows:—

	\$	c.	\$	c.
Vote, ...	...	...	...	700.00
Salaries, ...	...	297.03		
Transport, ...	...	104.62		
Uniforms, ...	...	10.00		
Contracts for removing dead trees, ...	...	66.20		
Balance, ...	...	222.15		
	\$	700.00	\$	700.00

Exchanges.

33. Plants and seeds were received during the year from the following contributors:—

	Plants.	Seeds.	
Royal Gardens, Kew, ...	...	4 packages.	
Botanic Gardens, Calcutta, ...	60	3	do.
Do., Ceylon, ...	12	22	do.
Do., Trinidad, ...	33	22	do.
Do., British Guiana, ...	...	3	do.
Do., Jamaica, ...	...	5	do.
Do., Grenada, ...	...	16	do.
Do., Saigon, ...	16	...	do.
Do., Natal, ...	...	34	do.
Do., Brisbane, ...	...	22	do.
Do., Port Darwin, ...	...	12	do.
Do., St. Petersburg, ...	...	4	do.
Do., Madras, ...	...	7	do.
Messrs. Veitch, London, ...	60	...	do.
" Bull, London, ...	...	1	do.
" Chatterjee, Calcutta, ...	...	14	do.
" Reasoner Bros., Florida, U. S. A., ...	...	18	do.
" Cannell & Son, England, ...	...	64	do.
" Sander & Co., England, ...	81	...	do.
Dr. Keith, Siam, ...	6	...	do.
Baron von Mueller, Melbourne, ...	...	8	do.
Mr. C. Curtis, India, ...	100	22	do.
Mr. D. Guiceneuf, France, ...	...	2	do.
Mr. G. Peché, Maulmain, ...	80	...	do.
Mr. Hume Black, Brisbane, ...	...	51	do.
Mr. Van Huivel, Pontianak, ...	27	...	do.
Mr. M. T. Gibson, Borneo, ...	33	...	do.
Mr. Hole, Pekan, ...	1	1	do.
Mr. Boxall, India, ...	25	1	do.
Professor Vaughan-Stevens, Pahang, ...	33	2	do.
Lieutenant Kelsall, Selangor, ...	100	...	do.
The Hon'ble E. E. Isemonger, Malacca, ...	...	15	do.
Mr. H. H. Everett, Sarawak, ...	12	...	do.
Mr. J. F. Duthie, India, ...	...	12	do.
Mr. C. Gray, Madras, ...	15	...	do.
Mr. F. Griffith, do., ...	70	...	do.
Superintendent, Government Plantations, Perak, ...	...	1	do.
Mr. Cecil Wray, Perak, ...	109	...	do.
H. H. The Sultan of Johor, ...	600	...	do.
Mr. G. S. Dare, Singapore, ...	...	1	do.
Captain Ridout, do., ...	7	...	do.
Mr. Seah Liang Seah, do., ...	...	1	do.
Mr. M. Micholitz, do., ...	2	...	do.
	1,497	368	

34. Plants and seeds were distributed to the following recipients:—

	Plants.	Seeds.
Royal Gardens, Kew, ...	21	2 packages.
Botanic Gardens, Calcutta, ...	20	1 do.
Do., Ceylon, ...	...	1 do.
Do., Penang, ...	81	10 do.
Do., Trinidad, ...	...	16 do.
Do., British Guiana, ...	...	3 do.
Do., Fiji, ...	43	20 do.
Do., Brisbane, ...	...	1 do.
Do., Port Darwin, ...	...	1 do.
Do., Hongkong, ...	...	1 do.
Do., Buitenzorg, ...	...	1 do.
Do., Natal, ...	...	1 do.
Do., Grenada, ...	...	16 do.
Do., Dominica, ...	...	58 do.
Do., Saigon, ...	24	... do.
Do., Malacca, ...	338	... do.
The Hon'ble the Resident Councillor, Malacca, ...	75	... do.
Captain Floyteff, Imperial Russian Navy, ...	...	27 do.
Mr. Peché, Moulmein, ...	27	... do.
Messrs. B. S. Williams, London, ...	250	... do.
„ Sander & Co., do., ...	250	... do.
Lord Zetland, ...	17	... do.
Sir J. F. Dickson, K.C.M.G., ...	12	... do.
Public Gardens, Selangor, ...	500	... do.
Municipality, Singapore, ...	200	... do.
Mr. Louis Jacquet, Pulau Condor, ...	18	... do.
Mr. Goodhart, Sumatra, ...	10	... do.
Mr. Stephen, Rangoon, ...	...	7 do.
	1,887	156

Library.

35. The following publications were added to the Library during the year:—

- CLARKE—"Composite Indicaë," 1876.
 GRIFFITH—"Notulæ Asiaticæ."
 ——"Posthumous Papers," Part I, 1847.
 CROSS BEVAN & KING—"Report on Indian Fibres and Fibrous Substances," 1887.
 "Nederlandsch Kruidkundig Archief," 2nd Series, IV, 3, 2; 2nd Series, V, 2; 2nd Series, V, 3; 2nd Series, 1 and 2.
 "The Agricultural Record"—January, February, March, April, May, June, September, October, November, and Special Number 1890, Trinidad.
 MULLER—"Fragmenta Phytographiæ Australiæ"—17, 18, 19, 40, 66, 68, 69, 75, 80, 85, 86, 87, 94.
 ——"Observations on some Papuan and Polynesian Sterculiaceæ," VIII.
 ——"Brief Report on the Papuan Highlands Plants gathered during Sir WILLIAM Mc GREGOR'S Expedition, in May and June, 1889."
 TEYSMANN & BINNENDIJK—"Plantæ Novæ Horti Bogoriensis in Insula Java."
 NEUMAYER, Dr.—Anleitung, 1888.
 HOOKER, Sir W.—"Botany—Enquiries regarding Botanical Desiderata."
 GRIESBACH—"Grundriss der Systematischen Botanik," 1854.
 BAILEY—"A Synopsis of the Queensland Flora"—3rd Supplement.
 ——"Barbadoes Agricultural Gazette," October, 1890.
 ——"Guide to the Royal Gardens, Kew."
 PRESTOE—"Catalogue of Plants in Royal Botanical Gardens, Trinidad," 1870.

ENGLER, A.—"Loranthaceæ."

BROWN, R.—"Orchideæ and Asclepiadaceæ," 1833.

DELPUS—"Prodromus d'una Monographia delle Piante Formicarie,

Part III, 1889.

SMITH & GRIFFITH—"Plants producing Seed without action of Pollen," 1839.

GRIFFITH—"Icones Plantarum Asiaticarum."

"Grenada Agri-Botanico Bulletin," December, 1890 (Liberian Coffee).

"Journal of Mycology," Vol. VI, No. 3, of the United States Department of Agriculture.

[The above were presented by the Royal Gardens, Kew.]

The following were purchased:—

BECCARI—"Malesia," Vol. III, fasc. IV, 1889.

JUNGHUN, Dr.—"Javansche Balanophoreen."

BALANSA, M. B.—"Graminées de L'Indo-Chine Français."

MIQUEL—"Illustrationes Piperacearum."

HANBURY, D.—"On the Species of Garcinia which afford Gamboge in Siam."

MIKLOUCHO-MACLAY—"List of Plants in use by the Natives of the Maclay Coast, New Guinea."

WHITE, D.—"A Botanical Description and Natural History of the Malabar Cardamom."

DE VRIESE, W. H.—"Mémoire sur les Rafflesia Roehussenii et Patma."

ROXBURGH, D.—"Account of Bassia butyracea."

PIERRE, L.—"Diploknema sebifera."

COLLA—"Memoria sul Genere Musa e Monografia del Medesimo."

DE CANDOLLE—"Monographiæ Phanerogamarum," Vol. VII, 1891.

"The Journal of the Linnean Society," Vol. XXVIII, No. 194.

Presented by various Contributors.

TREUB, Dr.—"Annales du Jardin Botanique de Buitenzorg," Vol. IX, pt. 2, Vol. X, pt. 2.

———"Notes on the Cultivation and Preparation of Gambier."

———"Verslag Hands Plantentuin te Buitenzorg," 1890.

Icones Plantarum," Vol. X, pt. IV.

BAILEY—"Catalogue of Plants in the two Metropolitan Gardens—The Brisbane Botanic Garden and Bowen Park."

"Annual Report of the Department of Agriculture, Brisbane," 1889, 1890.

"Bulletin No. 8, Department of Agriculture," Brisbane.

DEPARTMENT of AGRICULTURE—"Bulletin No. 4—Relative Merits of various United States of America Stocks for the Orange."

TRYON, H.—"Report on the Insect and Fungus Pests," No. I, Queensland, 1889.

FAWCETT, W.—"Economic Plants."

———"Bulletin" No. 22.

"Bulletin—Botanical Gardens, Grenada—Vanilla."

TRELEASE—"Missouri Botanic Gardens."

"Report, Missouri Botanical Gardens, United States America," 1890.

GOODALE—"Some Botanic Gardens in the Equatorial Belt and in the South Sea."

———"Some Museums."

———"Some of the Possibilities of Economic Botany."

———"Biology."

"Proceedings of the Tenasserim-Agri-Horticultural Society of Moulmein."

LAMB, S.—"Tobacco, its Cultivation in Northern Queensland."

In addition to the above, the Annual Reports of the various Botanical Gardens, and also of the Forest Department of India have been received.

BOTANIC GARDENS, SINGAPORE.

Statement of Receipts and Expenditure for the year 1891.

RECEIPTS.		EXPENDITURE.	
	\$ c.		\$ c.
By Balance in Bank, ...	217 79	<i>Salaries.</i>	
" Government Grant, ...	8,500 00	Herbarium Keeper, ...	179 50
" Sale of Plants and		Head Mandor, ...	180 00
Flowers, ...	1,030 75	Extra do., ...	103 59
" Interest, ...	33 18	Carpenter, ...	165 72
		Extra Carpenter, ...	54 72
		Mason, ...	76 96
		Printer (Label), ...	119 00
		Do., Apprentice, ...	33 13
		Peon, ...	95 50
		Aviary Keeper, ...	96 00
		Garden Police, ...	342 00
		Coolies, ...	2,762 67
			4,208 79
		<i>Bills for 1891.</i>	
		Purchase of Plants and	
		Seeds, ...	147 20
		Manure and Cartage, ...	171 02
		Food for Birds and Ani-	
		mals, ...	567 31
		Flower Pots and Tubs, ...	222 18
		Botanical Books and Her-	
		barium Paper, ...	685 43
		Laterite and Gravel, ...	173 54
		Repairs to Buildings, ...	182 00
		Tools and Stores, ...	287 84
		Wardian Cases and Freight,	104 00
		Wood for Construction	
		purposes, ...	217 78
		Bricks, Lime, etc., ...	207 77
		Director's Petty Expenses,	207 40
		Assistant Superintendent's	
		Petty Expenses, ...	192 40
		Contribution to Flower	
		Show, ...	429 15
		Miscellaneous, ...	951 87
			4,746 89
			8,955 68
		Balance, ...	826 04
			\$9,781 72
	\$9,781 72		\$9,781 72

FOREST DEPARTMENT, SINGAPORE.

Area.

1. The total area of the forest reserves now in Singapore is 14,509 acres 1 rood and 8 poles. This gives a decrease of 7 acres 1 rood and 15 poles from that of last year, due to the sale of a piece of land in the Bedok district valueless for forest purposes. The land fetched the sum of \$135.

Boundaries.

2. The boundaries have been well kept up and cleaned of grass and fern, and over the stream and swamps the bridges have been renewed. A large number of notice boards have been put up at salient points of the reserves to warn persons against trespassing therein. The whole of the reserves are now correctly surveyed and demarcated.

Forest Watchmen.

3. The same number of Forest Corporals, Lance-Corporals and Watchmen was employed this year as last, viz., 23 in all. All worked well, and no complaints were made against them. Khaki uniforms were supplied this year, in place of the blue serge suits last year, as the latter proved less satisfactory for jungle work. The distribution of the men is as follows:—For the Bukit Timah, Bukit Panjang, East Bukit Timah, Choa Chu Kang, Jurong, Pandan and Upper Tanglin reserves there are 1 Forest Corporal and five Watchmen. At Kranji and Sungei Buloh there are 1 Lance-Corporal and two Watchmen. At Bukit Mandai and Sumbawang 1 Lance-Corporal and two Watchmen. At Chan Chu Kang, Ang Mo Kio and Selitar one Lance-Corporal and four Watchmen. At Changi and Bedok one Lance-Corporal and two Watchmen. At Toas and Murai one Lance Corporal and two Watchmen.

Buildings.

4. Two new forest stations have been built—one at Chan Chu Kang and one at Kranji—with brick pillars and balow posts, at a cost of \$253.90 each.

Farming Encroachments.

5. Two pepper encroachments in the Forest Reserves at Upper Mandai were given out on lease for one year for \$40, and one at Jurong was let for \$10. An encroachment of gambir at Sumbawang was let for \$25, making a total revenue of \$75.

The plants on these encroachments are now nearly effete and will soon cease to be leased. Meanwhile the trees of India rubber, and Renghas, planted among the crops, have taken good hold and are growing steadily and well.

Planting.

6. The work of planting waste land with valuable trees goes on as fast as possible, but it is not easy to get seeds of the more valuable trees in sufficient quantity for covering very large tracts.

Para Rubber (*Hevea brasiliensis*, Spruce) seeds were obtained from Kew and from the trees in the Experimental Garden, and a large number of plants raised. Eight acres of this valuable India rubber tree have been planted this year at Sumbawang, and the trees are thriving remarkably well. Rubber collected from the trees in the Experimental Garden was pronounced by Messrs. SILVER to be of very good quality. Fast as this plant grows, it will be nearly ten years before it is at the best stage for tapping. More seed is urgently required.

The Renghas plants (*Gluta Renghas*) raised from seed obtained from Pahang, are also growing with great vigour. Two acres have been planted at Jurong. The two-year old plants at Chan Chu Kang and Upper Mandai are now many of them over six feet tall.

This plant produces a very fine mahogany-like timber, but unfortunately it is disliked by the cutters on account of the poisonous character of the black varnish which exudes from it. The Malays give the name of Renghas to several trees all of the same family; of these the best timber tree is apparently the *Melannorrhæa, Curtisi*, and *M. Wallichii*. The latter species occurs in Singapore, but is now very scarce. The former is a native of Penang.

All possess the poisonous properties of the *Gluta*, which is a great objection to them, but it seems that by no means all persons who deal with these trees are affected by them. In moving and planting the hundreds of *Gluta* seedlings here, there has only been one case of *Gluta* poisoning among the coolies.

In the Upper Mandai encroachments about five acres of various trees have been planted and all are doing well. Among them are *Sterculia elata*, *Pithecolobiums*, Inga Saman, Jack (*Artocarpus integrifolia*), Glam (*Melaleuca leucadendron*), Broad-leaved Mahogany (*Saietenia macrophylla*). The Jack suffers much from the ravages of *plandoks* (mouse deer), which are very fond of its leaves.

A quantity of cuttings of the Male Bamboo (*Dendrocalamus strictus*), were taken from plants in the gardens and have been planted at Sumbawang; they are doing very well. More are being struck, and it is hoped eventually to be able to supply the farms for lance handles in quantity. A number of seeds of the Bilian tree (*Eusideroxylon Schwageri*, Teysm) were obtained from Borneo, and having been planted a fair proportion germinated. Hitherto there has been some difficulty with this invaluable timber tree, but it was found that the seeds germinated better simply put a little way beneath the soil, and with the hard shell not cracked or split as had been tried previously. It is, however, not easy to procure the seed of this plant in quantity. I hope, however, to be able to obtain a further supply from Sandakan, where it is said to be plentiful.

During my explorations in Pahang, I explained to the natives my desire for seed in any quantity of *Dichopsis gutta*, and offered to pay a cent a seed delivered in Pekan. Many, especially of the Kelantanese, said that they could get plenty in the season and undertook to do so, but I am doubtful as to ever obtaining it. Two French experimenters visited Singapore with plans for extracting the gutta from leaves and twigs without destroying the tree. The methods adopted, however, were not successful, and I regret to say that, on my return from Pahang, I found that four of the best *Dichopsis* trees in the island had been cut down in one of the reserves, which loss was the more to be regretted as one or more of the trees were about to flower and a supply of seed might have been obtained.

Fires.

7. There have been only eight cases of fire in the reserves this year, as against twelve of the previous year. In the Ang Mo Kio reserve two fires occurred, in one an acre in the other case 70 acres of lalang and secondary jungle were burnt; at Changi there were three fires, in two of which about 30 acres of grass and brushwood were burnt; at Jurong a little grass was burnt; at Selitar also there was a small grass fire; and there was one at Pandan in which about 12 acres were burnt. Every effort to detect the incendiaries failed, but at Ang Mo Kio there was no reasonable doubt but that the grass was fired by Chinese grass-cutters, who were arrested afterwards cutting the young lalang shoots, and fined five dollars each, while at Changi it appeared that the Malays at Tanah Merah had ignited the grass to get the fluffy seeds of the lalang, produced after burning, for stuffing pillows.

Prosecutions.

8. There were 16 cases in all instituted during the year for cutting and removing timber, etc., and fines to the amount of \$127 inflicted, besides \$16.15 paid in to the Government for the value of the timber cut. Two cases were withdrawn, one being connected with the reopening of an old cart track at Changi, and one being a case of tree cutting by a Government contractor, who paid the value of the trees cut down to clear a piece of ground for landing road metal from the Tampenis River. In two cases summonses were issued—one against an Eurasian for cutting trees and making tiger pits at Changi Loyang, by which the lives of the forest watchmen were endangered; he was convicted and fined five dollars and costs: the other was issued against four Malays for cutting young trees at Tanjong Penjuru, convicted and fined four dollars and costs. In two cases the defendants were cautioned and discharged, in one case for cutting lalang in the other for cutting pitcher plants the stems of which are used for tying bundles. In the remaining 10 cases fines amounting in the aggregate to \$110 were inflicted.

Licenses for Timber cutting.

9. During the year, several portions of mangrove swamp have been let for cutting firewood, fishing-stakes, and pepper posts. The firewood-cutting licenses brought in \$178, and a license issued for 1,500 fishing-stakes fetched \$60. The prices charged by the Forest Department were considerably higher than those of the other departments, but there is no difficulty in getting the Malays and Chinese to take out as many licenses as are desirable. Thus the permits for a single man to cut bakau for firewood are \$4 for two months, being an increase of one dollar above that of the other departments, and permits for fishing-stakes granted at the Land Office at \$20 per 1,000 stakes were readily taken up from the Forest Department at \$40 a thousand. One cause of this is that the more accessible of the Government mangroves have been very heavily cut, so that the timber is at present small and hardly worth the cutting, while the Forest Reserves, hitherto not having been cut to any extent, produce plenty of good wood. But in any case the profit made by the cutters is quite large enough to allow of the increased charge.

Bakau swamp forest is more popular for firewood-cutting on account of its accessibility by water, which is a much less expensive form of carriage than that by land, and the trees grow close together and have not to be sought for at considerable distances apart. The wood is very suitable for firing, and very good fishing-stakes can also be found in the swamp.

The principal woods cut are Blukup (*Rhizophora mucronata*), Tumu (*Kandelia Rheedii*) and Akit (*Rhizophora conjugata*). A strong man can cut in a day 300 bundles of split firewood, tied up, and ready for sale. Each bundle contains five pieces 15 inches long and about an inch thick: one hundred bundles sold on the spot fetch 10 nts, and sell in Singapore for 25 cents. Engine firewood is of larger size, the pieces 2 feet long and 4 inches thick and weighing about 3 catties. These fetch 40 or hundred on the spot, and 65 cents in town.

Fishing-stakes are cut of various sizes and are sold according to size. A stake nine fathoms long sells for 35 cents, and six fathoms long 25 cents, that is \$250 to \$350 per thousand. The license to cut these costs \$40, so that the profit is fairly large, but it must be remembered that the expenses of bringing the stakes to the village are often very great. The stakes are usually brought down by raft, and from Sungei Buloh, where a license was issued this year, to Telok Blanga it takes ten days to bring them down. One headman and six others can cut 1,000 rollers in a month. Each cuts for himself, and pays a commission of a dollar to the headman, who is responsible to the *Towkay* for the 1,000 stakes, the *Towkay* advancing the money for the license, and pays the cutters according to the agreement, viz., 35 cents for 9 fathoms, and 25 for 6 or 7 fathoms. The *Towkay* sells them again to the fishing stake owners, at a higher price, viz., 45 cents for nine fathoms and 35 cents for 6 to 7 fathoms. In this way he makes a very considerable profit, and as he pays for the license the increased charge affects him only and does not affect the hard-working cutter.

Bakau bark generally used for tanning in Singapore, is not at present procured from the Forest Reserves, as the Malays bring it from the Peninsula in large boats or tongkangs. It is sold by the cart-load, at \$13.50 per cart. The barks used are Blukup, Tumu and Akit, and also Pagar Anak (*Ixonanthes icosandra*), which is not a mangrove tree.

Besides the above-mentioned trees, the following contribute to the formation of the mangrove forests:—

Nirek (*Carapa moluccana*), a very hard timber, but large trees are almost invariably hollow internally. The bark has a reputation as a medicine for dysentery.

Tengar (*Ceriops Candolleana*).

Busing (*Bruguiera caryophylloides*) also called Bakau Puteh.

Lenggadi (*B. parviflora*, Wt.).

(*B. eriopetala*).

Teremtam (*Lumnitzera coccinea*), good timber.

Stada (*Podocarpus neriifolia*, Don.).

Expenditure for 1891.

Vote,	...	...	...	...	\$4,000
Salaries,	...	...	...	...	\$2,838.58
Buildings,	...	...	...	...	507.80
Uniforms,	...	...	...	...	147.00
Miscellaneous,	...	...	...	...	605.23
Balance,	...	...	...	...	1.39

\$4,000

Revenue.

Bakau Timber,	...	...	...	...	178.00
Fishing-stakes,	...	...	...	...	60.00
Pepper encroachments,	...	...	...	...	50.00
Gambir do.,	...	...	...	...	25.00
Rattans,	...	...	...	...	8.00

Total, ... \$321.00

HENRY N. RIDLEY,

Director of Gardens and Forests, S. S.

APPENDIX A.

GARDENS AND FOREST DEPARTMENT, PENANG.

Leave of absence having been granted on account of ill-health, I was absent from the Settlement from January 26th to December 25th. During that time Mr. DERRY took charge and, I regret to find, suffered much from fever. It is a matter for serious consideration whether it would not be better to remove the present quarters to a more salutary spot.

Forest Reserves.

No additions have been made during the year, but the existing boundaries have been recleared where necessary, and regularly patrolled by the Guards, who instituted during the year fifty-nine prosecutions for illicit timber cutting and encroachments, as against fifty in the previous year. In forty-eight cases the offenders were punished, and the others dismissed with a caution.

2. The Station at Penara Bukit, which has become quite uninhabitable, has been reconstructed under the supervision of the Public Works Department at a cost of \$400, and minor repairs done to the Station at Telok Bahang.

3. The nursery and village reserve at Kubang Ulu, Province Wellesley, has, during the year, been transferred from this Department to the charge of the District Officer of Bukit Mertajam, to be used, I presume, chiefly for raising shade trees to plant up the principal roads.

4. The total expenditure in connection with maintenance of Forest Reserves and Kubang Ulu Nursery for the year amounts to \$2,300 as shown in statement of expenditure annexed.

Waterfall Garden.

5. This garden continues to maintain its popularity both with residents and visitors passing through. The development of trees, &c. is most noticeable after an absence of nearly a year.

6. Considerable progress has been made in the construction of side drains, with stone and cement, in the steeper portions of the grounds where the wash is considerable.

7. A new culvert, one hundred and twenty feet long and two feet broad, has been built to carry off the rain-water from Government Hill Road, which will, it is hoped, give a better chance of establishing an avenue of *Polyalthia longifolia*, from the entrance gate to the garden office.

8. Some new beds and a circular path have been laid out around the Band Stand, which is an improvement to this part of the grounds.

9. Portions of the main roads have been metalled, and the foot-paths periodically weeded and put in order. Bridges and plant sheds have been repaired, and the usual routine work in connection with beds, borders, &c. attended to.

10. The Swimming Bath, which was opened on the 1st January at a merely nominal charge, has been well patronized, and yielded a revenue of \$180.05, which considerably more than covers salary of care-taker and other incidental expenses, besides giving an ample water supply to the plant nursery.

11. The revenue from plant sales is more than in any previous year, the total amount collected being \$312.91, as against \$220 in 1890, and \$75 in 1889.

12. The new Municipal Reservoir in course of construction at the top of the garden, and the consequent cartage of all material for the work over the garden roads, render impossible for the present that state of neatness desirable in a public garden. The ultimate result of this work, as regards its general effect on the appearance of the garden, will depend largely on the extent to which the Municipal Commissioners co-operate in making up the surrounding, &c. when the work is complete. At present it is anything but an ornament.

13. Through the kindness of the Director of the Royal Gardens, Kew, and of Messrs. VEITCH, SANDER, and LOW, I obtained and brought with me from England a large and valuable collection of plants which form a grand addition to those already in cultivation here. The whole amounted to over three hundred plants, and occupied fifteen cases, most of which were opened and watered at intervals during the voyage. The losses were inconsiderable, and entirely the result of a few cold nights before getting to the Straits of Gibraltar. In the appendix I have given a list of the plants obtained, and it is understood that, as opportunities occur, Malayan plants will be sent to those contributors in exchange.

Bungalow Garden and Experimental Nursery.

14. The Tennis Court in front of the new wing to Government Bungalow laid out at the beginning of the year, was ready for use about the middle of May.

15. Of annuals and other flowering plants, a fair display was maintained. Achimenes, Pansy and Larkspur did well in pots, and Dahlia, Coreopsis, Ageratum and Cornflower in beds.

16. Owing to the bungalow being more frequently occupied than formerly, a larger stock of pot plants is necessary for decorating the corridor and rooms, and the same holds good as regards roses and other flowers for cutting.

17. During a stay of two months in Gwalior on my way to England, I obtained from the Superintendent of State Gardens a collection of acclimatised vegetable seeds, which were at once forwarded to Penang. The Overseer reports that some kinds, especially onions and cucumbers, gave better results than has been obtained from English or Continental saved seeds. A further trial will be made this year, and if the result is equally good, a supply will be obtained for distribution among Chinese market gardeners. The English vegetables grown in Gwalior during the cold weather are equal in every respect to the best obtainable in England.

18. The roads and paths were maintained in good order, side drains repaired, and other routine work attended to.

19. The avocado or alligator pear, known also as vegetable marrow or midshipman's butter, fruited for the first time this season. The trees look well and promise to be as easy of cultivation as any of our native fruits.

Preservation of Coco-nut Trees.

21. The Inspector and two men were employed nine months in Penang and three months in Province Wellesley.

22. One hundred and six notices were served on persons having on their premises dead trees or rubbish likely to prove breeding places for beetles; and as the result 2,073 dead trees and 109 heaps of rubbish were destroyed.

In addition to the above, many trees were destroyed as soon as the owners' attention was called to the subject.

23. Four prosecutions were instituted in Province Wellesley, and the offenders fined \$5 each for neglecting to comply with the terms of the Ordinance.

Six Summons served in Penang had not been decided at the end of the year.

24. In connection with the work of the Department, the Acting Assistant Superintendent visited the Dindings, Singapore, Kedah and Langkawi; and also supervised the work of planting, &c. of Residency grounds, the laying out of new Cemetery, and planting of shade-trees within Municipal limits.

General.

25. The total expenditure of the Department amounted to \$10,086.40, as shown in the Statement annexed.

C. CURTIS,

Assistant Superintendent of Forests.

Penang, 18th January, 1892.

Revenue and Expenditure of the Forest and Gardens Department, Penang, 1891.

REVENUE.	EXPENDITURE.	
		\$ c.
Grant—Maintenance of Forest Reserves, ... \$2,300.00	Salaries of Forest Guards, ...	683 58
	„ Office Assttand and Messenger, ...	245 05
	Forest Guards' Uniform, ...	72 00
	Maintenance of Boundaries, ...	486 50
	„ Kubang Ulu Nursery, ...	242 25
	Reconstruction of Station, ...	400 00
	Repairs to Station, ...	9 06
	Rent of Temporary Quarters, ...	18 00
	Materials for Herbarium, ...	54 91
	Purchase of Books, ...	21 40
	Boat-hire and Cartage, ...	57 55
	Oil for Station, ...	9 70
		2,300 00
Grant—Maintenance of Waterfall Garden, ... \$4,500.00	Salaries, ...	3,057 99
	Purchase of Plant and Seeds, ...	163 49
	„ Pots and Tubs, ...	171 99
	„ Tools, &c., ...	133 11
	Improvement of Side Drains, ...	66 49
	Material for Plant Cases, ...	82 55
	„ General Repairs, ...	70 99
	„ Plant Sheds, ...	119 92
	Repairs to Bridges, ...	227 57
	Cartage, ...	68 85
	Freight, ...	33 01
	Road Metal, ...	87 18
	Paint, ...	22 69
	Expenses in connection with Swimming Bath, ...	45 60
	Petty Expenses, ...	69 00
	Miscellaneous, ...	27 06
	Balance, ...	52 51
		4,500 00
Grant—Maintenance of Grounds of Government Bungalow and Experimental Nursery, ... \$2,000.00	Salaries, ...	1,756 66
	Purchase of Plant and Seeds, ...	31 00
	„ Pots, ...	15 36
	„ Tools, ...	38 26
	Repairs to Plant Shed, ...	10 97
	Manure, ...	143 50
	Miscellaneous, ...	3 54
	Balance, ...	0 71
		2,000 00
Travelling and Personal Allowances, ... \$700.00	Pony Allowance, ...	408 75
	Transport and Field Allowances, ...	142 32
	Expenses in connection with Journey to Singapore, ...	30 65
	Expenses in connection with Visit to the Dindings, ...	10 16
	Expenses in connection with Visit to Kedah, ...	5 40
	Miscellaneous, ...	55 49
	Balance, ...	47 23
		700 00

*Revenue and Expenditure of the Forest and Gardens
Department, Penang, 1891,—Continued.*

REVENUE.	EXPENDITURE.													
Expenses of carrying out the provisions of the Coco-nut Trees Preservation Ordinance, \$700.00.	<table> <tr> <td style="vertical-align: middle;">{</td><td>Salaries,</td><td>547 35</td></tr> <tr> <td></td><td>Transport,</td><td>139 50</td></tr> <tr> <td></td><td>Balance,</td><td>13 15</td></tr> <tr> <td></td><td></td><td style="border-top: 1px solid black;">700 00</td></tr> </table>	{	Salaries,	547 35		Transport,	139 50		Balance,	13 15			700 00	\$ c.
{	Salaries,	547 35												
	Transport,	139 50												
	Balance,	13 15												
		700 00												
Total Receipts from Plant Sales, Swimming Bath, &c. (Paid into Revenue Account), \$498.01	Grand Total Expenditure,	\$10,086 40												

C. CURTIS,

Assistant Superintendent of Forests.

Penang, 18th January, 1892

*List of Plants brought from England by the Assistant Superintendent
of Forests and Gardens, Penang, December, 1891.*

Contributed by the Director, Botanic Gardens, Kew.

Anthurium Galeottii.	Dorstenia elata.
" leuconeurum.	Alloplectus vittatus.
" hybridum.	Scutellaria mocciniana.
" affine.	Begonia socotrana.
" Miqueliana.	Salvia azurea.
" emarginatum.	" Bethelli.
" Hookerii.	Jamaica banana.
" acaule.	Agave rigida.
" Binotii.	" heteracantha.
" Andreanum.	" ferox.
" radicans.	" marmorata.
Aglaonema Mannii.	" Bennetii.
Philodendron Mamei.	" francoisini.
Nephtytis liberica.	" americana lutea.
Dorstenia arifolia.	" viridis marginatus.
Dieffenbachia imperialis.	" filifera superba.
" grandis.	" potatorum.
Stenospermation Wallisii.	" Hookerii.
Brehonia spinosa.	Aloe heteracantha.
Mimusops balata.	" saponaria.
Brunfelsia (?) from St. Lucia.	" tricolor.
Chrysophyllum majalis var. montana.	" mitræformis.
Courataria exigua.	" glaucescens.
Dracæna Hookeriana.	" N. Sp. from Turk's Island.
" fragrans.	" sp. Galpin.
Gustavia exigua.	Achimenes tubiflora.
Philodendron selloum.	Cyrtanthus obliquus.
Impatiens platypetala.	Crinum Moorei.
Begonia Md. Lionel.	" americanum.
Steudneria discolor.	" sp. (longifolium?) Watson, 183-87.
Cyclanthus cristatus.	" Kirkii.
	Clistocactus colubrina.

List of Plants brought from England by the Assistant Superintendent of Forests and Gardens, Penang, December, 1891,—Continued.

Contributed by the Director, Botanic Gardens, Kew,—Continued.

Cereus flagelliformis.
Ceropegia Sandersonii.
Beschorneria superba.
Ceropegia Monteiroæ.
Cannas dwarf.
Dyckia princeps.
 " *floribunda.*
 " *rarifolia.*
Eucomis bicolor.
Euphorbia canariensis.
Furcraea, sp. Shea.
Gasteria triangularis.
 " *verrucosa.*
 " *carinata.*
 " *maculata.*
 " *dicta.*
 " *subnigricans.*
Hæmanthus Katherinæ.
 " *albiflos.*

Hæmanthus carneus.
 " *natalensis.*
Kniphofia Northiæ.
Patersonia cœrulea.
Pilocereus mexicanus.
Puya Webberii.
Phyllocactus (seedling).
 " *J. T. Peacock.*
 " *longipes.*
 " *anguligera.*
Stenomesson luteoviride.
 " *incarnatum.*
Scilla natalensis.
Urceolina pendula.
 " *gloriosa.*
Veltheimia viridiflora.
Aristolochia gigas, var. Sturtevantii.
Impatiens Hawkerii.

Contributed by Messrs. James Veitch & Sons, Royal Exotic Nursery, Chelsea.

Adiantopsis radiata.
Adiantum œmulum.
 " *amabile.*
 " *aneitense.*
 " *Birkenheadii.*
 " *cuneatum grandiceps.*
 " *cyclosorum.*
 " *daphnitis.*
 " *Flemingii.*
 " *fragrantissima.*
 " *glaucophyllum.*
 " *Henslovianum.*
 " *Lambertianum.*
 " *Legrandii.*
 " *Luddemannianum.*
 " *macrophyllum.*
 " *mundulum.*
 " *Pacotii.*
 " *pulverulentum.*
 " *reniforme.*
 " *rhodopyllum*
 " *rubellum.*
 " *Seemanii.*
 " *scutum roseum.*
 " *tinctum.*
 " *Veitchii.*
 " *venustum.*
 " *Waltoni diffusum.*
 " *Weigandii.*
 " *Williamsii.*
 " *Fecii.*
Asplenium cicutarium.
 " *formosum.*
 " *pteroides.*
 " *rutœfolia.*
Blechnum brasiliensis.
 " *corcovadense.*
Cheilanthes elegans.

Cheilanthes hirta.
Cibotum princeps.
 " *Schiedei.*
Davallia decora.
 " *retusa.*
Gymnogramma Laucheana.
 " *Massonii.*
 " *tartaricum.*
Lastrea lepida.
 " *pallens.*
Nephrolepis Bauseii.
 " *cordata compacta.*
Nothochlœna chrysophylla.
 " *nivea.*
Osmunda japonica corymbifera.
Platyloma flexuosum.
 " *tenuifolium.*
Polypodium refractum.
Polystichum triangulare laxum.
Hymenodium crinitum.
Pteris Bauseii.
 " *leptophylla.*
Selaginella grandis.
 " *Lyallii.*
 " *Emiliana.*
Pteris Victoria.
Adiantum Maresii.
 " *macrophyllum, var.*
Pteris Smithiana.
Lomaria gibba rosea.
Areca lutescens.
Araucaria excelsa.
Anthurium Brownii.
Medinilla Curtisii.
Nepenthes Curtisii.
Impatiens Hawkerii.
Hybrid rhododendrons.
Caladium line vars.

List of Plants brought from England by the Assistant Superintendent of Forests and Gardens, Penang, December, 1891,—Continued.

Contributed by Messrs. H. Low & Co., Clapton Nurseries.

Angrecum citratum.	Oncidium crispum.
" articulatum.	" tigrinum.
" hyaloides.	" Marshallianum.
" sesquipedale.	" ornithorhynchum.
Cattleya Mossiæ.	" cucullatum.
" Trianæ.	Phalænopsis denticulata.
" Eldorado.	Pilumna fragrans.
" Gaskelliana.	" nobilis.
" Percivaliana.	Rodriguezia secunda.
Epidendrum vitellinum majus.	Lælia purpurata.
Grammatophyllum Ellisii.	" Dayana.
Lycaste sp.	Cattleya intermedia amethystina.
Maxillaria grandiflora.	Epidendrum ciliolare.
Oncidium papilio majus.	Odontoglossum citrosmum.

Contributed by Messrs. F. Sander & Co., St. Albans.

Cattleya Trianæ.	Epidendrum macrochilum.
" maxima peruviana.	Ocidium hastatum Roezlii.
" Mendelii.	" splendidum.
" labiata autumnalis vera.	" roraimense.
" Mossiæ.	" crispum.
" Bowringiana.	Chysis aurea.
" Gaskelliana.	" bractescens.
" velutina.	Angroecum leonis.
" Schofieldiana.	" Sanderianum.
" gigas.	Lycaste lanipes.
Lælia harpophylla.	Zygopetalum Mackayii majus.
" anceps.	" crinitum.
" grandis.	Miltonia spectabilis.
Trichopilia coccinea.	Dendrobium Leechianum.
Anguloa Ruckerii.	Cyrtopodium St. Ledgerianum.
Houlletia Brockelhurstiana.	Renanthera Storeii.
Dendrobium phalænopsis Schroederianum.	Phajus Humboldtii.
Leptotes bicolor.	Cypripedium caudatum.
Odontoglossum citrosmum.	Lycaste aromatica majus.
" vexillarium.	Dendrobium Foelschii.
" grande.	" dicuphum.
" Harryanum.	" undulatum.

C. CURTIS,

Assistant Superintendent of Forests.

Penang, 18th January, 1892.

APPENDIX B.

GARDENS AND FOREST DEPARTMENT, MALACCA.

MALACCA,

18th January, 1892.

SIR,—1. I have the honour to submit my report on the Forest Department, Malacca, for the year 1891.

2. Mr. DERRY left for Penang on the 21st January, 1891, and I was left in charge till 4th January, 1892.

3. The principal work of the year has consisted of maintenance, general nursery work and planting, experimental cultivation, and clearing land.

4. The main drive has been kept in good repair by the Garden staff, and the entrance from Batu Berendam Road has been widened and raised and a new bridge built, so as to be above the water level during the rainy season.

5. To the avenue of specimen local trees on the part of the drive which entirely belongs to the Garden, the following have been added:—Kembaing Semangkok, Mer-sawa, Kempas Sawang, Klat Nasi Nasi, Kluet, Malbira, Kabu Kabu Utan, Rambahan Bukit, Merbaju, Kuayah, Kanidai, Pisang Pisang, Kranji Burong. Penagah Lilin has also been planted during the year.

6. Thirteen flower-beds have been formed on one side of the main drive, and clumps of trees and shrubs planted.

7. A collection of ornamental shrubs and flowering plants for supplying Government grounds, and for general distribution, has been maintained throughout the year.

8. The nursery work is shown in the following analysis:—

Seeds sown.	Cuttings planted.	Seedlings transplanted.	No. of kinds.	Trees prepared for box planting.	No. of kinds.
102	4,337	19,471	20	6,551	53

9. Altogether 3,777 trees have been planted during the year, which leaves a balance at the close of the year:—

Forest trees ready for planting, ...	2,298
Fruit trees and other economics, ...	1,762
Total, ...	4,060

10. An area of about 7 acres has been cleared at Bukit Sabukor Garden, through which a new road 400 yards in length from the main drive to the Assistant Superintendent's Quarters was made, and the following trees planted:—

<i>Myristica fragrans</i> , ...	Nutmeg, ...	40
<i>Caryophyllum aromaticum</i> , ...	Clove, ...	119
<i>Achras sapota</i> , ...	Chiku, ...	27
<i>Nephelium Lappaceum</i> , ...	Rambutan (Merah & Gading), ...	96
<i>Ananassa sativa var.</i> ...	Mauritius Pine-apple, ...	297
<i>Areca catechu</i> , ...	Areca-nut, ...	81
South American Tapioca for experiment,	Oronoque, ...	104
	Buck-stick, ...	100
	Bitter-stick, ...	102
	Camache, ...	104
	Red Sourise, ...	121
Total, ...		1,191

11. All the available land suitable for experimental cultivation has been cultivated throughout the year.
12. Egyptian cotton, annatto, tea, nutmeg, castor oil, Mauritius hemp, and chocolate have been grown on the land adjoining the lake.
13. Egyptian cotton (*Gossypium arboreum*) made very little progress in its growth, the soil of the Settlement generally is not rich enough for its cultivation.
14. Annatto (*Bixa orellana*) has grown well and could be cultivated readily in almost every part of the Settlement, but there is little demand for it.
15. Hybrid Assam tea (*Thea chinensis*, var.) has grown well and is now in full bearing, some of its seeds have been sown and germinated, the seedlings removed from the nursery bed and prepared for box planting.
16. Nutmeg (*Myristica fragrans*) grows satisfactorily on the hill sides, but it requires liberal manuring.
17. Castor oil (*Ricinus communis*) Calcutta variety grows well and fruits freely, but it was badly attacked by beetles lately and died. Its cultivation has now been discontinued.
18. Mauritius hemp (*Furcraea cubensis*) grows with great vigour in the nurseries, and several hundred plants have been planted near the lake. There are about 8,000 plants in the nurseries which could be transplanted.
19. Chocolate (*Theobroma cacao*).—Chocolate plant has proved very capricious in Malacca, whole plantations going off without any apparent cause, except the attacks of leaf insects, while here and there a solitary plant will for many years survive its fellows and go on bearing heavy crops of fruits. Therefore its cultivation has been discontinued in Malacca.
20. Liberian coffee.—Coffee requires very liberal manuring. Coffee planted on the ordinary soil without manure has not proved a success.
21. Cloves (*Eugenia caryophyllata*).—Some of the plants in the Garden, planted by Mr. DERRY, are now about 14 feet high, and in full blossom. The dry red soil of the Settlement suits cloves admirably.
22. Maltese lemons, nut-megs, Indian mahogany, camphor, West India crabwood, Mauritius hemp, Ceylon and Mauritius pine apples are growing well and made favourable progress during the year.
23. A large supply of seeds of the common fruit trees such as durian, binjeh, pulasan, mangosteen, duku, langsats, rambutan, rambei, were sown in the middle of the year, and a large number of seedlings transplanted and prepared for box planting.
24. A portion of the shabby looking coolie line in the nursery near the lake collapsed a few months ago, and the remains of the building were removed and the spot cleared. A piece of jungle land about 2 acres in extent on the slope of the hill on the other side of the lake has been cleared, excavated and levelled, on which a new kapong-bark-wall coolie-line 60 x 25 feet with Mandor and Printer's Quarters has been built. The main posts are of eight-sided Tras Balau, Penagah Lilin, Tampinis and Sapan of 14 inches in diameter, and the other materials of hardwood scantlings 3 to 7 inches in diameter and the roof of double rumbia attaps. Three kitchens have also been erected.
25. Want of space in which to grow the increasing collection of plants necessitated the erection of an additional plant-house in the nursery for the cultivation of ferns, palms, and a great variety of other plants. This is a ventilated roofed house 40 x 18 feet, the materials being hardwood scantlings 7 inches in diameter, and the roof of double nipah attaps.
26. A new cart road 600 yards in length from the Assistant Superintendent's Quarters to the new coolie-line running parallel with the lake has been made at the close of the year.

27. The Garden staff and the Forest watchmen have been assisted by a band of extra coolies in clearing the brushwood between the lake and the new road, about 14 acres in extent, and a portion of it has been planted with 541 Nibong (*Oncosperma tigillaria*) and 45 Kabong palms.

28. Owing to the unusually heavy rainfall, the general works of maintenance, especially of roads and paths, absorbed a larger amount of labour than usual.

Forest Reserves.

29. The principal works of the year consisted of preservation and maintenance of boundaries.

30. The number of fires which occurred this year within the Forest Reserves was two—one at Ayer Keroh which burnt down about 15 ac. s of lalang and brushwood in patches; and another at Sungei Udang which destroyed about 2 acres of lalang. Both fires, I believe, originated from the burning of lalang grass. The rapid and easy ignition of grass on hot days makes it exceedingly difficult to detect the offenders or to prevent the destruction.

31. There were three prosecutions—two for cutting and removing timber from the reserves, and one for theft of fruit from the Bukit Panchor Reserve. Three persons were arrested and convicted, and fines to the amount of \$26.09 inflicted, of which \$6.09 was paid.

32. The total number of Forest watchmen employed was 24, comprising one Corporal, eight Lance Corporals, fourteen Constables, and one Orderly. All worked well, and there were no complaints against them. They were supplied with uniforms this year.

33. About one-third of the useful timbers planted up on the watershed of the water works died, and the rest have grown well. Owing to much sickness and excessive rainfall at Ayer Keroh, I was unable to get coolies to clear the lalang and plant some more useful timbers on the watershed. It was very fortunate that I had not planted them, as a great fire occurred on the 13th of October last and burnt down all the lalang and brushwood on the land where I intended to plant the forest trees.

34. Additions have been made to three Forest Stations during the year at a cost of \$897.28.

35. The wood-oil trees in the Sungei Udang Reserve have been farmed to a Malayman of the name of DALI, at \$36 per annum, who paid the rent in advance regularly.

36. In October last, I purchased 1,500 Sagu Rumbia (*Sagus lævis*) seedling plants for \$20, and planted them on the nursery opposite the new cooly-line, where they are growing well.

37. It has been proposed to take in the Bukit Kuan and Bukit Katil hill chain as mentioned in Mr. DERRY'S report for 1890, but as I had to do the Land Office work as well, I was unable to attend to the above work. During the year, I demarcated, subdivided and registered 579 holdings in the Mukims of Padang Semabok and Ujong Pasir and also attended to applications for lands for tapioca cultivations, etc., etc.

38. Bukit Panchor Reserve.—The Forest watchmen have been assisted by a band of coolies in reclearing three and a half miles of old boundaries, at a cost of \$30.

39. Batang Malaka Reserve.—Three miles of new boundary line have been opened, at a cost \$17.50.

40. Batu Tiga Reserve.—Half a mile of boundary line has been reopened at a cost of \$2.25.

41. Ayer Panas Reserve.—Two and a half miles of boundary line have been re-cleared, at a cost of \$20.75.

42. Two hundred and twenty-eight dried specimens of plants were collected during the year and forwarded to the Director of Gardens and Forests, Singapore; some

are of rare kinds. A large number of dried specimens of grasses and sedges were also collected for the Hon'ble D. F. A. HERVEY, who, I believe, took them with him to England.

Exchanges.

43. Plants and seeds have been exchanged largely with Botanic Gardens, Singapore, and also with Botanic Gardens, Penang.

Total exchanges inwards—plants 723, seeds 44 kinds; outwards—plants, 10,651, seeds, 33 kinds.

44. Attached are statements of Revenue collected and Expenditure for the year under review.

Revenue for the year 1891.

Revenue collected during 1891 :—	\$	c.	\$	c.
By sales from Bukit Sabukor, ...	119	49		
Do. Government Reserves, ...	263	42		
			382	91
Timber supply for use of P. W. D., ...	100	45		
Trees supplied for Government ground buildings, ...	39	40		
			139	85
Total,			\$522	76

Expenditure for the year 1891.

Vote.	\$	c.	\$	c.
	6,000	00	6,000	00
Forest Watchmen, ...	2,283	01		
Garden, ...	1,390	82		
Ayer Panas Reserve, ...	20	75		
Batang Malaka Reserve, ...	17	50		
Batu Tiga Reserve, ...	2	25		
Bukit Panchor Reserve, ...	30	00		
Bukit Sabukor Garden, ...	35	00		
Pony Allowance, ...	431	99		
Field Allowance, ...	10	00		
Do., Mandor, ...	2	83		
Personal Allowance, ...	30	00		
Transport, ...	18	20		
Cartage, ...	95	28		
Freight and Shipping, ...	87	50		
Incidental Expenses, ...	15	56		
Herbarium Expenses, ...	36	53		
General Maintenance, ...	285	49		
Tools and Implements, ...	18	43		
Purchase of Plants and Seeds, ...	54	90		
Do. 2 Bullocks and a Cart, ...	110	00		
Uniforms, ...	126	00		
Building a cooly-line with Mandor and Printer's Quarters attached, ...	199	89		
Building a ventilated Plant-house, ...	47	60		
Manure, ...	99	90		
			5,440	83
Balance, ...			559	17
			\$6,000	00

P. J. HOLMBERG,

Acting Assistant Superintendent of Forests, Malacca

REPORT ON THE GARDENS AND FORESTS DEPARTMENT, STRAITS SETTLEMENTS.

BOTANIC GARDENS, SINGAPORE.

Staff.

1. The resignation of VINCENT CONIS at the beginning of the year, left a vacancy in the Upper Garden which was filled by COORAY, a Cinghalese, from the Agricultural College in Ceylon, who gives satisfaction.

The Mandor, RASIP, formerly in charge of the Upper Garden was transferred to the Economic Garden, and for a short time his services were required as an interpreter in Pahang during the war. MOHAMMED ANIFF was transferred from the Economic Garden to the Upper Garden, but as he proved indolent it is proposed to dismiss him.

Visitors.

2. The number of visitors was as large as usual, and the band performances once a month on moonlight nights proved highly attractive. There was less damage done by theft in the Gardens and plant-houses than in previous years.

Aviaries.

3. During the year a number of animals and birds were purchased or presented. Among the most important additions were:—One female Malay bear (*Helarctos malayanus*) presented; one deer (male) (*Rusa equinus*), presented; two remarkable varieties of the large squirrel (*Sciurus bicolor*), purchased; guinea-pigs (*Cavia porcella*); a rhinoceros hornbill (*Buceros rhinoceros*), presented by Mr. J. HILTY; an owl (probably *Bubo* sp.) said to have come from the Philippines, purchased; an egret (*Ardea* sp.); a serpent eagle (*Spizaetus* sp.); a brahminy kite (*Haliastur indus*) purchased; two pelicans (*Pelicanus philippinensis*) purchased; one lesser frigate bird (*Phaethon minor*); one large python, purchased, and others presented; one *Dipsas cynodon* presented by Mr. HUTTON; one hamadryad (*Ophiophagus elaps*) captured; and one river turtle (*Trionyx* sp.) captured in Singapore, which has been put into the lake.

The only remaining wild dog and a fine sea-eagle were killed by poison administered maliciously; though there was little doubt as to the offender, the Police were unable to procure any evidence in the matter. This is the third case of malicious poisoning of the animals in the Gardens within the last few years. The ease with which poison can be procured in Singapore, and the difficulty of the Police in bringing home cases of this kind make it by no means easy to protect the animals from this treatment.

Buildings.

4. The cooly lines were re-erected and improved at a cost of \$140. A small house was put up for the Kling coolies on the Economic Gardens, at the corner near Dalvey Road, so that this part of the Gardens may be protected from depredation.

The large plant-house was repaired at a cost of \$225.

New or Rare Plants.

5. During the year, many new plants were obtained from various countries, and from different parts of the Malay Peninsula, chiefly from Perak, Mount Ophir and Johor. Among the orchids never or rarely previously seen in flower here before, were the following:—*Dendrobium phalaenopsis*; *Eria Kingii*; *Liparis latifolia*;

Nephelaphyllum pulchrum; *Angræcum sesquipedale*; *Stanhopea grandiflora*; *Fernandezia acuta*; *Peristeria elata*; *Leptotes bicolor*; *Rodriguezia secunda*; *Brassia cordata*; *Oncidium papilio*; *Cirrhopetalum makoyanum*; *Podochilus uncifera*; *Arundina revoluta*.

The two new *Cypripediums*, *C. O'Brienianum* and *C. Chamberlainii*, were received in exchange. Of plants of interest other than orchids may be mentioned as having flowered this year:—*Didymocarpus atrosanguineus*; *D. semitorta*, (from Mount Ophir); *D. longipes*, (Mount Ophir); *Aristolochia Roxburghiana*, (Pahang); *Leea amabilis*, (Langkawi); *Hypericum chinense*; *Canscora* new species (from Kuala Lumpur); *Impatiens platypetala*, (Sumatra); *I. mirabilis*, (Langkawi); *Aglaonema costatum*, (Langkawi). A very fine new *Begonia* from Tringganu, and two other species from Pulau Aor and Perak respectively were also introduced. The *Victoria regia*, plants of which were formerly in one or more of the lakes, died out last year, and seeds since received have not germinated, so that now for the first time for many years the Gardens do not possess this plant. A very fine tree in the Economic Gardens, apparently an undescribed species of *Mangifera*, was struck by lightning at the close of the year but it does not appear to be much injured.

Lakes.

6. The big lake in the Gardens was drained off and thoroughly cleaned. This would have been soon necessary in any case, but it was found requisite to do it this year as a crocodile which escaped about two years previously had taken up its quarters in the lake, and defied all efforts to catch it. It at length became dangerous, having seized one of the coolies while drawing water so that it was considered advisable to drain off the lake to destroy it.

The new lake near the Tyersall Road was completed and planted with water lilies and other aquatics. The bridge across it was made and railed and the drive through the palmetum across the bridge into the Tyersall Road was finished. A *Hibiscus* hedge was planted on the outside and much work was done in removing unsightly trees and planting others in this part of the Garden.

Economic Gardens.

7. The arboretum on the upper part of the hill known as the Military Reserve has progressed favourably. Over ten acres was cleared of fern and brushwood and *changkolled* over. The plots for the different orders of plants have been marked out and labelled and from *Dileniaceae* to *Loganiaceae* have been planted up with trees and shrubs, all of which have grown remarkably well, as the soil here is very good. Grass has been encouraged to grow and has been planted between the trees to prevent the excessive denudation caused by the rainfall.

8. The arranged collections of economics have been added to and continued, and many cuttings and seedlings of useful plants have been raised.

9. A large number of economic plants have been sent out to various parts of the world both to private persons and to Botanic and Agricultural Stations.

10. The Avocado pear fruited well this year, and a further supply of seed has been received from Kew and from Trinidad. The Cola-nut (*Cola acuminata*) has flowered but failed to set fruit. *Styrax Benzoin* also flowered for the first time for many years.

Attempts are being made to introduce finer classes of pine-apples into Singapore, and in answer to letters the Gardens received suckers of English hot-house pines from Kew and of West Indian strains from Trinidad. The Brazilian pine known as *Abacaxi* has also been promised but not yet received.

Some plants of the Borneo Camphor tree (*Dryobalanops camphora*) were obtained by the plant collector in the Indau district of Johor, apparently the only locality for it in the Malay Peninsula. Unfortunately most did not recover the effects of the long and difficult route by which they were brought down.

11. The barks of several of the mangrove trees are used here in tanning and it seemed possible that some use might be made of an extract of the bark. Experiments have been made with several of these barks, but no record has been kept as far as I am aware as to what trees the bark was derived from.

I boiled in a copper pan ten catties of the bark of the Tengah (*Ceriops candolleana*) and the same amount of Blukup (*Rhizophora mucronata*) and from each obtained a quantity, (10 per cent.), of a red brown astringent extract, which was easily hardened into a shining black brittle mass.

Samples of these extracts I sent to England in order to get an opinion as to their possible value, but have not since received any reply. Mangrove bark extract

(from some other mangrove tree) was last year sent home from Jamaica, but was not taken up by the trade, apparently from want of knowledge as to the value of its tanning properties. As the extract is so easily made, and the bark is practically a waste product at the wood-cutting depôts in the mangroves, it seems worth while to try if its manufacture cannot be taken up for profit.

12. The large seeds of *Millettia atropurpurea*, a tree abundant in many parts of the Peninsula, were forwarded to the Gardens by Mr. HILL of Linsum Estate, with a suggestion that they might be utilised as a manure. The seeds were ground up and mixed with the soil and some plants of *Coix lachryma-Jobi* were planted in a pot with them, an exactly similar pot of the same plant in similar soil without the grounded seeds being put alongside for comparison. At first the unmanured plants grew much more rapidly than those with the manure, but eventually the latter caught them up and were even a little stronger and healthier, but the result did not show any great value in the *Millettia* seeds as a manure.

13. The cultivation of indigo by the Chinese has lately increased to a considerable extent, but the dye is only used locally and has not been exported. There seems to be an idea current that Singapore indigo will not set, but always remains liquid. This is quite an error, as it is easily dried and made into a fine powder. Samples of this have been sent to England to be appraised, but it is hardly probable that the dye as prepared by the Chinese with the most rudimentary apparatus and in the most careless way can be of good quality. Still as this climate has certain advantages over that of India for the cultivation of the plant, it may be well worth the attention of the planter. A Bulletin treating of the plant as grown here will be published as soon as the decision of the home authorities as to the sample sent is received.

14. During the year, Mr. DERRY in Malacca made some experiments in extracting pine-apple fibre, which gave a good result, but the expense of the manufacture of the best quality seems to leave a comparatively small profit. Similar experiments have been made here, and long-leaved pines have been selected and cultivated for this purpose.

15. Enquiries have been made lately for a material for brush-making to replace Piassava fibre now becoming scarce. Mr. BULKELEY, a gentleman much interested in the trade, visited the Gardens to make investigations on this point, and after examination considered that selected fibres of the sugar palm (*Arenga saccharifera*) would possibly supply the want. As the supply of these fibres throughout the Peninsula is very large and no use is at present made of them, an important trade might be opened up should they be found suitable. Specimens of these fibres and others from the leaves of the sago palm, arcca-nut and coco-nut are being prepared, and when the series is complete, it will be submitted to experts.

16. Further experiments in ringing the gutta percha tree (*Dichopsis gutta*) have been tried with greater success than on previous occasions. It is a very difficult tree to propagate by cuttings, probably on account of the slowness of its growth. Great interest has been taken in its cultivation lately, which has been stimulated by attempts to form companies for the extraction of the gutta from leaves and twigs.

Artist.

17. The Artist continued his useful work of making careful drawings of the plants of importance economically or botanically of the Malay Peninsula.

Herbarium.

18. A very large series of specimens have been added to the herbarium, which is now becoming a truly representative one of the Malayan flora.

In the early part of the year the Director visited the Dindings, and the Larut Hills, and the Kuala Kangsa district, whence an extensive series of plants both dry and living was obtained, much assistance being given by the Perak Government. Later the Mount Ophir range was explored and a considerable number of the plants peculiar to that district obtained, including many novelties, among which was a species of *Balanophora*, the first recorded plant of this order met with in the Malay Peninsula. In August, Mr. LAKE of the Johor civil service and Lieutenant KELSALL, R.A., traversed the Peninsula from Kuala Sedili to Batu Pahat, and by permission of His Highness the Sultan of Johor, a plant collector accompanied the expedition. Good and important collections were made along the Sedili and Sembrong Rivers, on the high range of Gunong Janeng, and at Batu Pahat. With Mr. LAKE also the collectors visited Gunong Pulai and obtained a characteristic collection. In December the Director visited, while absent on leave, the ridge of Gunong Panti, and

collected there and at Kota Tinggi a number of specimens. Mr. T. FEILDING, during his stay in Singapore, obtained a number of specimens from Muar, Kuala Indau and from the eastern islands of Pulau Aor, Pulau Tinggi and Pulau Dayong, lying off the east coast of Johor and a small series of orchid specimens was sent to the Gardens from Batu Pahat by NONGCHIE, Gardener to the Sultan of Johor. By these collections the flora of Johor hitherto almost a blank in the herbarium is very fairly represented.

A good number of plants were collected in Singapore by the forest watchmen; 316 specimens were sent from Penang by Mr. CURTIS; 236 from Malacca by Mr. DERRY; and about 40 from the Hon'ble D. F. A. HERVEY; 79 specimens chiefly from Perak from Dr. KING. From Borneo, Dr. HAVILAND presented 382 specimens including a good series of his valuable collection from Kinabalu; 367 specimens from various East Indian collectors were presented by Kew; and 478 from the collections of WALLICH, BEDDOME and THWAITES were received from the British Museum. Specimens of 430 flowering plants and 20 Algæ were received from Baron VON MUELLER from Australia. The total number of specimens received, most of which were mounted and arranged in the cabinets was upwards of five thousand.

The number of specimens sent to various Museums is as follows :—

- 2,902 to the British Museum.
- 695 to the Royal Gardens, Kew.
- 1,425 to Dr. KING, Calcutta.
- 369 to Baron F. VON MUELLER.
- 40 mosses to V. BROTHERUS.
- 20 Melastomaceæ to M. COGNIAUX.

A few specimens were also sent to the Perak Museum and to the Pharmaceutical Society.

The whole of the order *Anonaceæ* was sent on loan to Dr. KING to aid him in elaborating that order for the materials for the Flora of the Malay Peninsula, and were returned by him critically named.

Several new cabinets were purchased, and most of the old ones were repaired and altered so as to be more dust and insect-proof.

Owing to the large accessions in the herbarium and library of late years it was found requisite to enlarge the office, and a sum of \$500 was voted for the ensuing year to pay for part of the needed alterations.

Coco-nut Trees Preservation Ordinance.

On the dismissal of the former Inspector, MUSSAFER ALI, M. A. BAKAR was employed as Inspector under the Act, with one cooly. Inspections were made over the greater part of the island from time to time, and 278 notices to cut down trees and remove stumps and rubbish were served. The number of dying trees condemned and destroyed was 1,887, and 4,050 stumps and pieces of dead trees were removed, and burnt or buried. Twenty notices were served on owners of tanneries requiring them to burn the refuse bark, in which the beetles were breeding, and five notices were served on owners of piles of cow-dung, and four on saw-mill owners requiring the removal of decaying saw dust. In all but ten cases the notices were speedily complied with, but great difficulty has been experienced in the case of one of the saw-mills, in which the accumulation of saw dust for many years is so enormous that it is almost impossible to dispose of it. It covers a tract of ground of a very large extent to a depth of over four feet. To burn it on the spot would be almost impossible, and were it possible would cause great risk of firing the mills and other houses on the adjoining property, while to throw it into the sea, will be a long and expensive work. This, however, is being done. This mill has been doubtless the cause of a great deal of damage to the adjoining coco-nut plantations.

Although a great deal of work has been done in the Kalang district, it still remains the worst in Singapore. This is owing partly to the saw-mills and tanneries and partly to the small patches of neglected ground, the owners of which are either too poor to remove the trees themselves, or have disappeared and cannot be traced. Still there is a marked improvement here, but as the vote for last year was insufficient to employ an adequate number of coolies to destroy the dead trees and stumps on the property belonging to the poorer classes here, a good deal of work has still to be done.

Ten summonses were taken out against persons not complying with the notices served. In four cases an extension of time was allowed, and the work completed, and in two cases the defendants could not be found, so that they had to be struck off. In the remaining four, fines were inflicted to the amount of \$24 in all.

Expenditure.

	\$	c.	\$	c.
Vote, ... ..	...	...	700	00
Additional Grant asked for, ... ..	...	...	43	00
Salaries,	451	16		
Transport,	89	33		
Uniforms,	14	00		
Contractors for removing and destroying trees and stumps,	188	35		
Balance,		0 16		
	<u>\$743</u>	<u>00</u>	<u>\$743</u>	<u>00</u>

Exchanges.

Plants and seeds were received during the year from the following contributors:—

	Plants.	Seeds.
Royal Gardens, Kew,	48	1 box.
Botanic Gardens, Calcutta,		9 packages.
Do., Ceylon,		8 do.
Do., Trinidad,	27	17 do.
Do., British Guiana,		6 do.
Do., Jamaica,		8 do.
Do., Grenada,		11 do.
Do., Brisbane,		1 do.
Do., St. Petersburg,		70 do.
Do., Buitenzorg,		1 do.
Do., Mauritius,		12 do.
Do., Hongkong,		7 do.
Do., Fiji,		2 do.
Do., Hanoi,		1 do.
Do., Antigua,		1 do.
Messrs. Cannell & Son, England,	38	56 do.
„ Dammann & Co., Naples,		42 do.
„ Sander & Co., England,	21	... do.
Baron von Mueller, Melbourne,		23 do.
Mr. Goodhart, Sumatra,	20	... do.
Mr. Baker, Perak,		8 do.
Mr. Micholitz,	28	1 do.
The Hon'ble A. L. Donaldson, Singapore,		2 do.
Mr. Larken, Johor,		1 do.
Mr. C. Hose, Sarawak,	100	... do.
Mr. Pryer, Borneo,	12	2 do.
Mrs. Phillips, Singapore,	1	... do.
The Hon'ble D. F. A. Hervey, Malacca,		2 do.
Mr. R. Little, Singapore,	1	... do.
Mr. Robinson, Norfolk Islands,		2 do.
Sir G. Elphinstone, Perak,	1	... do.
Mr. Vade, Singapore,		3 do.
The Hon'ble G. S. Murray, Singapore,	12	... do.
Mr. Hilty, Singapore,	13	... do.
Mr. von Ravensway, Singapore,	72	... do.
Mr. Pereira, Singapore,	15	... do.
Miss Ridley, England,		1 do.
Major-General Berkeley, England,	25	... do.
Mr. Lake, Johor,	12	... do.
Mr. Gueritz, Borneo,	50	... do.
	<u>496</u>	<u>308</u>

The usual inter-departmental exchanges were very heavy, some thousands of young seedlings were received from Malacca. Duplicates of most of the rare and interesting plants brought from England by the Assistant Superintendent of Forests, Penang, mentioned in last year's Report, were received from Penang.

Plants and seeds were distributed to the following recipients:—

		Plants. Seeds.	
Royal Gardens, Kew, ...	...	34	... packages.
Botanic Gardens, Calcutta, ...	...	100	... do.
Do., Trinidad, ...	...	19	do.
Do., Antigua, ...	...	9	do.
Do., British Guiana, ...	...	10	do.
Do., Bangalore, ...	...	9	do.
Do., Fiji, ...	...	9	do.
Do., Lagos, W. Africa, ...	...	10	do.
Do., Mauritius, ...	...	50	do.
Do., Hongkong, ...	...	10	do.
Do., St. Petersburg, ...	...	14	do.
Messrs. Sander & Co., England, ...	...	400	... do.
Major-General Berkeley, England, ...	...	17	... do.
Messrs. B. S. Williams, ...	...	150	... do.
Mr. Voute, Java, ...	...	22	... do.
Dr. Buysmann, ...	...	8	do.
Mr. Goodhart, Sumatra, ...	...	30	... do.
Messrs. Boustead & Co., ...	...	2	... do.
Superintendent Government Plantations, Perak, ...	...	100	... do.
Dr. F. Kamienski, Odessa, ...	...	25	50 do.
Mr. F. Griffith, Madras, ...	...	32	... do.
His Excellency C. V. Creagh, Borneo, ...	...	6	... do.
Mr. W. B. Pryer, Borneo, ...	...	25	... do.
Mr. G. Pechè, Moulmain, ...	...	25	... do.
His Majesty the King of Siam, ...	...	100	... do.
St. Andrew's House, Singapore, ...	...	100	... do.
Mr. Brindaboon Ghose, Calcutta, ...	...	10	do.
Mr. J. Ravensway, Singapore, ...	...	7	... do.
		1,175	208

Library.

The following publications were added to the Library during the year:—

Presented by the Royal Gardens, Kew:—

- PIERRE, L.—“Flore Forestiere de la Cochin Chine,” 14th Fasc., 1889.
 Do., do., 15th Fasc., 1890.
 BAKER, J. G.—“New Ferns,” 1874-91.

Presented by the British Museum:—

- NEES AB ESENBECK—“Systema Laurinearum,” 1836-1840.
 REICHENBACH LUDWIG—“Nomenclator Botanicus Hortensis.”
 WIKSTROM—“On Daphne,” 1820.
 CUNO—“Enumeratio Methodica Plantarum.”
 BLANCO—“Flora de Filipinas,” 1837.
 PRESL—“Tentamen Pteridographiæ,” 1836.
 CRANTZ—“Institutiones Rei Herbariæ,” Tomes 1 and 2, 1766.
 JACQUIN—“Collectanea,” 1, 2, 3, 4 Supplements, 1786-89.
 VAHL—“Symbolæ,” pars. 1, 2 and 3.
 WENDLAND—“Botanische Beobachtungen,” 1798.
 SIEBOLD and ZUCCARINI—“Flora Japonica,” (text only) 1835-70.
 THUNBERG—“Icones Plantarum Japonicum,” 1794.
 HOST—“Icones et Descriptiones Graminum Austriacorum,” 1801-09.
 LAMBERT—“Catalogue Botanical Museum,” 1842.
 TREUB, Dr.—“Slands Plantentuin te Buitenzorg,” 18 Mei, 1817; 18 Mei, 1892.
 KAMIENSKI, Dr.—“Lentibulariaceæ.”
 NORDSTEDT. OTTO—“Australasian Characeæ,” by Baron von Mueller.
 SÂNYÁL—“A Handbook of the Management of Animals in Captivity in Lower Bengal.” (Presented by Mr. W. Davison).
 OYSTER, Dr.—“Catalogue of North American Plants Paolo Kansan, U. S. A.,” 1888.
 HART, H. L.—“The Agricultural Record Trinidad, July, August, December, 1890,”—Sur l'Isonandra Percha on I Gutta. (Presented by M. Sérullas.)

HENNINGS, P.—“Fungi Novo Guineensess.”

The following were purchased:—

HOOKER, Sir W. I.—“Icones Plantarum” Vol. I—new series; Vols. II, III, and IV.

LEONARD and CHRISTY—“Dictionary—Materia Medica,” 1892.

CURTIS—“Botanical Magazine,” Vols. 17-70.

MIQUEL—“Illustrationes Flor. Archip. Ind.”

KORTHALS—“Verhandlingen.”

The usual periodicals and the Annual Reports from the various Botanical Gardens were received.

BOTANIC GARDENS, SINGAPORE.

Statement of Receipts and Expenditure for the year 1892.

RECEIPTS.		EXPENDITURE.			
	\$ c.	Salaries.	\$ c.	\$ c.	
By Balance in Bank, ...	826 04	Herbarium Keeper, ...	205 87		
„ Government Grant, ...	8,500 00	Mandor, ...	165 96		
„ Sale of Plants and Flowers, ...	1,061 08	Assistant Mandor, ...	4 25		
„ Interest, ...	39 73	Carpenter, ...	164 46		
		Assistant Carpenter, ...	86 38		
		Printer, ...	120 00		
		Assistant Printer, ...	61 00		
		Peon, ...	96 00		
		Aviary-keeper, ...	96 00		
		Mason, ...	50 00		
		Police, ...	346 50		
		Coolies, ...	3,209 91		
				4,606 33	
		<i>Bills.</i>			
		Manure and Cartage, ...	371 38		
		Food for Birds and Animals, ...	754 14		
		Pots and Tubs, ...	312 28		
		Purchase of Plants and Seeds, ...	368 38		
		Purchase of Botanical Books and Herbarium Paper, ...	1,116 01		
		Repairs to Buildings, ...	467 42		
		Tools and Stores, ...	568 64		
		Wood for Construction purposes, ..	378 12		
		Bricks, Lime, etc., ...	120 90		
		Laterite and Gravel, ...	346 66		
		Director's Petty Expenses, ...	173 54		
		Assistant Superintendent's Petty Expenses, ...	131 78		
		Miscellaneous, ...	255 42		
				5,364 67	
		Balance, ...		9,971 00	
				455 85	
	\$10,426 85			\$10,426 85	

FOREST DEPARTMENT, SINGAPORE.

Area.

1. No additional land was taken over this year, so that the area remains at 14,509 acres 1 rood and 3 poles.

Staff.

2. The same number of Forest Watchmen was employed as last year, viz., 23 in all. All worked well.

Buildings.

3. Four Forest Stations have been re-built, viz., at Changi, Bukit Timah, Sungai Jurong and Bukit Mandai, at the expense of \$290.43 each.

Farming.

4. One pepper encroachment only was leased this year, the others and the old gambir plantation having ceased to be sufficiently productive to let.

Licenses.

5. Passes for cutting mangrove for firewood, fishing stakes and rattans were given out in the reserves of Seletar, Sungai Jurong, Changi, Kranji, Sungai Morai, Toas and Pandan, and brought in a revenue of \$470 under the following items:—

Mangrove—firewood, ...	\$310
Fishing Stakes, ...	139
Rattans, ...	14
Lalang, etc., ...	7
	<hr/>
	\$470

Planting.

6. The planting up of waste land has been carried on as rapidly as possible throughout the year.

At Bukit Mandai 2,090 young plants of Para Rubber (*Hevea brasiliensis*) were planted and 1,950 of these are growing very well and strong. With them 50 seedlings of *Castilloa elastica* have been planted. This covers an area of 13 acres of previously useless land. In a few years these trees should produce a revenue from the sale of the India-rubber and will also be of value in producing a good stock of seed.

At Upper Mandai 400 seedlings of the broad-leaved mahogany (*Swietenia macrophylla*) have been planted together with 500 seedling oaks (*Quercus*) covering an area of 10 acres. There are great hopes of the success of this mahogany in the Peninsula. It grows well and strongly and does not seem at all inclined to die down on account of poverty of soil as the common mahogany does. The oak gives a useful timber with a good figure.

The fireguard at the 12th mile, Kranji, has grown well and the lalang has been kept down so that there is now but little fear of damage from fire here. Along the upper portion of the hill, an area of 15 acres has been planted up with various trees, upwards of 2,050 in number, including Penaga (*Myristica elliptica*), a good timber; Saga (*Adenanthera pavonina*), a rapid growing tree which will aid in keeping down the grass; (*Cassia siamea*); Rasak (*Vatica russak*), a good timber much in request and getting scarce; Ebony (*Maba buxifolia*), known as "kayu arang" (300 plants); Kranji (*Dialium*), three species, 700 trees, all good timbers, indeed equal in strength and durability to any timber in the Peninsula; and 540 other trees in small lots.

A nursery was started at Bukit Timah in which 6,000 seeds of Belian, (*Eusideroxylon schwageri*, Teysm.) have been planted, and seedlings of this most valuable tree raised from a small quantity of seed were planted here and there in other reserves.

Along the edges of all the newly planted ground, a border of Gelam trees (*Melaleuca leucadendron*) has been planted and is coming up well.

During the past two years many acres of worthless grass land have been planted up with timber trees, which in a year or two will be able of themselves to keep down the lalang, which otherwise would choke them. Unfortunately the vote for the Forests for next year (1893) has been so reduced that not only can no more

planting be done but it will be impossible to properly weed and clean the trees already planted. This is the more to be regretted as it has been at last found possible to induce the Natives to bring for sale at cheap rates seed and seedlings of the most valuable timbers. Belian seed too has been, through the aid of Mr. PRYER of Sandakan, sent in large quantities, and did funds permit it would be possible to plant many acres of worthless ground with this tree which produces probably the best timber in the Oriental region.

The tree is being cut down wholesale in Borneo and exported, but in Singapore the wood is very expensive, and, with the destruction that is going on, will ere long be even more so. There is an idea in Singapore that it is too hard to work, but the great use of it in Borneo shows the fallacy of this. Like all good timbers it is of course very hard, and the Chinese carpenter finds it more profitable to work with the softer and inferior woods, not only on account of their being easier to cut but also because they soon perish and have to be replaced. There is no reason except that of expense why the timbers of at least the more important buildings should not be of Belian instead of softer and more perishable woods.

No one who visits the saw-mills of Singapore can fail to be struck with the poor class of timber to be seen there now, many planks are cut from the sap wood of the inferior classes of Meranti and Seraya, and every year must see a still poorer supply of good timber, as the Siak, Johor and Bornean forests are being heavily denuded. It would, therefore, seem advantageous to plant up the worthless lalang fields with seedlings of such timbers as Belian, Kranji, Rasak and the like, in order that by the time all the good accessible woods are destroyed, a fresh supply may be ready.

Nor would any future time be more suitable than the present while the seed of these trees is still procurable. Belian seed which, if properly planted and looked after, would develop into valuable timber, is wasting in the Bornean forests. Kranji fruit is imported in quantity into Singapore merely for eating, the seed being practically destroyed. It was formerly abundant in Singapore, but was in such demand for coffins that the Chinese practically exterminated the tree, shipping the wood to China. Both trees grow rapidly and well here, and at a small expenditure might be planted extensively.

Fires.

7. There were eight fires during the year, some of considerable extent. One broke out at Bukit Panjang, and burnt about 150 acres of lalang and medium sized trees. It had been raised by two Chinese for the purpose of clearing a small patch of grass on their property in order to plant pine-apples. They were arrested and fined \$25 apiece; one paid the fine, the other suffered a month's imprisonment.

At Bedok 40 acres of grass were burnt in February; at Jurong one acre of grass and fern; at Chan Chu Kang two acres of grass were burnt in July. In the Changi reserve there were no less than four fires, about 32 acres of grass, fern and small trees being burnt.

Prosecutions.

8. There were 15 cases of prosecution for cutting and removing timber, grass, etc. Of these, four defendants were cautioned and discharged, and in one case the defendant absconded. The remainder were convicted and fines to the amount of \$141.50 inflicted, out of which, \$65 was paid.

Expenditure.

Vote, ...	...	...	...	\$4,000 00
Salaries, ...	...	...	...	\$2,748 17
Buildings, ...	...	...	...	871 28
Uniform, ...	...	...	...	147 00
Miscellaneous, ...	...	...	...	226 77
Balance, ...	...	...	...	\$6 78

Revenue.

Encroachment, ...	...	...	...	\$ 15 00
Sales of Forest Produce, ...	...	...	...	470 00
				\$485 00

HENRY N. RIDLEY,
Director of Gardens and Forests, S. S.

APPENDIX A.

GARDENS AND FORESTS DEPARTMENT, PENANG.

1. The only important change in the staff was caused by the death of Mr. P. NIEUKEY, who had been Overseer of the Waterfall Garden almost from its commencement. MAHOMED HANIFF, now in the last year of his apprenticeship, is acting as Overseer on probation.

2. After a further trial of five months, during which the health of myself and family suffered severely from fever, it was found necessary to vacate the Garden bungalow and rent quarters as convenient to the work as possible. Thinning out the jungle in the neighbourhood of the bungalow had no effect whatever in making the bungalow more healthy. I am thankful to say that the change has proved most beneficial, as none of my family have since suffered from fever, and myself only slightly, caused in my case by exposure such as would induce fever almost anywhere in the tropics.

Maintenance of Forest Reserves.

3. In this branch of the Department the work of the year consisted principally in the performance of Police duties, and the re-clearing of boundaries. Forty-three persons were prosecuted for various offences, the more important being timber cutting, encroachment, and setting fire to Crown forest. Of this number, thirty-two were convicted and fined in sums varying from one to fifty dollars; the total amount aggregating \$314.

4. Since January, 1889, up to which time great leniency was shown, in order that the villagers and hill cultivators principally concerned might become acquainted with the limits within which timber cutting or cultivation is prohibited, and which had been defined during the two previous years, two hundred and fourteen persons have been prosecuted, and it is safe to assert that had no conservancy measures been taken up to the present, there would now be but little old forest remaining in Penang.

5. During the last three months of the year, thirty-seven miles of boundary were gone over and re-cleared where it had become overgrown with *lalang*, *resam*, &c. It is principally on abandoned land and along the edges of clearings that difficulty is experienced in keeping the boundaries open. In old jungle there is scarcely any trouble.

6. In this connection I may point out that satisfactory maps of each separate reserve are much needed.

Waterfall Garden.

7. Perhaps the most noticeable of the many improvements effected during the year is the re-placing of two wooden bridges over the main stream with new ones of iron and granite. One of these old bridges was in existence before the land was acquired by Government for the purpose of forming a public garden, and the road was laid out so as to utilize it, but for the past two years it has been in so unsafe a condition that carriage traffic has been suspended, greatly to the inconvenience of visitors. The new one has been built a few feet higher up the stream, and the approaches improved by altering the curve on one side, and cutting down the road to an easier gradient on the other.

8. The second bridge was built by the Garden coolies about five years ago, and the masonry is still in good condition. What has now been done is to replace the wooden beams with an iron frame-work, granite pillars at each end, and an iron railing. At the same time it has been raised about eighteen inches which has afforded an opportunity of improving the gradient of the road.

9. Various other works of importance have been carried out, including the cutting down and sloping a steep cliff, thirty feet high, close by the main bridge, and re-metalling 9,448 superficial feet of carriage road. The development of the surroundings of this slope will be gone on with in 1893.

10. Several beds of annuals and shrubs have been re-planted, some of the former three times, supply of plants being maintained in pots and boxes for this purpose so that the beds are not long out of flower.

11. In no previous year has there been so much colour in the Garden, and this is in a great measure due to the liberal use of hybrid varieties of Indian shot (*Canna indica*), obtained in Europe during my visit in 1891. These have been propagated extensively from the original thirteen varieties brought out, and several hybrids of merit have been raised here during the year.

12. The lily pond has been deepened, and the *Victoria regia* continues in good condition.

13. A few nutmeg and clove trees have been planted near the turning to the bungalow, where there were already durians, betel-nut and other interesting things for which the Island is famous, so that now visitors from steamers, who have often very little time to spare, will be able to see these trees in one place without loss of time.

14. In the Chitty Temple nursery a collection of "Pisangs" (*Bananas*) have been planted and labelled distinctly with the local names, for the purpose of comparing their relative merits, and of affording a supply of young plants to correspondents.

15. Consequent on the Municipal Commissioners laying the main from the new Reservoir across one of the Garden roads, at a height of about three feet above the level, it became necessary to make a detour involving the cutting of about six hundred lineal feet of new carriage road. This was brought to the notice of the Commissioners, and also the damage done to other parts of the Garden road by carting over it all the material required for constructing the Reservoir. The Commissioners agreed to re-metal the road referred to and to supply the necessary labour for cutting the new portion, supervision to be undertaken by the Garden staff. When completed this will afford an easier means of access to the Reservoir and upper portion of the ground.

16. No considerable addition has been made to the area of the Garden, but much has been done towards developing the land already included by planting additional groups of flowering trees, palms, &c. and by reducing to more effective proportions the clumps of jungle left standing when the first clearing was made.

17. The plant sheds, of which there are four, exclusive of the shelter, near the band-stand and those in the nursery, are a source of never failing interest to visitors and residents of Penang. These have been numbered for convenience of reference, and a notice board placed at the entrance gate indicating the route by which these sheds, waterfall, swimming bath, &c. can be most conveniently reached.

18. No. 1 is an octagonal shed with a water tank, rockery and fountain in the centre, and is such as in an English nursery would be termed a show-house. Moderate sized palms in pots and tubs surround the water tank, and the side beds are filled with a great variety of ornamental foliage, flowering plants, ferns, &c. which are changed from time to time. Four new wings, each 16 x 20 feet, have been added, and more lightly shaded than the centre, and a pretty regular display of annuals and other flowering plants is kept up in these.

19. No. 2 is situated just at the end of the lower bridge. It is a span-roofed shed 88 x 40 feet principally devoted to aroids, the whole of which are planted out among rockwork. The posts and roof have been entirely renewed during the past year and a re-arrangement of the plants made, those that had grown too big being removed to the shady ravine leading to the swimming bath. For effectiveness and economy in labour this system of planting among rockwork has much to recommend it.

20. Shed No. 3 opposite the entrance to the plant nursery, erected about six months ago, is devoted to orchids and ferns in pots. It has a double span roof and covers an area of 42 x 58 feet. The covering is made of Bertam chicks and attaps, and the beds on which the plants are set is built of rough stones, the interstices planted with small ferns, mosses, &c. In Table C I have given a list of some of the interesting plants, from a decorative point of view, that flowered in the Garden during the year, many of which were placed in this shed during the time they were in flower. *Angrecum sesquipedale*, *Habenaria carnea*, *Cattleyas*, *Calanthes* and *Dendrobiums* were much admired.

21. Shed No. 4 is situated in the upper portion of the grounds and the plants, consisting of local tree ferns, aroids, begonias, &c., are all planted out in the same manner as No. 2.

22. The principal trouble in connection with these plant sheds is the perishable nature of the material used, but with the amount granted for maintenance of this garden it is not possible to do more than has been done. Light T and angle iron structures, such as are used all over India, with the modifications rendered necessary by difference of climate, would, as I have pointed out in previous reports, be more ornamental, prevent the destruction of many valuable plants by the falling of rotten supports or unavoidable accidents during repairs, and prove cheaper in the end.

23. The demand for plants has been largely in excess of previous years, and although the prices charged are very moderate, \$612.24 was received and paid into Revenue account, as against \$312.91 in the previous year.

24. The swimming bath has not been so well patronized as in 1891, the falling-off being principally in annual subscriptions. The total amount received is \$117.95, against \$180.05 in 1891.

25. A large number of plants and seeds have been exchanged, much to the advantage of the Garden; the additions to the orchid collection especially being of great value. A list of the principal donors and recipients is given in Appendix C annexed.

Government Hill Gardens.

26. Fruit trees in the Experimental Nursery were manured about the beginning of the rains, but no fruit of any importance has yet been produced. A small plantation of Liberian coffee and nutmegs was made in this nursery in March, but the former were soon attacked with leaf disease.

27. The routine work of maintaining the Garden and grounds in connection with Government bungalow has been carried on much as in previous years. A fair display of flowering plants in beds, and in pots for the decoration of the corridor, &c. has always been available, and occupants of the bungalow have been supplied daily with vegetables.

Coco-nut Tree Preservation.

28. The Inspector with one climber and one notice server has been employed alternate months in Penang and Province Wellesley, and the work has been satisfactorily performed.

Four hundred and sixty-nine (469) notices were served ordering the destruction of 5,815 dead trees, or portions of trees, and 60 heaps of refuse likely to prove breeding place for the beetles.

29. In the majority of cases these notices were complied with, but in 88 cases it was found necessary to enforce the law, and fines were inflicted amounting altogether to \$198.

General.

30. Press of work in the Waterfall Garden, especially since the death of the late Overseer, prevented much time being devoted to the collecting of plants.

A hurried trip to Pulau Langkawi in the month of April yielded a good result, a great many of the plants collected having been exchanged for South American and African orchids.

31. Brief visits were also paid to the Dindings, Kedah, and Perak in connection with the work of the department, and a few plants obtained on each occasion.

32. The Director of Gardens and Forests visited this Settlement in February, and afterwards proceeded to Perak; while he remained in that State his collections of living plants were forwarded to the Penang Gardens to be established, and subsequently a portion were sent on to Singapore.

33. A good deal of work was got through at the Residency, principally by the aid of convict labour. This consisted in raising the ground on the Tramway side and of planting a screen of quick-growing trees to shut off the buildings belonging to this Company. Clumps of shrubs were planted on the land raised, and a number of fruit trees planted in the background.

34. As in former years, the supervision of planting shade trees, and Dato Kramat Garden has been undertaken for the Municipality. The laying out of the new Cemetery has also been completed.

35. The total expenditure of the department for the year amounts to \$9,657.63, and the revenue received from sale of plants, &c., \$753.24. The total amount of fines in connection with the preservation of forest reserve and coco-nut trees amount to \$512, as shown in Table A annexed.

C. CURTIS,

Assistant Superintendent of Gardens and Forests.

Penang, 23rd January, 1893.

TABLE A.

Revenue and Expenditure—Gardens and Forest Department, Penang, 1892.

REVENUE.	EXPENDITURE.	
		\$ c.
Grant—Maintenance of Forest Reserves, ... \$2,300.00	Salaries of Forest Guards, Apprentice and Messenger,	997 62
	Salaries of Coolies re-clearing Boundaries &c.,	233 10
	Maintenance of Kubang Ulu Nursery,	258 20
	Tools and Material,	28 17
	Oil for Stations,	16 80
	Repairs to Boat,	5 05
	House Rent,	210 00
	Plants and Seeds,	79 32
	Materials for Herbarium,	36 82
	Cost of Periodicals,	20 00
	Transport, &c.,	52 40
	Miscellaneous,	6 00
		1,943 48
	Balance,	356 52
		2,300 00
Grant—Maintenance of Waterfall Garden, ... \$4,500.00	Salaries of Gardeners and Coolies,	3,237 04
	Plants and Seeds,	86 54
	Pots,	92 50
	Tubs and Baskets,	31 64
	Planks for Plant-cases, &c.,	69 46
	Material for extending Plant Shed No. 1,	40 88
	„ renewing Plant Shed No. 2,	161 48
	„ new Orchid Shed,	101 78
	Corrugated Iron for Drying Shed,	19 96
	Cartage,	99 00
	Freight,	31 22
	Road Metal,	110 40
	Laying on Water to Plant Sheds,	27 42
	Tools and Material,	249 30
	Petty Expenses,	116 20
	Miscellaneous,	24 40
		4,499 22
	Balance,	0 78
		4,500 00
Grant—Maintenance of Grounds of Government Bungalow and Experimental Nursery, ... \$2,000.00	Salaries,	1,614 96
	Seeds,	46 04
	Pots,	48 42
	Tools,	55 62
	Manure,	114 20
	Temporary Quarters,	116 56
	Transport,	1 60
		1,997 40
	Balance,	2 60
		2,000 00

TABLE A,—Continued.

*Revenue and Expenditure, Gardens and Forest Department,
Penang, 1892,—Continued.*

REVENUE.	EXPENDITURE.	
Travelling and Personal Allowances, \$700.00	{ Pony Allowance,	\$ c.
	{ Gharry hire,	390 19
	{ Passage, Personal Allowances, &c. in connection with Visit to the Dindings,	33 64
	{ Passage, Personal Allowances &c., Perak,	32 70
	{ Expenses and Allowances in connection with Visit to Langkawi, ...	52 50
	{ Expenses and Allowances, Kedah, ...	19 75
	{ Field Allowance,	12 75
	{	8 00
{ Balance,	549 53	150 47
		700 00
Expenses of carrying out Provisions of Coco-nut Trees Preservation Ordinance, ... \$700.00	{ Salaries,	544 40
	{ Allowances,	120 00
	{ Petty Expenses,	3 60
	{	668 00
{ Balance,	32 00	700 00
Plant Sales, \$ c.	{	
Receipts from Swimming Bath, ... 117 95	{	
Sales of Confiscated Timber, &c., ... 23 05	{	
Grand Total, 753 24	{ Grand Total Expenditure,	\$9,657 63

TABLE B.

A List of the Principal Contributors and Recipients of Plants and Seeds.

CONTRIBUTORS.	REMARKS.
Superintendent of Royal Botanic Gardens, Calcutta, ...	Miscellaneous plants.
Director of Botanic Gardens, Buitenzorg, ...	Palm seeds and orchids.
Director of Gardens and Forest Department, Singapore, ...	Miscellaneous seeds and plants.
Superintendent of Botanic Gardens, Hongkong, ...	Seeds.
Superintendent of State Gardens, Gwalior, ...	Roses, ferns, &c.
Superintendent of Gardens, Saharanpur, ...	Guava seeds.
Messrs. F. Sander & Co., England, ...	Orchids.
Messrs. Jas. Veitch & Sons, England, ...	Miscellaneous plants and seeds.
Mr. H. G. Batten, Mergui, ...	Orchids, &c.
Messrs. Hughes, Do., ...	Orchids.
Sir Graeme Elphinstone, Perak, ...	Orchids, &c.
Mr. G. Pechè, Moulmain, ...	Orchids.
Mr. W. Scott, Perak, ...	Australian seeds.
Messrs. Baldwin, Do., ...	Miscellaneous plants.
Mr. J. C. Ravensway, Singapore, ...	Orchids.
Mr. E. C. Harte, Penang, ...	Australian seeds.
Mr. A. T. Bryant, Dindings, ...	Miscellaneous plants.
Mr. L. Hawkins, Do., ...	Do.
Mrs. Pole Carew, Ceylon, ...	Orchids.
RECIPIENTS.	
Director of Royal Gardens, Kew, ...	Miscellaneous plants.
„ of Botanic Gardens, Buitenzorg, ...	Do.
„ of Royal Botanic Gardens, Calcutta, ...	Do.
„ of Gardens and Forest Department, Singapore, ...	Do.
Superintendent of State Gardens, Gwalior, ...	Do.
Right Rev. Bishop Hose, Sarawak, ...	Cannas, &c.
His Honour Mr. Justice Goldney, ...	Ferns, &c.
Sir Graeme Elphinstone, Perak, ...	Nutmegs.
Messrs. Jas. Veitch & Sons, England, ...	Miscellaneous.
Messrs. F. Sander & Co., Do., ...	Do.
The Hon'ble the Resident Councillor, Penang, ...	Do.
The Resident of Perak, ...	Vegetable seeds.
Mr. G. Pechè, Moulmain, ...	Ferns, &c.
Mr. L. Hawkins, Dindings, ...	Nutmegs and coffee.
Mr. J. C. v. Ravensway, Singapore, ...	Miscellaneous plants.
Mrs. Mower, Rangoon, ...	Begonias, &c.
Mr. S. P. Chatterjee, Calcutta, ...	Bananas, &c.
Mrs. Pole Carew, Ceylon, ...	Orchids.
Superintendent of Lower Perak, ...	Seeds.

TABLE C.

*A List of the more important Plants and Trees flowered in the
Botanic Gardens, Penang, 1892.*

NAME.	REMARKS.
Achimenes hyb. vars., ...	In flower nearly all the year.
„ tubiflora ...	...
Acrotrema costatum, ...	...
Aerides virens, ...	...
„ odoratum, ...	...
Amorphophallus sp. n., ...	Collected in Langkawi.
Angrecum bilobum, ...	} Madagascar orchids of great interest, especially A. sesquipedale.
„ scottianum	
„ sesquipedale,	
Arisema anomalum, ...	Collected in Perak; recently figured in "Botanic Magazine."
„ fimbriatum, ...	Habitat uncertain until I found it abundant in Langkawi.
Anthurium Dechardii,	} Nearly always in flower.
„ ferrierense,	
„ Andreanum,	
Aristolochia elegans,	Very free flowering climber.
„ ridicula,	...
„ sp., ...	...
Amaryllis hyb. vars., ...	Many plants from Veitch's seed.
Arundina bambusifolia,	...
„ sp., sepals and petals white	Siam.
Aphelandra fulgens, ...	...
Æchmea fulgens, ...	...
• Æschynanthus Wallichii,	Beautiful basket plant.
„ marmorata,	...
Aster, ...	Best from Indian saved seeds.
Bignonia magnifica, ...	} Two excellent climbers; seldom out of flower.
„ Chamberlaynii,	
Bauhinia acuminata,	
Brassaia actinophylla,	...
Brownea grandiceps,	...
Boca sp. n., ...	Collected in Langkawi.
Bougainvillea glabra,	...
Cattleya aurea, ...	} Cattleyas are among the most lovely of the orchid tribe. Several species do well here with proper attention, especially as regards water.
„ gigas, ...	
„ trianae, ...	
„ Lawrenciana,	
„ intermedia, ...	
„ eldorado, ...	
„ Mossiæ, ...	
„ Gaskelliana,	
„ Schroederæ,	
„ speciosissima,	
Cypripedium niveum, ...	} A great number of these flowered.
„ bellatulum,	
„ insigne var. exul,	
„ insigne Lowii,	
„ barbatum,	
„ haynaldianum,	...
Crossandra undulæfolia,	One of the best bedding plants.
Crypteronia pubescens,	Tree with catkin-like flowers.
Cyrtodeira fulgens, ...	} Largely used as rock plants.
„ chontalensis,	
Calanthe vestita, ...	} Several hundreds grown annually and flower from November to February.
„ rubens, ...	
„ „ var. alla,	
„ regnieriana,	
„ veratrifolia, ...	
„ Veitchii, ...	
„ limatodes, ...	...

TABLE C,—Continued.

*A List of the more important Plants and Trees flowered in the
Botanic Gardens, Penang, 1892,—Continued.*

NAME.	REMARKS.
Cœlogyne Parishii, ...	...
„ Cumingii, ...	...
„ asperata, ...	...
„ pandurata, ...	...
„ sps., ...	Several of botanical interest.
Crinum Mooreii, ...	...
„ pedunculatum, ...	The plant referred to in Fl. Br. Ind.
Clerodendron macrosiphon, ...	} Free flowering useful shrub.
„ nutans, ...	
Calophyllum inophyllum, ...	} Ornamental trees.
Cinnamomum iners, ...	
Cassia fistula, ...	} Most useful for beds or borders.
Canna indica, ...	
Dillenia ovata, ...	Handsome tree.
Dendrobium chrysotoxum, ...	Most of the dendrobiums from Borneo, Java, the Philippines and Lower Burma do well in Penang.
„ Dearii, ...	
„ secundum, ...	
„ moschatum, ...	
„ Pierardii, ...	
„ densiflorum, ...	
„ cretaceum, ...	
„ Farmerii, ...	
„ formosum, ...	
„ fimbriatum, ...	
„ „ oculatum, ...	
„ Dalhousianum, ...	
„ tortile, ...	
„ sp. from Sikkim, ...	
„ Bensonii, ...	
„ phalanopsis var. schroederianum ...	
„ dicuphum, ...	
„ Veitchii, ...	
Didymocarpus lacunosa, ...	Native species recently figured in "Botanic Magazine."
„ cordata, ...	Collected in Langkawi.
„ crinita, ...	...
„ sps., ...	Several unnamed.
Dianthus smensis, ...	Good beds.
Daisy, ...	} Fairly good beds.
Dahlia, ...	
Eucharis amazonica, ...	Grown in every garden.
„ candida, ...	...
Eranthemum sps., ...	Several.
Eria sps., ...	Several, mainly of botanical interest.
Epidendrum sp., ...	Useful climber.
Faradaya papuana, ...	Collected in Penang; rare.
Gloriosa superba, ...	} Many varieties.
Gesnera, ...	
Gloxinia, ...	} Good beds.
Gomphrena striata, ...	
„ purpurea, ...	Good beds.
Gaillardia hybrida, ...	Collected in Perak and Penang.
Globba sps., 3 unnamed, ...	Many varieties; used for beds and hedges; always
Hibiscus sinensis, ...	• in flower.
Helichrysum (everlastings), ...	...
Habenaria carnea, ...	Very fine orchid.
Impatiens sultanii, ...	Always in flower.
„ Hawkerii, ...	Received for I. Hawkerii.
„ sp., unnamed, ...	
„ mirabilis, ...	...

TABLE C,—Continued.

*A List of the more important Plants and Trees flowered in the
Botanic Gardens, Penang, 1892,—Continued.*

NAME.	REMARKS.
<i>Ipomea superbiens</i> , ...	Free flowering shrub.
<i>Ixora Duffii</i> , ...	
<i>Jacaranda mimosæfolia</i> , ...	Handsome flowering tree.
<i>Jatropha</i> sp., ...	
<i>Jasminum</i> sps., ...	Several.
<i>Lælia Dayana</i> , ...	
<i>Lycaste Skinnerii</i> alba, ...	
„ <i>aromatica</i> , ...	
<i>Leea</i> sps. 2, ...	Unnamed.
<i>Lagerstræmia floribunda</i> , ...	Fine tree.
<i>Lonicera</i> sp. (Honeysuckle), ...	Good beds.
<i>Medinilla javanica</i> , ...	
„ sp., ...	
<i>Mussænda</i> sps., ...	
<i>Oncidium crispum</i> , ...	
„ <i>papilio majus</i> , ...	
„ <i>ornithorhynchum</i> , ...	
„ <i>splendidum</i> , ...	Very fine.
<i>Phalanopsis violacea</i> , ...	
„ <i>cornu-cervi</i> , ...	
„ <i>amabilis</i> , ...	Many of thees grown.
„ <i>grandiflora</i> , ...	
„ <i>tetraspis</i> , ...	
„ <i>sumatrana</i> , ...	
<i>Phajus alba</i> , ...	
„ <i>grandifolius</i> , ...	
<i>Piper magnoliæfolia</i> , ...	
<i>Plumbago capensis</i> , ...	Good beds.
<i>Petunia nyctaginioeflora</i> ...	Fairly good beds from December to June.
<i>Phlox Drummondii</i> , ...	
<i>Phyllobæa</i> sp. n., ...	Collected in Langkawi.
<i>Ruellia rosea</i> , ...	Good beds.
<i>Renanthera</i> sp., ...	
<i>Russelia juncea</i> , ...	
„ <i>floribunda</i> , ...	
<i>Saraca indica</i> , ...	Fine tree.
<i>Saccolabium Hendersonii</i> , ...	
„ <i>curvifolium</i> , ...	
„ <i>Blumii</i> , ...	
<i>Spathoglottis Wrayii</i> , ...	Fine variety with 12. 14 bls. on a scape.
„ <i>plicata</i> , ...	
„ <i>alba</i> , ...	Pulau Sembilan.
<i>Spathodea campanulata</i> , ...	Fine flowering tree.
<i>Sericographis squarrosa</i> , ...	
<i>Salvia splendens</i> , ...	
„ <i>azurea</i> , ...	
<i>Streptocarpus</i> hyb. vars., ...	Flowered many, but the climate is too moist.
Sunflower, ...	
<i>Torenia Fournierii</i> , ...	Good beds.
<i>Tainia penangiana</i> , ...	
<i>Tecoma stans</i> , ...	Useful flowering shrub.
<i>Trichopilia coccinea</i> , ...	
<i>Tacca cristata</i> , ...	
„ <i>pinnatifida</i> , ...	
<i>Veronica rosea</i> , ...	} Good beds.
„ <i>alba</i> , ...	
<i>Vanda tricolor</i> , ...	
„ <i>suavis</i> , ...	
„ <i>gigantea</i> , ...	
„ <i>insignis</i> , ...	
„ <i>Hookerii</i> , ...	
<i>Victoria regia</i> , ...	
<i>Wormia Burbidgii</i> , ...	
„ <i>suffruticosa</i> , ...	
<i>Zygopetalum Mackayii</i> majus, ...	

APPENDIX B.

GARDENS AND FORESTS DEPARTMENT, MALACCA.

Revenue.

1. The revenue collected during the year has exceeded that of any preceding year. Sums (now received) amounting to \$74 were not received in time to be credited to collections for 1892, and are, therefore, carried forward to 1893 account.

2. The account for the year closed as follows:—

Sales from Experimental Garden, ...	\$162.62	
Sales from Forest Reserves, ...	342.83	\$505.45
Value of Timber supplied for Government use, (P. W. D.), ...		538.79
Total, ...		<u>\$1,044.24</u>

REVENUE DETAILED.

3. *Experimental Garden.*

Sale of Nutmeg Plants, ...	\$ 55.47	
„ Clove „ ...	52.77	
„ Liberian Coffee, ...	12.00	
„ Ornamental Plants, ...	6.20	
„ Fruit Trees, ...	13.65	
„ Fruit Crop, ...	18.00	
„ Plantains (fruit), ...	4.53	\$162.62

Forest Reserves.

Tenth on Damar, ...	\$ 86.27	
Kabong Palm (tali hijau and toddy), ...	20.21	
Rent on Wood-oil, ...	21.00	
Sale of Timber, ...	36.85	
Sale of Fruit, ...	178.50	\$342.83
Total, ...		<u>\$505.45</u>

Experimental Garden.

4. Nursery Work.—The Garden has been maintained in good order throughout the year and the usual nursery work and experimental cultivation continued.

5. The nursery work is shown in the following analysis:—

Seeds sown.			Cuttings planted.	Seedlings transplanted.	Prepared for sale or planting.	Planted.	Sold.
No. of kinds.	Seeds counted.	Seeds not counted.					
78	19,636	7½ gallons.	1,696	6,763	11,067	11,099	2,223

Balance remaining available for planting or distribution:—

Forest trees, ...	1,129
Fruit trees, ...	1,515
Miscellaneous economics, ...	1,860
Total, ...	<u>4,504</u>

6. The following trees have been planted permanently in the Garden—(a) for timber supply or stock, (b) for shade purposes or experiment:—

(a)—Mentangor bunga (<i>Chrysophyllum</i> sp.),	...	...	350
Tampines (<i>Slætia sideroxylon</i>),	...	...	275
(b)—Buah kēras, (<i>Aleurites molluccensis</i>),	...	...	32
Cacao (<i>Theobroma cacao</i>),	...	...	32
Cloves (<i>Eugenia caryophyllata</i>),	...	...	43
Nutmegs (<i>Myristica fragrans</i>),	...	...	105
Tea—hybrid Assam (<i>Camellia thea</i> var.),	...	...	838

Total, ... 1,675

Experimental Cultivation.

7. Cloves (*Eugenia caryophyllata*) has been cultivated with success from the nursery-bed to the commercial product. The plant is well adapted for general cultivation, and if taken up by Natives would form an important subsidiary industry. The market price of cloves compares favourably with pepper, while the cost of production of the latter is four times higher than the former. Planted on high land where the roots cannot reach water, and without shade, cloves flower in about four years. The commercial product is the unopened flower-bud which should be dried in a partially shaded place, and when dried, the product is ready for market. Some of the Garden trees planted in 1888 are now 15 feet high and are flowering freely. From seeds collected in January, a stock of 1,758 plants have been raised. Of these, 43 have been planted, 735 sold, and the remainder 960 will be sold when strong enough.

8. Nutmegs (*Myristica fragrans*) grow well in the Settlement with liberal cultivation, but are not of easy culture in the young stage, and have the further disadvantage of taking from 8 to 10 years before fruiting. During the year, 105 plants have been planted, and 795 plants sold.

9. Tea Hybrid Assam (*Camellia thea* var.).—About one-third of an acre of land has been cleared and planted with tea, (838 plants) raised from seeds grown in the Garden. The young plants are growing freely and promise well. The stock plants, two years ago, suffered from the attacks of white ants, but have been free from this pest throughout the year.

10. Liberian coffee (*Coffea liberica*).—Several attempts have been made in the Settlement to grow coffee on abandoned tapioca lands, as might be expected, without success. Some splendid specimens may be seen wherever the attempt has been made, proving, beyond doubt, the hardihood and adaptability of the plant to the soil and climate, if cultivated under suitable conditions.

A few plants have been maintained at the Garden as stock plants, 400 young plants sold, and a supply of seedlings raised for general distribution.

11. Mauritius hemp (*Fourcroya cubensis*).—Fibre producing plants might be cultivated with advantage on much of the land in Malacca now covered with brushwood and which is too poor for such a crop as coffee. A suitable plant must be a lover of shade, as the brushwood once felled—bearing in mind the poverty of the soils referred to—such lands soon become too arid and impoverished to sustain a crop more than two or three years. Mauritius hemp has not proved itself to be adapted to these conditions; about ten per cent. produce long leaves, and the remainder pole before the leaves are long enough to be valuable for fibre.

Miscellaneous Plants.

12. West Indian crabwood (*Carapa guyanensis*); Satin wood (*Chloroxylon swietenia*); Cuba least (*Paritium elatum*); Balsam of Copaiva (*Copaifera gorskiana*) have all grown well, and a tree of Camphor (*Cinnamomun camphora*) is now flowering.

13. Pine-apple fibre (*Ananassa sativa* var.).—Experiments on this and on the fibre of *Musa sumatrana* (Pisang Karok) were made during the year, a report on which will be published in the next Bulletin.

Exchanges.

14. Plants and seeds have exchanged with the following establishments:—

Botanic Gardens, Singapore, outwards—cuttings 200, seeds 100, plants 140 and seedling gëlam trees 6,500; inwards—seeds 3 packets, plants 50.

Botanic Gardens, Penang, inwards—seeds 15 packets.

Botanic Gardens, Bangalore, inwards—seeds 1 packet.

TAN HUN GUAN, Malacca, inwards—half gallon coffee seeds; outwards—1 gallon tea seeds.

Forest Reserves.

15. Excepting a part of the unsettled frontier which forms part of a reserve boundary between Batang Malaka and Nyalas, the whole of the reserves have now been demarcated.

16. Batang Malaka Reserve.—Owing to my absence on duty in Penang during the year 1891, this reserve has remained undemarcated until the present year. The work has now been completed, and boundaries extending over four miles have been opened at a cost of \$35.75. The reserve is entirely hilly; the hills are:—Bukit Punggor, 1,303 feet, Bukit Batang Malaka, 1,419 feet, Bukit Jus, Bukit Bembun, 1,601 feet, and Bukit Nyalas about 1,200 feet. The Malacca River has its source in these hills, as well as several smaller streams. The area of the reserve is approximately 3,000 acres, it is well wooded, and I expect to find some young plants of gutta percha, as this district has been famous for its *getah* trees, and a few young plants have been found near the reserve boundary.

17. Brisu Reserve.—Pending the completion of a survey of this district, it has not been possible to complete this reserve earlier. All private rights have now been excluded from the reserve, and boundaries extending twelve miles opened at a cost of \$180.75.

18. The reserve is divided into two blocks, making a total area of 3,440 acres. Several small hills are included within the reserve, the most important are:—Bukit Putus, Bukit Jelutong, Bukit Baling, 614 feet, Bukit Senggeh and Bukit Peninjau, 280 feet. The smaller block is well wooded with mostly Seraya (*Hopea cernua*), but the larger block contains younger jungle.

19. Bukit Bruang Reserve.—A fire broke out amongst the lalang near Ayer Keroh, damaging a plantation commenced in 1892, but about seventy per cent. of the trees have since revived. The vacancies have been re-filled during the year, and the plantation extended. Including the ground re-planted, about twenty acres have now been planted at a cost of \$355.70.

20. The following seeds and trees have been planted:—

In plantation:—

Leban seeds (<i>Vitex pubescens</i>),	...	...	22 gallons.
Kledang (<i>Artocarpus sp.</i>),	...	...	1,050 plants.
Merebau (<i>Azela palembanica</i>),	...	...	320 do.
Tampines (<i>Sloeria sideroxylon</i>),	...	...	890 do.
Tembusu (<i>Fagraea peregrina</i>),	...	...	1,200 do.
Leban (<i>Vitex pubescens</i>),	...	...	4,550 do.
Poko Perak (<i>mangifera sp.</i>),	...	...	80 do.
Getah Terap (<i>Artocarpus blumei</i>),	...	...	50 do.
Keranji papan (<i>Dialum platysepalum</i>),	...	...	60 do.
Keranji burong (<i>Dialum indicum var.</i>),	...	...	40 do.
Mersawah,	...	...	20 do.
Mentangor bunut (<i>Chrysophyllum sp.</i>),	...	...	75 do.
Ribu-ribu,	...	...	40 do.
Kembang sa-mangko' (<i>Sterculia scaphigera</i>),	...	...	105 do.
Chempedak (<i>Artocarpus chempedak</i>),	...	...	60 do.
Kayu malaka (<i>Phyllanthus emblica</i>),	...	...	30 do.
Poko sena (<i>Pterocarpus indicus</i>),	...	...	70 do.

8,640

Planted on separate ground:—

Rattans,	...	...	124 do.
Pandans (<i>Mankuang paya</i>),	...	...	360 do.
Kabong (<i>Arenga saccharifera</i>),	...	...	300 do.

Total, ... 9,424

21. Merlemau Reserve.—The watchmen have been assisted by a band of fifteen men in re-bridging the swampy portions of this reserve, and a new boundary, three miles long, instead of a swampy one, opened at a total cost of \$179.25.

22. Other Reserves.—Inspection-paths extending over eight miles have been opened at Bukit Sadanan Reserve at a cost of \$57.50. Portions of the boundaries of Batu Tiga Reserve readjusted at a cost of \$36.50; and a foot-path to the top of Bukit Panchor opened at a cost of \$36.

Prosecutions.

23. Two cases of illicit wood cutting occurred during the year, both were of a petty nature and only nominal fines inflicted.

Fires.

24. Excepting the fire mentioned at Bukit Bruang, no other fire has occurred on reserved lands.

Expenditure.

25. A statement of expenditure for the year is attached:—

Expenditure during the year 1892.

	\$	c.
Forest Watchmen, ...	2,362	07
Experimental Garden, ...	1,487	09
Personal Allowance, ...	60	12
Pony Allowance and Pony Hire, ...	429	52
Field Allowance (Assistant Superintendent), ...	216	00
Field Allowance (Mandor), ...	9	50
Bullock-cart, ...	24	78
Tools, Implements, Pots, ...	43	93
Maintenance, ...	121	86
Incidental, ...	47	29
Freight and Shipping, ...	29	70
Uniform, ...	6	30
Office and Herbarium, ...	150	20
Rent of Quarters (Forest Watchmen), ...	24	00
Purchase of Plants and Seeds, ...	72	80
Manure, ...	15	80
Bukit Sadanan Reserve, ...	57	50
Batu Tiga Reserve, ...	36	50
Batang Malaka Reserve, ...	35	75
Bukit Bruang Reserve, ...	355	70
Merlemau Reserve, ...	179	25
Brisu Reserve, ...	180	75
Bukit Panchor Reserve, ...	36	00
Sungai Udang Reserve, ...	14	00
Balance, ...	3	59

Total, ... \$6,000 00

R. DERRY,

Assistant Superintendent of Forests.

Malacca, 30th January, 1893.

REPORT ON THE GARDENS AND FORESTS DEPARTMENT,
STRAITS SETTLEMENTS. 1893

BOTANIC GARDENS, SINGAPORE.

Staff.

1. In the early part of the year, the Mandor, ANIFF, resigned his appointment, and T. C. PEREIRA replaced him. The coolies worked well throughout the year, but there was a good deal of sickness, mostly of a mild type, among them. There were two or three cases of injury from poisonous trees or fruits, the dangerous plants being *Melanorrhæa*, *Hippomane Mancinella* (the Manchineel), and *Kentia MacArthurii*; and one man was much hurt by a deer which attacked him while feeding it.

Visitors.

2. The number of visitors to the Gardens was as large as usual, and included many European botanists of note, on their way to Java to make botanical researches, several of whom expressed regret that there was no laboratory accommodation in the Botanic Gardens, as, in many respects, Singapore was better suited for the carrying on of research than Java.

The Regimental Band performed once or twice a month on Friday afternoons in the Gardens, and attracted many visitors.

Aviaries.

3. The zoological collection proved as attractive as in former years, and several interesting animals and birds were added to it. Among these were:—A mias (purchased); six common monkeys (presented by Mr. MACHADO); a golden cat (*Felis Temminckii*, presented by Mr. MOUSLEY); a black bear (female, purchased); an Australian dingo (presented by Captain PITTS); a black buck (presented by the 2nd Battalion of the Lincolnshire Regiment); one rusa (female, *Cervus equinus*); one American deer (presented by Captain DAVIES); two bamboo rats (*Rhizomys*, presented by Mr. GOODHART); two Raffles' squirrels (purchased); two common squirrels (caught); one emu (presented by Captain TALBOYS); one purple coot (presented by Mr. MACHADO); two Malacca swamp tortoises (*Cestudo Amboinensis*, captured); one monitor (*Hydrosaurus salvator*, presented). Two hamadryads (*Ophiophagus elaps*) and several other snakes were captured in the Gardens.

A common monkey was born in the aviary on the 27th of March. The teal on the lake also hatched out a brood of ten ducklings, which were unfortunately all destroyed by hawks or eagles.

New and Rare Plants.

The following plants, seldom or never before flowered in Singapore, flowered this year:—*Brassia caudata*; *Aspasia variegata*; *Cattleya Schroderæ*; *C. Bowringiana*; *Oncidium cebolleta*; *O. roraimense*; *O. luridum*; *Mormodes pardinum*; *Lycaste aromatica major*; *Miltonia spectabilis*; *Laelia harpophylla*; *Stanhopea grandiflora*; *S. eburnea*; *Catasetum tridentatum* (from South America and the West Indies); *Dendrobium sanguinolentum* and var. *cerinum* (from Kedah Peak); *D. antennatum* (New Guinea); *D. hymenopterum* (Kedah Peak); *Cymbidium lancifolium* (Malacca); *Sarcanthus castaneus* (Singapore); *Vanda*, Miss. Joaquim (a hybrid between *V. teres* and *V. Hookeriana*); *Cleisostoma crassum* (Borneo); *Saccolabium calceolare* (Borneo); *Rhododendron Brookei* (Borneo); *Aristolochia gigas Sturtevantii* (Trinidad); *Didymocarpus citrinus* (Kedah Peak); *Sonerila*, a new species with tuberosus rhizomes (Kedah Peak); and another large-branched species from Igeh, which was presented by Mr. A. MACHADO, together with a very fine flame-coloured *Didymocarpus*, a new genus of *Commelinaceæ*, near *Polia*, and *Codonacanthus* sp., all from the same locality; *Trevesia eminens* (Philippines); *Entada polystachya*; *Hedychium longicornutum* (Malacca); *Clerodendron minahassæ* (Celebes).

Among the ornamental foliage plants and ferns, the most remarkable species received were:—*Asplenium scandens* (Borneo, presented by Bishop HOSE); *A. sp.* (Perak); *Lecanopteris carnosula*, Bl. (Malacca); *Adiantum*, nsp. (Singapore); *Nephrolepis tenuiflorum* (Kedah); *Cyrtandra*, sp. (Borneo, presented by Mr. J. DOWN.

During the year, a catalogue of the Garden plants was drawn up. It is hoped that it may be printed this year, as it will be useful as a reference list, and in arranging for exchanges with other Gardens. A bulletin, treating of the cultivation of indigo, patchouli, and fibre plants, was also published.

Artist.

The Artist, Mr. JAMES D'ALWIS, was employed during the year in making drawings of new and rare plants peculiar to the Malay Peninsula.

Experimental Garden.

The clearing of the ground formerly known as the Military Reserve, for the arboretum was continued, and the positions of the natural orders as far as *Urticaceæ* were marked out, labelled and planted up with such species as could be procured. The economic groups were also further developed, and many additional kinds planted. A piece of damp waste ground was devoted to a collection of screw-pines (*Pandani*), and a number were planted and labelled.

During the year, a number of plants of economic value were obtained, including several new strains of pineapples, viz., the black pine of the West Indies, the Abacaxi from Pernambuco, and English pines from Windsor Castle. A valuable cooking plantain was received from Jamaica, and a stock of the best native kinds received from Malacca. Some seeds of good strains of Florida oranges, presented by Admiral AMMEN of Washington, failed to germinate. A valuable yam from New Guinea was also presented to the Gardens, and is growing rapidly. A good stock of Cola nuts was received from Kew. This plant grows very well here, and has flowered, but has not yet borne fruit.

Among fibre plants, *Urera tenax* was received from Natal, and a stock of the wild plantain (*Pisang Karok*) from Malacca.

Inspection of Coco-nut Trees.

The inspection of trees, and destruction of dead or decaying trees, was carried on as in past years, and 279 notices were served on various persons during the year. Fourteen hundred and sixteen (1,416) dead trees and stumps were ordered to be destroyed, and twenty-six piles of rubbish, likely to act as breeding-places for beetles, were cleared away. In most cases, the notices were promptly complied with, as the Natives quite understand the damage which has been and is being caused by the insects, but in sixteen cases it was found necessary to prosecute. Fines to the amount of \$33 were inflicted on seven persons. Six others, immediately complying with the notices on receiving summonses, were dismissed on paying the cost of the summonses, and in three cases the owners could not be found and the summonses had to be withdrawn.

Much trouble has been caused by one or two cases in which the piles of sawdust and refuse tan-bark were so extensive that it was impossible to entirely destroy them. In these cases the owners are compelled to employ men to turn over the refuse, and destroy the grubs and beetles, which, as the insects are found to have some value for feeding ducks, they are not unwilling to do.

Experiments were made in destroying the larvæ, with gas-water and with London Purple. But it was found that the former had but little more effect on them than ordinary water, while grubs put into London Purple seemed quite unharmed.

During the year, one tannery was burnt down, and underneath and between the houses many larvæ were found to exist, nor had the fire made any great diminution in their numbers, as living grubs were found less than a foot below the ground where the houses had been burnt.

Expenditure.

Vote,	...	...	...	...	...	\$	c.
						700	00
						\$	c.
Salaries,	...	...	...	...	...	444	20
Transport,	...	...	...	...	...	76	61
Uniforms,	...	...	...	...	...	10	00
Expenses in removing trees and stumps,	...	...	...	...	...	169	00
						699	81
Balance,	...	...	...	...	...	0	19
						\$700	00

Herbarium and Museum.

During the year, a large number of specimens were added to the herbarium. In an expedition to Kedah Peak and its neighbourhood and, later, to the Perak Hills, I obtained 860 specimens; 259 plants were collected by Mr. FOX, and 175 by a native collector in Pahang; 196 specimens were sent from Penang by Mr. CURTIS, and 486 from Malacca sent by Mr. GOODENOUGH; Dr. KING presented 318 specimens

from Perak and India, and 64 specimens were sent from the almost unknown region of Legeh by Mr. A. MACHADO.

Dr. HAVILAND presented 454 specimens from Borneo, and Mr. A. EVERETT 83 specimens of mosses from Borneo and the Natuna Isles. Baron VON MUELLER presented 76 Australian plants.

Specimens were sent in exchange or for identification to the British Museum, Kew Gardens, Dr. KING, Baron Von MUELLER, Dr. COGNIAUX, Colonel BEDDOME, Dr. HACKEL, Dr. BROTHERUS, and Dr. BURCK.

A good series of named varieties of paddy was received from Manila; a series of named dammars was procured in Malacca, and a number of other economic products were collected, and the whole collection re-arranged and classified. Several large specimens of timber were also obtained and the hand specimens were arranged in a cabinet.

Library.

In addition to the usual periodicals and Garden Reports, the following works were received and added to the Library:—

Presented:—

- Dr. TRIMEN.—Handbook of the Flora of Ceylon, Vol. I.
- Dr. KING.—Materials for a Flora of the Malay Peninsula—part 4.
- C. MOORE.—Handbook of the Flora of New South Wales.
- F. SANDER.—Reichenbachia, Vol. II.
- Dr. MASTERS.—List of Conifers and Taxads cultivated in Britain.
- Do. —Conifer Conference 1891—Introductory Address.
- TRELEASE.—Missouri Botanic Garden—3rd and 4th Annual Reports.
- RENDLE, A. B.—Falling of Leaves.
- Do. —An Advance in our Knowledge of Seedlings.
- GRESHOFF, M.—Monographia de Plantis Venenatis et Sopientibus ad pisces capiendis.
- HOOKER, Sir JOSEPH.—Flora of British India, Part XIX.
- MACMILLAN, CONWAY.—The Metaspermæ of the Minnesota Valley.
- RIDLEY, H. N.—Flora of the East Coast of the Malay Peninsula.
- BAILEY, VERNON.—The Prairie Ground Squirrels.
- A. K. FISHER.—Hawks and Owls of the United States.
- VEITCH, H. J.—Manual of Orchidaceous Plants—part IX.
- MACDONALD, A. C.—Ensilage (Capetown), presented by the Author.
- Bulletin van het Kolonial Museum te Haarlem, 1892-3.
- Acta Horti Petropolitani, Tom. XII, fasc. II, presented by the Director of the Botanic Gardens, St. Petersburg.

Presented by the Government of the United States:—

- Dr. G. VASEY.—The Agricultural Grasses and Forage Plants of the United States, 1889.
- Do. Monograph of the Grasses of the United States—Grasses of the South.
- Do. Report of an Investigation of the Grasses of the Arid Districts.
- Do. Illustrations of North American Grasses, Vol II.
- Do. Reports of the Botanist for 1889 to 1892.
- J. M. COULTER.—Manual of the Phanerogams and Pteridophytes of W. Texas, Vol II, Parts 1 and 2.
- J. N. ROSE.—List of Plants collected by Dr. EDWIN PALMER in 1890, in Mexico and Arizona, Vol. I, 4.
- Report of the Secretary of Agriculture, Washington, 1892.

Purchased:—

- MIQUEL.—Choix des Plantes Rares.
- MARTIUS.—Historia Naturalis Palmarum.
- CASTILLO.—Flore de la Polynesie Française.
- LOCK.—Coffee and its Culture.
- JACKSON, B. D.—Index Kewensis, Part I.
- SAGOT, P.—Manuel Practique des Cultures Tropicales.
- SCORTECHINI.—Description of new Scitamineæ of Malay Peninsula.
- BECCARI, O.—Description of new Palms, New Guinea.

Exchanges.

The usual exchanges of plants and seeds with kindred institutions have been maintained; 1,247 plants and 508 packets of seeds were received from the undermentioned contributors, and 841 plants and 133 boxes and packages of seeds were sent out:—

Contributors:—

Royal Gardens, Kew.
 Botanic Gardens, Calcutta.
 Do., Ceylon.
 Do., Durban.
 Do., Saigon.
 Do., Hongkong.
 Do., Bangalore.
 Do., Buitenzorg.
 Do., British Guiana.
 Do., Jamaica.
 Do., Adelaide.
 Do., Paris.
 Do., Trinidad.
 Do., Port Darwin.
 Messrs. E. Sander and Co., St. Albans.
 " Cannell and Sons, Kent.
 " Dammann and Co., Italy.
 " Böehmer, Yokohama.
 " Reasoner Bros., Florida.
 Baron von Mueller, Melbourne.
 Agri-Horticultural Society, Madras.
 J. Ravensway, Singapore.

J. d'Almeida, Esq., Singapore.
 A. Cohen, Esq., Pernambuco.
 Admiral Ammen, Washington, U. S. A.
 Miss Ridley, England.
 J. P. Joaquim, Esq., Singapore.
 R. Little, Esq., do.
 W. Boxall, Esq., do.
 W. Micholitz, Esq., do.
 St. V. B. Down, Esq., do.
 H. M. Becher, Esq., do.
 A. D. Machado, Esq., Kelantan.
 W. Nanson, Esq., Singapore.
 Geo. Derrick, Esq., do.
 G. Pechè, Esq., Moulmain.
 J. R. Hilty, Esq., Singapore.
 The Right Revd. Bishop Hose.
 A. Ericsson, Esq., Singapore.
 T. Sarkies, Esq.
 Hon. Martin Lister, Negri Sembilan.
 Dr. Ellis, Singapore.
 Seah Liang Seah, Esq., Singapore.
 M. Myre de Vilers, Siam.
 R. W. Hullett, Esq., Singapore.

BOTANIC GARDENS, SINGAPORE.

Statement of Receipts and Expenditure for the Year 1893.

RECEIPTS.			EXPENDITURE.		
	\$	c.		\$	c.
By Balance in Bank, ...	455	85	<i>Salaries.</i>		
" Government Grant, ...	8,500	00	Herbarium Keeper, ...	235	53
" Sale of Plants and Flowers, ...	821	59	Chief Mandor, ...	235	00
" Miscellaneous Receipts, ...	150	85	Carpenters, ...	212	34
" Interest, ...	27	10	Printers (Label), ...	120	00
			Peons, ...	167	50
			Aviary-keeper, ...	95	88
			Mason, ...	123	40
			Police, ...	348	05
			Coolies, ...	3,298	00
			<i>Bills.</i>		
			Manure and Cartage, ...	189	67
			Food for Birds and Animals, ...	802	66
			Purchase of Pots and Tubs, ...	322	66
			Purchase of Seeds and Animals, ...	184	55
			Purchase of Books and Herbarium Paper, ...	658	53
			Purchase of Tools and Stores, ...	372	43
			Purchase of Timber, Planks, etc., ...	351	47
			Purchase of Bricks, Lime, etc., ...	214	81
			Purchase of Laterite and Gravel, ...	519	06
			Repairs to Buildings, ...	333	06
			Subscription to Telephone, ...	90	00
			Director's Petty Expenditure including Freight, ...	360	24
			Assistant Superintendent's Petty Expenditure, ...	112	10
			Miscellaneous, ...	529	88
					5,041 12
					9,876 82
			Balance, ...		78 57
					\$9,955 39
					\$9,955 39

FOREST DEPARTMENT, SINGAPORE.

Introduction.

The great reduction of the Forest Vote for this year has precluded any great progress being made in forestry, and the consequent reduction of the number of men employed has been followed by an increase in thefts of Government timber and in fires. Two small reserves have been practically abandoned, viz., Bedok, and Upper Tanglin, and it has been difficult to protect the other reserves or to keep the boundary-paths open and clean.

Staff.

The absence of Mr. DERRY on leave in June, entailed transferring Mr. GOODENOUGH to Malacca to take up the acting appointment, and his place was taken by the Coco-nut Trees Inspector, BAKER, for some months, when T. BAYLISS was appointed. From January to November, 19 forest watchmen were employed, but it was then found necessary to reduce them to 10.

Planting.

A considerable number of timber trees were planted during the year, chiefly Bilian (*Eusideroxylon Schwagerii*), of which, 2,270 young trees were planted on Bukit Timah, and 1,680 at Bukit Mandai, where also 970 trees of Balam and 370 Kuku Balan Utan were planted. The "Fire-guard" along the Bukit Mandai Road was cleaned of weeds. The trees have now attained a fair size, and have already shewn their use in resisting the advance of fire.

The India-rubber trees (*Hevea brasiliensis*), male bamboos (*Dendrocalamus strictus*), and Rengas (*Gluta Renghas*), planted some years ago, have made rapid growth and seem to be doing very well. Many more young plants of Bilian and other timber trees sown in 1892, remain in the Nursery beds, but cannot be planted out on account of want of funds. Indeed, an extra grant of \$500 was found necessary in order to cover the expenses of planting out those which were ready for removal this year.

Licenses.

Owing to the working out of most of the mangrove swamp districts in the neighbourhood of Singapore, the application for firewood licenses has very much increased, and the demand can hardly be supplied, although the price of the licenses has again been raised. One hundred and thirty-six (136) passes for cutting firewood, fishing stakes, lalang, and rattans, in the reserves of Changi, Kranji, Seletar, Sungei Pandan and Toas were issued.

The revenue derived from these passes and other sales amounted to \$ c.
441 50

		\$	c.
Mangrove firewood,	...	356	50
Fishing stakes, rollers, etc.,	...	35	00
Rattan, ...	...	1	00
Lalang, ...	...	1	50
Sale of gutta-percha leaves,	...	12	00
Sale of an old hut, ...	...	2	00
Sale of an old boat, ...	...	4	00
S'marum timber, ...	...	2	00
Temporary occupation licenses, ...	...	2	50
		416	50
Farming of pepper encroachments,	...	18	00
" fruit trees, ...	...	7	00
		\$441	50

Fires.

Fourteen fires occurred in the reserves during the year, about 202 acres of lalang, and brushwood being destroyed. The largest outbreak was at Bukit Mandai reserve, where 152 acres of grass and secondary forest, and upwards of four hundred seedlings were burnt.

Prosecutions.

Nine persons were prosecuted for removing timber, etc., one of whom was cautioned and dismissed, the remainder were fined or imprisoned, the fines amounting to \$104. of which, \$66 were paid.

H. N. RIDLEY,
Director of Gardens and Forests.

GARDENS AND FORESTS DEPARTMENT, PENANG.

1. There has been no change in the staff during the year. MAHOMED HANIFF, who was Acting Overseer of the Waterfall Garden at the date of my last report, was confirmed in the post on the completion of his apprenticeship in June.

Maintenance of Forest Reserves.

2. Consequent on the reduction of the Government Grant from \$2,300 in 1892 to \$1,000 in 1893, the number of Guards had to be reduced to five, which is the least with which any effective protective work can be done in such small and scattered mountainous reserves as those in this Settlement.

With this staff, the boundaries, aggregating 65 miles in length, have been kept as clearly defined as circumstances would permit. Twelve persons were prosecuted for illicit timber cutting, and two for causing jungle fires. Two of these cases were dismissed, and the remainder fined in sums varying from \$2 to \$50, the total amount of fines inflicted amounting to \$174.

3. The Sergeant's quarters on Government Hill tumbled down during the year, and there being no money available for re-construction, he has been obliged to hire a house and live at an inconvenient distance from his work. The temporary station at Telok Bahang is also in an advanced state of decay and will soon be uninhabitable. These buildings have hitherto been maintained out of the annual grant, but on the reduced scale this is no longer possible, and additional provision for buildings is necessary.

4. The Revenue Survey, completed during the year, shows that the protected forest area is greater than was originally estimated, the actual extent being 15.75 square miles, or 10,057 acres, equal to about one-seventh of the whole island; and Pulau Jerejak 1.30 square miles, or 830 acres. These reserves are in eight blocks, mainly on the sides and crests of steep hills at from 1,000 to 2,750 feet elevation, and are for the greater part stocked with valuable kinds of timber. Owing, however, to their inaccessibility to timber-cutters, it is improbable that any considerable revenue will be derived from the greater portion, unless timber and charcoal become much more expensive than at present.

5. It must, however, be borne in mind that the value of these hill reserves is not represented by the probable amount of revenue to be derived from them, either now or in the future, as their purpose is mainly climatic, and it would be a great misfortune should they by any means be destroyed.

6. The most important, from a revenue-producing point of view, is the North-West reserve, a great portion of it being bounded by the sea. Licenses for cutting within this, and easily accessible parts of some of the other reserves, would, I believe, be willingly taken out at considerably higher rates than at present paid, but considering that no restriction had been put on timber-cutting up to 1885, and that all the best kinds of timber are of slow growth, strict supervision would be necessary. My opinion is that it would be better to wait a few years longer before issuing licenses for these reserves.

7. A good number of specimens of forest trees, &c. were collected during the year while on inspection duty in connection with forest reserves, &c., and about 720 of these were sent to Kew, Dr. KING, the British Museum, and Singapore. Early in the year, the whole of the *Dipterocarpaceæ* collected by myself in Penang and Langkawi were sent to Dr. KING, on loan, for use in connection with the working out of this order for "Materials for a Flora of the Malayan Peninsula." These he has since returned named, and a large proportion prove to be previously undescribed.

Waterfall Garden.

8. There has been no falling off either in the attraction, or appreciation by the public of this garden, and, as in previous years, by far the greater portion of my time has been devoted to it. Many additions and improvements have been effected, and a great number of new and interesting plants added to the collection.

9. Two thousand and five hundred (2,500) plants and 82 packets of seeds were distributed free to public institutions and by way of exchange, and about the same number of plants sold, the total amount received from this source amounting to \$500. Ornamental foliage and flowering plants are most in demand, but a good number of shrubs, fruit trees, shade trees, &c. are included in these figures. A list of the principal Contributors and Recipients is given in Appendix B annexed.

10. Among the more striking plants that flowered in this garden during the year (of which an abbreviated list is given in Appendix C) was a giant plant of *Grammatophyllum speciosum*, which bore about one thousand flowers. This plant was photographed by local photographers both amateur and professional. Another was *Aristolochia gigas* var. *Sturtevantii*, with enormous flowers over twenty inches across. This plant was, by the kindness of the Kew authorities, carefully packed and sent on board the steamer the morning I left London for Penang, and, although a rather weak plant, reached here alive. It is now nearly always in flower, and several plants have been propagated from the original, some of which have already flowered in the other Settlements. It is a truly remarkable plant, its great drawback being its abominable smell.

11. Some new beds have been made near the office and planted with annuals, flowering shrubs, &c., and also a circular clump of palms that had outgrown their tubs. Many trees of various kinds, principally indigenous, such as *Styrax serrulata*, *Pentace Curtisii*, &c., have been planted in various parts of the grounds. Cannas have, as in 1892, the first year the finer hybrid forms were introduced, been a striking feature. Messrs. JAS. VEITCH & SONS kindly presented a set of a dozen varieties of the best new ones that have been distributed since 1890. Several new hybrids have also been raised in the garden here from crosses made by myself, one of which is superior to any of those received from England, and by the permission of His Excellency Sir CECIL CLEMENTI SMITH, the late Governor, bears his name.

12. A new shed for ferns and begonias has been erected, mainly with material that had been used for the Agricultural and Horticultural Show, and the plants have made excellent progress since being placed in it. It will, however, like all soft wood structures in this climate, last only a comparatively short time.

The octagonal plant shed, which contains many of the more valuable plants in the garden, has been entirely renewed with well seasoned *chengal* timber and *bertam* chick roof for shade, so that it will not require any further attention for at least three years.

13. Two new water tanks have been built, one for ferns and the other for orchids, and connected with the water supply from the swimming bath, so that now there is scarcely a botanical garden in the Tropics so well provided with water, which, in a country subject to spells of dry weather of from two to three months' duration, is a most important matter.

14. Re-metalling of the main road leading to the reservoir was done in the months of January and February, with material supplied by the Municipal Commissioners, when we were under the impression that all heavy cartage in connection with the new reservoir was finished, but as that proved to be an error, and it is not finished yet, this will have to be done over again when the leak in the reservoir has been stopped. The expense of this will not, however, I hope, fall on the gardens but on the Commissioners. Until the work at the reservoir is finished, a great portion of the garden cannot be kept in decent order.

15. Unusually heavy rains in June did much damage to roads and paths, and caused some considerable slips along the river banks, which necessitated re-sloping and turfing.

White ants having proved very troublesome in the office, especially on account of their depredations among herbarium specimens. The whole surface below the arches was cemented, and there has since been no trouble. This was done by the Public Works Department, but all the other works by the garden coolies.

16. The total expenditure in connection with this garden amounts to \$4,499.52, and the revenue derived from sale of plants and use of Swimming Bath to \$568.50, as shown in Appendix A annexed.

Government Hill Gardens.

17. Work in the Experimental Nursery has been principally confined to keeping the ground clean and manuring the fruit trees. The orange trees obtained from Malta by the late Sir J. DICKSON produced a few fruits of fairly good quality, but the prospect of a paying crop is not promising. The expenses of carrying up manure is too great to allow of the cultivation of many things that could otherwise be profitably cultivated in this nursery.

18. In Government Bungalow Gardens, the work has been of the usual routine order, consisting of keeping the grounds in order and maintaining, as far as possible, a regular supply of vegetables and flowers for occupants of the bungalow and the Resident Councillor. The Overseer in charge, in addition to his garden work, attends to the Post and Telegraph Office, which takes up the greater portion of his time.

Coco-nut Tree Preservation.

19. As in previous years the Inspector has divided his time equally between Penang Island and Province Wellesley. Two hundred and six (206) Notices were served on owners requiring them to destroy dead trees or material which serve as breeding places for the beetle. Of this number, 43 were summoned for non-compliance with the order in accordance with the Ordinance, and fines inflicted amounting to \$42.25.

Altogether 1,704 dead and diseased trees were destroyed, and 58 heaps of rubbish, 75 diseased trees growing on Crown land were also cut down and destroyed. The total expenditure in connection with this work is \$692.50.

General.

20. A short trip for the purpose of collecting new and interesting plants for cultivation and exchange was made to the Siamese West Coast, about 200 miles North of Penang, in February, and the result was most satisfactory. Leaving Penang by one of the local Chinese steamers, I arrived at Tongkah, also known as the Island of Junk Ceylon, after a passage of 24 hours. After spending four days in this island, the Siamese Chief Commissioner kindly lent me a boat and furnished me with a letter of introduction to the Raja of Pangah, whose residence is about 40 miles from Tongkah. On the way we touched at several small islands, generally adding something to the collection at each place. A striking feature of this part of the Peninsula is the abrupt manner in which the islands rise from the sea, so much so that landing on some of them is impossible. The same character marks the rocks and small hills for some miles inland, so that looking land-ward from some distance out at sea, there is no means of distinguishing between the rocky islands inshore and similar rocks among the mangrove forest. It is evident that a great silting up has taken place here in recent times. The town and the Raja's residence are situated some miles up the river, which in places flows between the high rocks that are seen from the sea. The whole valley in which the town is situated is surrounded by hills of the same character, except at the upper and lower ends. It is an ideal place for a botanist, and should be visited at the beginning or end of the rains, when many interesting plants that were quite dried up at the time of my visit will be discovered. In one place I saw an immense mass of *Vanda gigantea* with at least fifty spikes of fully expanded flowers, and near this several plants of *Cypripedium niveum*. Among the interesting plants obtained here was a lovely blue *Didymocarpus*, and a species of *Tetraphyllum* with rosy pink flowers. A few plants of *Dendrobium aggregatum*, and *D. Farmerii* were collected, but they are extremely rare here and it is apparently their extreme Southern limit. The Siamese Chief Commissioner, Tongkah, kindly sent a steam launch to tow my boat from near the mouth of the Pangah River to Ghirbee River, and when I had spent a day there back to Tongkah, whence I returned to Penang. I cannot sufficiently express my thanks to the Siamese Commissioner at Tongkah, and the Raja of Pangah, for the assistance they rendered during my fourteen days' stay.

21. An Agricultural and Horticultural Show was held on the Race Course during the first three days in June and proved a great success. Temporary sheds were erected for plants, fruits, vegetables, poultry and cattle, while the existing buildings were used for produce &c. Malacca and the Native States sent many exhibits, and perhaps the most noteworthy exhibits of the whole Show were the Liberian coffee and pepper plants in tubs, covered with fruits, from Selangor. The prizes offered for native medicinal plants, coco-nuts, betel-nuts, paddy and other products in which natives are mainly interested, brought hundreds of samples, so that judging in these classes was a matter of extreme difficulty. It is to be hoped that this kind of exhibition will be repeated at no distant time.

C. CURTIS,
Assistant Superintendent of Forests.

APPENDIX A.

Revenue and Expenditure—Gardens and Forest Department, Penang, 1893.

REVENUE.	EXPENDITURE.	
		\$ c.
Grant—Maintenance of Forest Reserves, ... \$1,000.00	Salaries of Forest Guards, ...	503 46
	House Rent for Assistant Superintendent, ...	360 00
	House Rent of Sergeant of Forest Guards, ...	18 00
	Transport and Field Allowances, ...	45 55
	Uniform, ...	33 00
	Materials for Herbarium, ...	18 00
	Oil for Stations, ...	5 40
	Miscellaneous, ...	12 92
		996 33
	Balance, ...	3 67
		1,000 00
Grant—Maintenance of Waterfall Garden, ... \$4,500.00	Salaries, ...	3,231 68
	Tools and Material, General Repairs, &c., ...	292 38
	Pots and Plant Tubs, ...	144 90
	Material for new Ferns Shed, ...	80 34
	Material for renewing Plant Sheds, ...	214 30
	Planks for Plant Cases, &c., ...	84 93
	Seeds and Plants, ...	89 23
	Freight on Plant Cases, ...	18 00
	Manure, ...	56 40
	Cartage, ...	42 20
	Furniture for Bungalow, ...	15 50
	Articles for Swimming Bath, ...	6 84
	Periodicals, ...	14 00
	Advertising, ...	5 90
	Field Allowances, ...	17 56
	Paper for Herbarium, ...	34 60
	Miscellaneous and Petty Expenses, ...	150 76
		4,499 52
	Balance, ...	0 48
		4,500 00
Grant—Maintenance of Grounds of Government Hill Bungalow and Experimental Nursery, ... \$600.00	Salaries, ...	571 48
	Purchase of Seeds, ...	6 75
	Purchase of Tools, ...	19 05
	Miscellaneous, ...	2 28
		599 56
	Balance, ...	0 44
		600 00
Grant—Expenses of carrying out Provisions of Coco-nut Trees Preservation Ordinance, ... \$700.00	Salaries, ...	552 00
	Fixed Allowance, ...	120 00
	Uniforms, ...	5 50
	Cutting down dead Coco-nut Trees on Crown Land, ...	15 00
		692 50
	Balance, ...	7 50
		700 00

APPENDIX A,—Continued.

*Revenue and Expenditure—Gardens and Forest Department,
Penang, 1893,—Continued.*

REVENUE.	EXPENDITURE.	
		\$ c.
Travelling and Personal Allowances, ... \$700.00	{ Pony Allowance,	432 00
	{ Botanical Tours,	159 73
	{ Journey to Singapore,	87 70
	{ Field Allowances,	6 00
	{ Balance,	685 43
		14 57
		<hr/> 700 00
Plant Sales, \$500 00		
Receipts from Swimming Bath, ... 68 50		
Rents, 7 00		
Total, ... \$575 50		

APPENDIX B.

Principal Contributors and Recipients of Plants and Seeds, 1893.

CONTRIBUTORS.	RECIPIENTS.
Director, Royal Garden, Kew.	Director, Royal Gardens, Kew,
Do. do. do., Calcutta.	Do., do. do., Calcutta,
Superintendent of Botanic Gardens, Hongkong.	Do., Botanic Gardens, Java.
Superintendent of Botanic Gardens, Bangalore.	Do., do. do., Singapore.
Messrs. Jas. Veitch & Sons, London.	Superintendent Botanic Gardens, Hongkong.
„ F. Sander & Co., St. Albans.	Messrs. J. Veitch & Sons, London.
Agri-Horticultural Society, Rangoon.	„ F. Sander & Co., St. Albans.
Do. do., Calcutta.	Agri-Horticultural Society, Calcutta.
Mrs. S. Apcar, Calcutta.	Do., Do. Rangoon.
„ Mower, Rangoon.	Mrs. Mower, Rangoon.
Mr. G. Pechè, Moulmain.	Mr. W. H. Frizell, Penang.
„ J. C. van Ravensway, Singapore.	„ G. Pechè, Moulmain.
„ O. Bartels, Brisbane.	„ S. T. Apcar, Calcutta.
„ Pereira, Singapore.	„ O. Bartels, Brisbane.
„ F. G. A. Goedhart, Sumatra	„ A. T. Bryant, Dindings.
„ D. Logan, Penang.	„ W. Egerton, Sungei Ujong.
„ C. Goldham, Tongkah.	„ C. Maries, Gwalior.
„ C. Maries, Gwalior.	„ G. Baldwin, Perak.
„ T. A. Wooldridge, Penang.	„ D. Logan, Penang.
„ D. Blaze, Penang.	„ T. A. Wooldridge, Penang.
„ G. Baldwin, Perak.	„ J. K. Birch, Penang.
Dr. Franceschi, California.	„ G. F. Adamson, Penang.
Mr. A. T. Bryant, Dindings.	Colonel Frowd Walker, Perak.
	Public Gardens, Taiping.

APPENDIX C.

A List of a few of the interesting Plants flowered in the Waterfall Garden, Penang, 1893.

NAME.	Date of Flowering.	Native Country.
<i>Anthurium Andreanum</i> , ...	Always in flower.	Columbia.
„ <i>Dechardii</i> , ...		S. America.
„ <i>ferrierense</i> , ...		Garden Hybrid.
<i>Angrecum citratum</i> , ...	May.	Madagascar.
„ <i>articulatum</i> , ...	March.	Do.
„ <i>Sanderianum</i> , ...	April.	Do.
„ <i>Scottianum</i> , ...	Oct.-Nov.	Comoro.
„ <i>sesquipedale</i> , ...	Oct.-Dec.	Madagascar.
<i>Ærides multiflorum</i> , ...	May-June.	Burma.
„ <i>odoratum</i> , ...	July.	India.
„ <i>virens</i> , ...	July-Aug.	Malaya.
<i>Æschynanthus Wallichii</i> , ...	Nearly always in flower.	Dindings.
„ <i>marmorata</i> , ...		Penang.
<i>Aristolochia elegans</i> , ...	flower.	Brazil.
„ <i>gigas</i> var. <i>Sturtevantii</i>, ...	...	Do.
<i>Bulbophyllum radiatum</i> , ...	Aug.-Dec.	Panga, Siam.
<i>Cattleya Bowringiana</i> , ...	June.	C. America.
„ <i>amethystoglossa</i> , ...	February.	Brazil.
„ <i>aurea</i> , ...	May.	Costa Rica.
„ <i>gigas</i> , ...	May.	S. America.
„ <i>Mossiae</i> , ...	Dec.-Feb.	La Guayra.
„ <i>Mendelii</i> , ...	March.	Brazil.
„ <i>labiata</i> , ...	July.	Do.
„ <i>Percivaliana</i> , ...	Sept.-Dec.	Colombia.
„ <i>Schröderæ</i> , ...	June.	Brazil.
„ <i>Sanderiana</i> , ...	May.	New Grenada.
„ <i>trianæ</i> , ...	February.	Brazil.
<i>Calanthe curculigoides</i> , ...	September.	Malaya.
„ <i>limatodes</i> , ...	Sept.-Dec.	Burma.
„ <i>rubens</i> , ...	Nov.-Jan.	Longkawi.
„ <i>Regnerii</i> , ...	Oct.-Nov.	Siam.
„ <i>vestita</i> , ...	Sept.-Dec.	Burma.
„ <i>veratrifolia</i> , ...	Jan.-Dec.	Malaya.
„ <i>sp.</i>, ...	...	Perak.
<i>Cirrhopetalum medusæ</i> , ...	Sept.-Oct.	Penang.
„ <i>longissimum</i> , nsp., ...	Sept.-Oct.	Panga, Siam.
„ <i>sp.</i> , ...	Sept.-Oct.	Do.
<i>Cypripedium barbatum</i> , ...	Nov.-Dec.	Penang.
„ <i>Lowii</i> , ...	April.	Borneo.
„ <i>Haynaldianum</i> , ...	Nov.-Dec.	Phillipines.
„ <i>insigne</i> exul, ...	December.	Panga, Siam.
„ <i>niveum</i> , ...	August.	Langkawi.
„ <i>bellatulum</i> , ...	March.	Siam.
„ <i>Spicerianum</i> , ...	August.	Assam.
„ <i>Sedenii</i> , ...	April.	Garden Hybrid.
<i>Cælogyne Cumingii</i> , ...	April-May.	Penang and Perak.
„ <i>asperata</i> , ...	Feb.-July.	Perak and Borneo.
„ <i>toментosa</i> , ...	July.	Perak and Penang.
„ <i>Parishii</i> , ...	March.	Burma.
„ <i>pandurata</i> , ...	March.	Perak.
„ <i>Dayana</i> , ...	November.	Borneo.
<i>Crinum Mooreii</i> , ...	April.	Natal.
„ <i>pedunculatum</i> , ...	December.	New Guinea.
<i>Cycnoches chlorochilum</i> , ...	February.	Demerara.
<i>Dendrobium Buissonii</i> , ...	February.	Burma.
„ <i>Dalhousianum</i> , ...	Dec.-Mar.	Do.
„ <i>densiflorum</i> , ...	Dec.-Mar.	Do.
„ <i>formosum</i> , ...	August.	Do.

APPENDIX C,—Continued.

A List of a few of the interesting Plants flowered in the Waterfall Garden, Penang, 1893,—Continued.

NAME.	Date of Flowering.	Native Country.
Dendrobium Dearii, ...	Jan.-Dec.	Philippines.
" Farmerii, ...	February.	Mergui.
" taurinum, ...	September.	Phillipines.
" Jenkinsii, ...	May.	Burma.
" Wardianum, ...	Feb.-March.	Do.
" phalænopsis, ...	December.	New Guinea.
" Pierardii, ...	March.	Burma.
" Veitchii, ...	Dec.-Jan.	Java.
" sp., several of botanical interest only, ...		
Didymocarpus sp., fl. blue, ...	April-Dec.	Panga, Siam.
" sp., fl. yellow, ...	Nov.-Dec.	Kedah.
Eria albido-tomentosa, ...	July.	Langkawi.
" ornata, ...	July-Aug.	Do.
" sp., several from Perak and Langkawi, ...		
Epidendrum atropurpureum, ...	August.	Mexico.
" var. album, ...	August.	Do.
Eucharis candida, ...		New Grenada.
Galeandra sp. (Sander), ...	June.	
Grammatophyllum speciosum, ...	July.	Malaya.
Habenaria carnea, ...	July-Nov.	Langkawi.
" " white var. ...	July-Nov.	Do.
Hæmanthus Kalbreyerii, ...	June.	Guinea.
Impatiens Sultani, ...	} Always in flower.	Zanzibar.
" Hawkerii, ...		Pacific Islands.
" sp., ...		
" mirabilis, ...	May.	Langkawi.
Lycaste aromatica, ...	Jan.-Feb.	Mexico.
" Skinnerii, ...	August.	Guatemala.
Leptotes bicolor, ...	February.	Brazil.
Lælia harpophylla, ...	Aug.-Oct.	Do.
" Dayana, ...	August.	Do.
" anceps, ...	August.	Mexico.
Miltonia spectabilis, ...	July.	Peru.
" Roezlii alba, ...	June.	Do.
" Morelliana, ...	August.	Do.
" Warscewiczii, ...	November.	Brazil.
Oncidium barbatum, ...	February.	Guatemala.
" ampliatum majus, ...	Dec.-Mar.	C. America.
" ornithorhynchum, ...		Mexico.
" sp. (Sander), ...	March.	
" phymatochilum, ...	September.	Brazil.
Phajus alba, ...	June.	Burma.
" Blumii, ...	June.	Perak.
Peristeria elata, ...	July.	Panama.
Phalænopsis tetraspis, ...	Nov.-Dec.	Andamans.
" amabile, ...	} More or less in flower all the year.	Borneo and Java.
" esmeralda, ...		Langkawi and Siam.
" cornu-cervi, ...		Malaya.
" violacea, ...		Perak and Borneo.
" sumatrana, ...		Perak.
Saccolabium sp., ...	May-June.	Tongkah.
" curvifolium, ...	May-June.	Langkawi.
Vanda cærulea, ...	July.	India.
" insignis, ...	April.	Timor.
" teres, ...	April.	India.
" Hookerii, ...		Perak.
" tricolor, ...	September.	Java.
Zygopetalum Mackayii, ...	Sept.-March.	Brazil.

C. CURTIS,

Assistant Superintendent of Gardens and Forests.

REPORT ON THE GARDENS AND FORESTS, MALACCA.

1. Mr. J. S. GOODENOUGH took charge of the Department in June, on Mr. DERRY'S proceeding to Europe on leave.

2. With the reduced staff consisting of only four coolies and a mandor, nothing but the usual nursery garden work could be attempted. The beds adjoining the proposed lake were kept in good order, and about 6,366 plants of various kinds were propagated, of which 2,207, chiefly fruit-trees, were sold to various private persons, and 73 various trees were supplied to Government grounds.

3. A line of palms were planted along the main drive during the year, and they have grown well and already are a noticeable feature in the garden.

The Plant-sheds.

4. The plant-sheds, of which there are two, have been well looked after, and the plants contained therein are doing well.

5. One shed is situated a little way above the nursery. It is a span-roofed shed, of rumbia attaps, measuring 51 feet long by 14 feet wide, principally given to orchids, lilies and ornamental plants and shrubs.

6. The other one, 41 feet long by 18 feet wide, and situated next to the cross entrance, is also a span-roofed structure covered with rumbia attaps; the side tables, made of rough red iron-stones, are one foot high on which are placed ferns (some very fine ones), begonias (both native and foreign) and creeping aroids; and it is also used to shelter the more delicate native plants brought in from distant jungles.

Experimental Cultivation.

7. The clove trees, which were planted in 1888, have flowered twice during the year, and I hope to be able to get some data as to the probable yield of cloves per tree and of the market value.

8. Some of the young plants planted in the upper portion of the gardens in 1891 have not thriven as the soil was too hard. They have been removed to a more suitable spot, which has been more beneficial to them.

9. *Nutmegs*.—It would seem that dry, clayey soil does not suit these. A few trees planted for experiment in a dry spot dwindled away till they had a starved and stunted appearance, while trees planted in the lower part of the gardens where the soil is richer and less dry, have thriven and are all that can be desired.

10. *Tea* (Hybrid Assam) and *Liberian coffee* are growing well, and endeavours will be taken to keep a good stock supply, especially of the latter, for which there is an increasing demand in the Settlement.

11. *Farming*.—The fruit crop of the gardens was let for \$33.99 during the year.

12. *Exchanges*.—A large number of fruit trees and other economic plants were transmitted to Singapore and Penang, for shipment to other parts of the world.

13. *Herbarium*.—An extensive series of specimens was collected during the year, a set of which was sent to the Singapore Herbarium. The collection has now become so large that additional accommodation was found essential. Two new cabinets were, therefore, purchased at a cost of \$35.

14. *Forest Reserves*.—The total area of reserved forests in the Malacca Settlement is now 49,210 acres. The boundaries of all the reserves have been kept clear of weeds and grass, as well as possible with the reduced staff, except in the cases of the Brisu and Merlimau reserves, which had to be much neglected.

15. *Staff*.—The Forest Police, having been reduced by 12 men, now consists of only two Corporals, 3 Lance-Corporals and 7 Watchmen. All worked well, with the exception of one Corporal, who was found to be neglecting his work, and was dismissed.

16. *Licenses*.—Passes for timber-cutting, collecting dammar and wood-oil, cutting rattan, collecting palm-toddy and fibre were given out, for various reserves, viz., Sungei Udang, Bukit Bruang, Bukit Panchor, Merlimau, Bukit Sadanen, Jus and Batu Tiga, and brought in a revenue of \$593.10. The fruit-trees were farmed in the Panchor reserve and produced \$85.23.

17. *Fires*.—One large fire occurred at Ayer Kurau, which burnt down grass and brushwood to the extent of about forty acres. The cause was undiscovered.

18. *Prosecutions*.—There was but one prosecution during the year, for timber cutting at Batang Malaka. The defendant was fined \$20, which was paid.

19.

EXPENDITURE.

*Total Revenue and Expenditure.**Revenue.*

Gardens and Forests, \$1,022.67

Expenditure.

Gardens and Forests, \$2,499.64

Detail of Expenditure.

	Vote,	\$	c.	\$2,500 00
Salaries of Forest Guards,	1,272	96	
" " Gardens,	491	99	
Pony Allowance,	432	00	
Field "	145	00	
Freight and Shipping,	8	35	
Maintenance of Bullock and Cart,	12	30	
Purchase of Plants and Seeds,	0	35	
Incidental,	30	89	
Office and Herbarium,	46	40	
Transport,	59	40	
Balance,	0	36	
Total, ...				\$2,500 00

Detail of Revenue, Gardens and Forests

<i>Gardens.</i>	\$	c.	<i>Forests.</i>	\$	c.
Sale of Fruit-trees, ...	106	91	Tents on Dammar, ...	87	25
" Shade trees, ...	5	00	Wood-oil, ...	36	00
" Clove trees, ...	109	72	Sale of Timber, ...	284	35
" Nutmeg trees, ...	24	72	Water Supply to Sago Factory, ...	20	00
" Ornamental trees, ...	19	94	Sale of Rattans, ...	18	65
" Coffee trees, ...	6	00	" Kabong Palm-toddy and Fibre, ...	19	05
" Orchids, ...	4	15	" Fruits, ...	85	23
Fruit crop and Plantain, ...	33	99	" Charcoal, ...	23	00
Sale of Mangkuang leaves, ...	1	00	" Gutta, ...	3	66
" Rumbia leaves, ...	1	20			
Packing and Cart-hire, ...	24	41			
Total, ...	337	04	Total, ...	577	19
Plants supplied for Government use, ...	7	30	Timber supplied for Government use, Public Works Department, ...	92	52
Grand Total, ...	\$344	34	Timber supplied to Penghulu for a Mosque, ...	8	62
			Grand Total, ..	\$678	33

J. S. GOODENOUGH,
*Acting Assistant Superintendent of
 Gardens and Forests.*

REPORT ON THE GARDENS AND FORESTS DEPARTMENT, STRAITS
SETTLEMENTS, FOR THE YEAR 1894.

Botanic Gardens, Singapore.

Staff.

Several changes in the staff took place during the year. Mandor T. C. PEREIRA was replaced by AHMAT; Chief Mandor P. C. COORAY resigned; and the Inspector of Coco-nut Trees was dismissed. The frequency of these changes is to be deplored, but I can see no help for them without paying much larger salaries than we do. The Artist, Mr. D'ALWIS, who had previous to this year been paid from a special vote, was in January transferred to the Gardens vote. He too resigned his appointment on account of the smallness of his pay: this is particularly to be regretted, as it stops altogether, or at least considerably delays, the figuring of the new and characteristic plants of Malaya, with which it is intended to illustrate a written Flora. The Director, Mr. H. N. RIDLEY, went on leave to England in September; and Mr. DERRY, the Assistant Superintendent of Forests, Malacca, returned from England also in September, and was detailed for duty at Head Quarters pending the result of the recommendations of the Retrenchment Committee, who had recommended that his office should be abolished.

Visitors.

3. There is a steady increase in the number of visitors. I am glad to report a less number of thefts than usual; one resident, however, was caught stealing orchid-flowers, was prosecuted, and fined \$30. The Regimental Band played frequently in the Gardens on Friday afternoons, and on several occasions by moonlight, the latter performances attracting enormous crowds.

Aviaries.

4. The aviaries, which form such an attraction to visitors, have absorbed a considerable amount of labour and money, as they have been entirely reconstructed during the year. The old structures, which were made of wood and shingle roofs, had become absolutely dilapidated, and it was resolved to rebuild them in a more permanent manner. The enclosures have been made by brick walls, and the roofs of corrugated iron, and better accommodation has been given to the animals. Several additions have been made to the collections, amongst them being a mynah from Java, presented by His Grace the Duke of NEWCASTLE; two crowned partridges (*Rollulus cristatus*), presented by Dr. JOHNSTON of Pahang; three pelicans (*Pelicanus manillensis*), presented by Messrs. MACHADO and CUMMING; one emu (*Dromæus norw-hollandæ*) and two jabirus (*Mycteria australis*), presented by Captain VINCENT, Singapore; two Brahminy kites (*Haliastur indus*) and one Malayan palm civet (*Paradoxurus hermaphroditus*), presented by Mr. C. P. DERRICK, Singapore; and one female bear (*Ursus malayanus*), presented by Miss AYLESBURY, Perak. The following were purchased:—Three bandycoots (*Parameles* sp.) from New Guinea, and two young mias (*Simia satyrus*). I regret to report the death of the large Malay bear from inflammation of the stomach; he had been in the Gardens nearly five years. The large mias purchased last year died from general debility; and the black buck, which was presented by the 2nd Battalion The Lincolnshire Regiment, was killed by a deer, which

broke through the partition of the next compartment. A common monkey was born in the aviary on the 2nd of September; the mother having previously given birth to two others in the same place in 1892 and 1893, respectively. A young deer was also born in the Gardens on the 30th March. Two young tiger cubs from Pahang were deposited by His Excellency the Governor pending arrangements for their transfer to the Zoological Gardens, London.

Plant Houses.

5. Extensive repairs were carried out in the large plant house and orchid house adjoining. Many of the cross beams and their upright supports have been renewed: these ballow wood beams had stood since the house was erected some twelve years ago. The other plant sheds have been repaired where necessary.

6. Most of the plants mentioned in last year's Report have again flowered, as well as several new introductions. Among the latter is a new genus (named by the Director "Machadoa") after its discoverer, who found it in Tringganu; it belongs to the natural order *Commelinaceæ*, and is a pretty little plant. A new *Trichoglottis* flowered and was named *T. zehriana*—a very handsome purple-leaved grass. *Pennisetum* was introduced from New Guinea, and proved on flowering to be *P. macrostachyum*. Other new introductions are:—*Bougainvillea Sanderiana*, *Dracæna Sanderiana*, *Tradescantia decora*, new hybrid *Begonias*, *Cypripedium Charlesworthii*, *Collabium nebulosum*, *Selaginella usta*, *Selaginella grandis*, *Aristolochia saccata*, *Medinilla Teysmannii*, &c. Especial mention should be made of several important collections from Kew, including a complete set of *Phyllocacti*, a mixed collection of valuable economic plants, and 632 seeds of the cola nut. Messrs. SANDER & CO. have also contributed some valuable South American orchids, and mixed plants of a decorative character.

7. An attempt has been made to improve the cultivation of roses, and several consignments have been received from Bangalore, Calcutta and Saharanpur. It is hoped that by inarching the better kinds on the stock of one of the common strong growing local varieties, the flowers will be kept from degenerating as they do when left to grow on their own roots.

Lawn and Flower Beds.

8. Greater attention has been paid to the cultivation of flowering plants such as annuals, and the beds have been kept gay with a succession of such plants as *Gaillardias*, *Zinnias*, *Petunias*, &c. The most serviceable plants in this direction, however, have unquestionably been the *Cannas*, obtained chiefly from Mr. CURTIS in Penang, who has been so successful in introducing and growing most of the best varieties.

Lakes.

9. The lakes have received the usual attention in clearing the weeds (*Utricularia*) which grow with such astonishing rapidity, and about a hundred cart-loads of silt were removed from the top end of the big lake. The *Nympheas* were manured from time to time. I am glad to be able to report the re-introduction of the Victoria Regia lily after repeated failures. Our only plant died in 1891, and since then no pains have been spared to re-introduce it by seeds and young plants. Seeds were received from British Guiana and Kew, and a young plant obtained from Penang, but in spite of every care, the latter died, and the former failed to germinate. In September last, our efforts were rewarded with success, several plants germinated from seeds kindly supplied by Dr. TREUB from the famous Gardens at Buitenzorg, the largest plant is now well established in the small lake near the nursery.

Roads and Walks.

10. No extensive re-metalling has been done, but repairs have been made where necessary, and all the small walks around the Band-stand coated with a fresh layer of gravel. The bridge on the new lake has been removed, the planking being rotten, and, on the recommendation of the Superintendent of Works and Surveys, the culvert has been replaced by cast iron pipes 2' 6" in diameter obtained from the Municipality. The erection of granite posts and chains along both sides of the dam has yet to be done.

Economic Garden and Arboretum.

11. The arboretum may now be said to be practically complete, so far as allotting the space to the various natural orders is concerned. The space for the remaining natural orders from *Urticaceæ* were marked out and planted during the year. A good deal of time was taken up in turfing the ground between the trees to prevent the washing away of the surface soil by heavy rains, and it is found the trees grow

very much better when the ground is under grass. This part of the Garden, although not much visited now, will, it is hoped, be more frequently visited as the trees grow up and become more interesting.

12. Some experiments were made in making paper from various fibres, such as lalang, ginger plant stems, the sheaths of various palms, &c., with a fair amount of success. As these and some other experiments have been detailed more fully in Bulletin No. 4, I need not further allude to them here.

Inspection of Coco-nut Trees.

13. Two hundred and fifty-eight (258) notices calling upon occupiers to destroy 1,800 trees and stumps were served during the year, and in two cases only was it found necessary to prosecute, small fines being inflicted in both cases. In August last, the Inspector was dismissed by order of the Government for misconduct; and as in the opinion of the Government it was not considered necessary to keep up the post, the inspection of plantations and the working of the Ordinance is now carried on by one man only, which hardly needs pointing out is quite inadequate to do the work properly. In support of this, I may quote some figures taken from a letter sent me by Mr. ALLINSON, who was lately in charge of the Grove Coco-nut Estate, Tanjong Katong. He says:—"Three beetle-men are constantly employed on the estate, whose duty it is to search for and destroy the beetles found in the trees. The crop of beetles averages about 25 per diem. In addition to the searching of the trees, just described, a regular examination of stumps has been initiated with startling results, the figures are given in the Appendix.

"APPENDIX.

"Result of Daily Searches for Beetles.

	<i>" Black.</i>	<i>Red.</i>	<i>Trees cut down.</i>
" April, ...	526	1	30
" May, ...	637	2	16
" June, ...	521	5	14
" July, ...	612	...	...
" August, ...	584	...	...
" September, ...	680	4	...
" October, ...	759	20	28
" November, ...	700	9	15
" December, ...	515	3	11
	<u>5,534</u>	<u>44</u>	<u>114</u>

"Inspection of Stumps.

	<i>" Black.</i>	<i>Red.</i>	<i>Larvæ.</i>
" November,	724	5	5,000
" December,	228	2	2,000
	<u>952</u>	<u>7</u>	<u>7,000</u>

14. The above figures bear eloquent testimony to the fertility of the beetles, in spite of the greatest efforts to keep them in check, for if such numbers are to be found on one of our very best and most highly cultivated estates, what are we to expect from the less cultivated ones, to say nothing of the countless numbers of small holdings which carry a few coco-nut trees? There can be no doubt that, if we are to combat the scourge successfully, greater efforts will have to be made to carry out the Ordinance more effectively, and this can only be done by an increased staff working under an intelligent Inspector. (This will, however, form the subject of a separate report to Government.)

EXPENDITURE.

Vote, ...	...	...	...	...	\$700.00
Salaries, ...	...	...	...	\$320.52	
Expenses, removing trees and stumps, ...	...	...	...	286.00	
Transport, ...	...	...	...	39.42	
Uniforms,* ...	...	...	...	7.00	
				<hr/>	
				\$652.94	
			Balance,...	47.06	
				<hr/>	
				\$700.00	
				<hr/>	

Herbarium and Museum.

15. No botanical tours outside Singapore were taken during the year, nevertheless a considerable number of Singapore species were added, collected mainly by the Director in the outlying parts of the island. Four hundred and seventy-seven (477) specimens were received from Dr. KING, Calcutta; 36 from Dr. HAVILAND, Borneo; 272 from Malacca; 97 from Baron VON MUELLER, Australia; 88 specimens were collected in Java by Mr. HULLETT, and 30 from various sources. Many plants, chiefly orchids, were sent in to be named by local cultivators.

16. The following specimens were distributed (many of them for identification by various specialists):—One thousand four hundred and sixteen (1,416) to Dr. KING, Calcutta; 1,862 to the British Museum; 452 to the Royal Gardens, Kew; 101 palms to Professor O. BECCARI, Naples; 25 *Melastomaceæ* to Professor COGNIAUX, France; 96 species of mosses to Professor BROTHIERUS, Russia; 33 species to Dr. HAVILAND; 29 ferns to Colonel BEDDOME, England; 13 ferns to Bishop HOSE; 28 *Gramineæ* to United States Department of Agriculture and Professor HACKEL, St. Polten. Our herbarium of Malayan bamboos was loaned to Mr. GAMBLE of the India Forest Department, who was engaged on a monograph of the Indian species. After critical examination, several of ours prove to be new.

17. The Museum was enriched by a very complete set of Johor timbers to the number of 614, and while some of these, no doubt, will prove to be duplicates, it is nevertheless the most complete set ever got together: they have been cut to a uniform size, and will be placed in cabinets for reference.

18. A series of saprophytes were preserved in spirits, one of them proving new, and has been named *Thismia fumida*. Some plants used by the aborigines of the Peninsula for making their arrow poison, were presented by Professor VAUGHAN STEVENS. A series of various natural history specimens were sent to the British Museum and to Mr. HOLMES of the Pharmaceutical Society.

Miscellaneous.

19. A successful Flower Show was held in June, under the auspices of the Gardens Committee, the main feature of which was the very good display of orchids.

A Bulletin on Sago was prepared during the year, but the press of work at the Government Printing Office prevented its being published within the year, the same cause preventing the publication of the Garden Catalogue, drawn up some time ago. I hope these will be taken in hand in 1895.

Library.

20. In addition to the usual Periodicals and Garden Reports, the following works were received and added to the Library:—

Presented:—

Dr. TREUB.—Verslag omtrent den Staat van Stands Plantentium to Buitenzorg, 1892 and 1893.

Dr. TREUB.—Annales du Jardin Botanique de Buitenzorg, Vol. XII, Part I.

DUTHIE, J. F.—Records of the Botanical Survey of India, Vol. I, No. 1—Report on a Botanical Tour in Kashmir.

GAMMIE, G. A.—Report on a Botanical Tour in Sikkim.

Dr. PRAIN.—Memoirs and Memoranda, 1894.

Dr. CROMBIE.—British Lichens.

Dr. WATT.—Agricultural Ledgers, No. 1-4 1892, Nos. 1-20 1893, Nos. 1-6 1894.

Under-Secretary for Agriculture, Brisbane.—Agricultural Bulletins.

United States Department of Agriculture.—Experiment Stations Records.

MOLL, J. W.—Een toestel on Planten voor het herbarium Te Drogen.

Do., —Rapport sur quelques Cultures de Papaveracies.

Dr. BORSMA.—Bulletin No. 13.

Purchased :—

Index Kewensis, Fasc. II and III.

VASQUE.—Monographiæ Phanerogarum Guttiferæ, Vol. VIII.

Dr. TRIMEN.—Handbook of the Flora of Ceylon, Part II with Atlas.

Exchanges.

21. The usual exchanges of plants and seeds with kindred institutions outside the Colony have been maintained. Twelve hundred and fifty-four plants and three hundred and sixty-nine packets of seeds were received from the under-mentioned contributors, and three hundred and thirty-four plants and one hundred and four boxes and packages of seeds were sent out :—

Contributors :—

Royal Gardens, Kew.

Do., Calcutta.

Botanic Gardens, Ceylon.

Do., Bangalore.

Do., Saigon.

Do., St. Petersburg.

Do., Buitenzorg.

Do., Trinidad.

Do., Hongkong.

Do., Durban.

Do., British Guiana.

Do., Mauritius.

Do., Rockhampton.

Do., Saharanpur.

Do., Apia, Samoa.

Agri-Horticultural Society, Calcutta.

Baron von Mueller, Melbourne.

Prof. Max. Cornu, Paris.

Messrs. Sander & Co., St. Albans, London.

„ Bull, London.

„ Cannell & Son, England.

„ Dammann & Co., Italy.

„ Stanley Prise & Co., India.

Revd. Schlechter, South Africa.

Conservator of Forests, Dehra Dun.

J. O'Brien, Esq., England.

Geo. Peché, Esq., Maulmain.

F. Gilmour, Esq., Missouri, U. S. A.

Admiral Ammen, Washington, U. S. A.

Rt. Rev. Bishop Hose, Borneo.

W. Scott, Esq., Perak.

Dr. Johnston, Pahang.

Dr. Braddon, Sungei Ujong.

Major-General Berkeley, England.

Messrs. Pereira & Co., Florists, etc., Singapore.

R. Cundall, Esq., Manila.

W. Boxall, Esq., Singapore.

A. Ericsson, Esq., Singapore.

W. Micholitz, Esq., Singapore.

M. Langlasse, Singapore.

Mrs. A. S. Murray, Singapore.

BOTANIC GARDENS, SINGAPORE.

Statement of Receipts and Expenditure, for the Year 1894.

RECEIPTS.		EXPENDITURE.			
	\$ c.		\$ c.	\$ c.	
By Balance in Bank, ...	78 57	Salaries.			
Government Grant, ...	8,500 00	Artist, ...	250 00		
Sale of Plants and		Herbarium Keeper, ...	239 02		
Flowers, ...	864 51	Mandor, ...	217 59		
Interest, ...	49 48	Carpenters, ...	281 81		
		Mason, ...	98 25		
		Plant Collector, ...	100 00		
		Printer (Label), ...	165 48		
		Peon, ...	96 00		
		Aviary Keeper, ...	96 00		
		Police, ...	348 00		
		Coolies, ...	2,963 29		
				4,855 44	
		Bills.			
		Manure and Cartage, ...	205 39		
		Food for Birds and Animals, ...	824 55		
		Purchase of Pots and Tubs, ...	158 06		
		Purchase of Plants & Seeds, ...	194 32		
		Purchase of Books, ...	19 95		
		Purchase of Tools and			
		Stores, ...	614 62		
		Purchase of Timber, Planks,			
		etc., ...	303 97		
		Purchase of Bricks, Lime, ...	318 45		
		Freight on Plant Cases, etc., ...	232 35		
		Director's Petty Expendi-			
		ture, ...	217 31		
		Assistant Superintendent's			
		Petty Expenditure, ...	115 24		
		Subscription to Telephone, ...	97 50		
		Miscellaneous, ...	304 02		
				\$3,605 73	
				\$8,461 17	
		Balance, ...	...	\$1,031 39	
				\$9,492 56	
	\$9,492 56				

WALTER FOX,

Assistant Superintendent of Gardens and Forests, in Charge

Forest Department, Singapore.

22. A further reduction of the vote precluded very much being done, except protection and planting the remaining bilian plants that were not big enough to plant out in 1893. About a thousand plants were planted at Bukit Timah and Bukit Mandai. The young trees planted in former years were attended to as regards clearing of weeds, &c. The boundary paths and fire guards have been kept in order. A considerable portion of the time of the forest guards was taken up patrolling those coast and river reserves in which licenses were issued for cutting timber, &c., the amount of revenue obtained from this source being more than sufficient to pay the forest guards during the year.

Licenses.

23. A still further increase in the number of applications to cut mangrove fire-wood, fishing stakes, rollers, tan bark, &c. was made during the year, indeed some had to be rejected, as more applications were made than we could with prudence grant. Three hundred and thirty-five (335) permits were granted, as against 136 last year, yielding a revenue of \$982.75, as against \$416 in 1893.

24. Fifteen fires occurred during the year in the various reserves. Very little damage was done in any case, except the one that took place at Sungei Jurong and Pandan during the very dry weather that prevailed in February. On this occasion the fire swept over nearly 150 acres, and destroyed some good forest, and young plants. In every case it was found impossible to find out how they had originated. In one case some Chinese squatters were prosecuted on good circumstantial evidence, but the Magistrate did not think the case proved, and acquitted the prisoners.

Prosecution.

25. Three cases of illicit timber cutting were prosecuted, and fines inflicted in each case, amounting in all to \$30.

26. Since Mr. DERRY'S return in September, the Department has been without the services of an Inspector of Forests. Mr. GOODENOUGH who had been acting for Mr. DERRY reverted to the salary of his own appointment, and as there was no provision for the Acting Overseer, he was discharged. This explains the reason of a balance appearing on the vote at the close of the year.

General.

27. In accordance with the recommendations of the Retrenchment Committee, the forests were handed over from the 1st of January, 1895, to the charge of the Collectors of Land Revenue in Singapore and Penang, and the Collector of Land Revenue and District Officers in Malacca. As this is probably the last Report which this Department will make on them, it would be advisable that this opportunity should be taken of putting on record the present state of the Forest Department, and reviewing briefly its work since its initiation and comparing it with what existed before its creation. It will be remembered that it was in 1884 that the Governor Sir F. A. WELD commissioned the then Superintendent, the late Mr. CANTLEY, to prepare a Report on the Crown Forests of the Colony, and to make recommendations for the creation of a Department for their preservation. Mr. CANTLEY was eminently fitted for the task entrusted to him, no more by having just relinquished charge of the Gardens and Forests in Mauritius, than for his admirable powers of organization: and he threw himself into the work with his characteristic energy, the result was a most elaborate and valuable Report, in which he discussed the subject in a masterly and complete manner, he shewed the urgent necessity for stopping the ravages of the wholesale destruction of the forests which had been going on ever since the foundation of the Colony, and made no less valuable suggestions for the creation of a Department which would check those ravages, and carry out those principles of Forestry which have been shewn necessary in every country to be absolutely essential to its well-being. Unfortunately death prevented him from carrying out the task he had sketched out, nevertheless the thoroughness with which he laid the foundation have enabled his followers to bring the Department to the comparative state of efficiency it is in at present.

28. During the last few years, however, the votes have been so reduced as to prevent any work except almost that of protection, nor is this policy altogether to be regretted, for the comparative big votes of the first few years, necessitated by surveys and demarcations, were no longer required, as owing to the limited area of the forests in Singapore and Penang, their utility as a source of revenue, was subordinated

to their climatic and hygienic uses. This has not prevented, however, steady perseverance at re-afforesting which has been going on, brought about by protection, and assisted by artificial planting as far as funds allowed, thus building up a valuable source of revenue for the future, and especially so in Malacca, where the area of Crown Forests is considerable.

29. Mr. CANTLEY'S recommendations did not only apply to the Colony, but equally with all their force to the forests of the Peninsula, which, if carried out, in time would at all events prevent their indiscriminate destruction. But it is more to what has actually been accomplished in the Colony, that I would beg leave to point out. What was the state of things before 1884? As has been said, indiscriminate felling had been going on since the early days of the Settlement, the Crown Forests, such as were left of them, were the prey of the illicit tree-feller, who from want of any one to prevent him, helped himself to whatever he pleased; encroachments again went on unchecked, because seldom or never found out; fires were numerous; and most important of all the very sources of our water supply were being endangered both from destruction of forests, and the introduction of squatters with their pigs and other pollutions. All this has been stopped, and various parts of the island have been reserved, surveyed, and properly demarcated with boundary paths and fire guards, and an endeavour, so far as funds have permitted, to reafforest these reserves with young plants of the more valuable timbers which had become extinct on the island, and were getting scarce in accessible positions elsewhere.

30. The total area of Forest Reserve in Singapore amounts to 12,965 acres, divided into 13 reserves. A description of their contents will be found in the Annual Report for 1889.

[The area of Forest Reserves in Penang and Pulau Jerejak amount to 11,226 acres, and in Malacca to 42,000 acres.]

FOREST DEPARTMENT.

Expenditure for 1894.

Vote, ...	...	...	...	\$1,400.00
Salaries, ...	...	...	\$999.00	
Cartage, ...	...	...	33.00	
Seeds, ...	...	...	24.50	
Miscellaneous, ...	...	...	54.58	
				<hr/>
				\$1,111.08
			Balance,...	\$288.92
				<hr/>
				\$1,400.00
				<hr/>

WALTER FOX,
Assistant Superintendent of Gardens
and Forests, in Charge.

Gardens and Forests Department, Penang.

Waterfall Botanic Garden.

Numerous improvements to grounds, plant-sheds, &c. have been effected and no pains spared to make this Garden attractive to the general public. One great drawback to high class cultivation of difficult subjects is the lack of intelligent labour. All the gardeners and coolies employed are immigrants from Southern India and it almost invariably happens that by the time a man begins to be useful, he either returns to his native country, or obtains employment elsewhere at a higher rate of pay. In spite of this, we have established a more than local reputation for the cultivation of orchids and other choice plants, but this is only maintained by constant personal supervision and hard work.

2. A considerable increase in revenue from the sale of plants is shown in the Statement of Revenue and Expenditure annexed, the total amount being \$948.24, as against \$500 in 1893. I am doubtful whether this can be maintained in 1895, especially as the vote for travelling has been reduced to a point that allows of very little in the way of botanical collecting being undertaken for the purpose of obtaining new and rare plants for sale and exchange.

3. The usual interchange of plants and seeds has been carried on, with the result of adding a great number of interesting plants to our collection. A list of the principal contributors and recipients is given in Appendix B.

4. Many interesting orchids and other plants, some of them new and undescribed, flowered during the year, but none, I think, attracted more attention than a plant of *Congea tomentosa*, trained against the end of the fern-shed. This plant was collected by me two years ago, and herbarium specimens distributed under the name *Sphenodesma* sp. It is deserving of a place in every tropical garden, for as a decorative plant it must be classed with *Bougainvillæa* and *Petræa volubilis*, but of an entirely different colour to either. It may be already in cultivation, but I do not remember seeing it.

5. Several new beds have been formed and planted, and old ones re-planted from time to time so as to keep up, as far as possible, a show of flowering and coloured leaved plants. Roses, which are generally considered difficult to grow in the plains, have done remarkably well, but the choice of varieties suitable to this climate is limited. Maréchal Neil and Gloire de Dijon are superior to all others that have been tried so far. By grafting on a strong-growing stock found growing semi-wild in a garden in Penang, of which I do not know the name having never seen it in flower, greater success has been obtained than by using *Rosa gigantea*, the one generally used in India. During the dry season, from November to March, Dianthus made a grand display and deserve to be more generally grown than at present. Flowering plants are much less generally grown in Penang than foliage plants.

6. The principal orchid-shed, which was in a bad state of repair, has been reconstructed with hardwood timber. This shed is 58 x 40 feet. One of the sheds in the nursery, 50 x 18 feet, has been renewed with 3" and 4" iron supports and old boiler tubes from the sugar estates, and this is, I hope, the beginning of a new era in plant-shed construction. In this climate iron is not only the most suitable, but in the end the cheapest material, but the initial expense has hitherto prevented its use in this Garden. A portion of the material necessary for renewing another shed in 1895 has been purchased and paid for out of 1894 vote.

7. A new pond for the cultivation of the Victoria Regia lily in a more conspicuous place than that in which it was formerly grown, has been made by throwing a stone-work dam across the hollow a few yards above the Office on the opposite side of the road. This was finished, and three young self-sown plants from the old pond planted in June, and by the 1st September, they completely covered the whole area. The depth of water is from 3 to 4 feet, and the material in which they were planted leaf-mould and cow manure, a cart-load of which has been added every two months.

8. For the cultivation of annuals, and other flowering plants requiring sun, a raised octagonal bed of rough stone-work has been made opposite No. 1 plant-shed and been kept bright with a succession of flowering plants during the whole year. Want of full exposure to direct sunlight is the principal cause of failure in growing the majority of flowering plants, especially annuals.

9. This year has seen the completion of the Reservoir at the top of the Garden, and has enabled us to complete the formation and metalling of the new road to it, as well as re-metalling the road over which all material for constructing the Reservoir

has been carted. Altogether 1,525 lineal yards of carriage road have been re-metalled. In doing this, the Municipal Commissioners assisted both with labour and material.

10. A catalogue of flowering plants and ferns found growing wild in Penang has been compiled by me and printed by the Royal Asiatic Society, Straits Branch; about 50 copies of which have been distributed to various Botanists and Forest Officers. This list contains 1,971 species belonging to 793 genera, and 129 natural orders. It will require revision when the more recent collections have been critically examined by competent authorities, as many additional plants have been collected since this paper was printed.

11. In the beginning of the year, I was absent on two months' leave and visited Rangoon, Mandalay, Bhamo and the Mergui Archipelago. During this trip I obtained many interesting plants for the Garden, and made the acquaintance of several gentlemen interested in Botany, Horticulture, and Forestry, who not only did all in their power to assist me while on the spot, but have since contributed additional plants and seeds, and will, I hope, continue to do so in the future.

12. In July, a hurried visit was made to Taiping, my absence from Penang only extending over three clear days. One of these days was spent in judging at the Taiping Agricultural and Horticultural Show, and the other two in collecting plants of *Lecanopteris caruosa*, and other plants, a portion of which were sent to the Royal Gardens, Kew, at the request of the Director of that establishment, and it is gratifying to find that the majority arrived alive.

13. In October, I obtained permission to visit Perak for ten days for the purpose of obtaining plants for cultivation and exchange. A report on this trip was submitted, for the information of His Excellency the Governor, on my return, a copy of which is attached (Appendix C).

14. A visit was also made to the Dindings in connection with the planting of cloves and nutmegs in that Settlement.

Government Hill Gardens.

15. A fairly good and regular display of flowering plants, both in beds and pots, has been maintained in the grounds of the Government Bungalow. Among the more striking and easily grown plants for beds at this altitude (2,500 feet) may be noted cannas, roses, dahlias, dianthus, begonias and corn-flowers. As a pot plant nothing surpasses in brilliancy at this altitude *Impatiens Hawkerii*, which is grown in great numbers. The whole stock in this part of the world has been propagated by cutting from the original plant I brought from Kew in December, 1891. All attempts to induce this plant to produce seed has been abortive.

16. The old plant-shed on Gun Hill has been taken down and removed to a less exposed position below the Governor's Bungalow, and the original site planted with grass.

17. Vegetables have been regularly supplied to the Governor's Bungalow when occupied, and twice a week to the Residency throughout the year. Only a limited number of European kinds can be profitably grown, the easiest and most satisfactory being carrots, beet, leeks, lettuce, kohlrabi, radish, peas, and, in the dry season, tomatoes. "Collections" of both vegetable and flower seeds put up by the trade, either in Europe or India, always contain at least 50 per cent. of varieties quite unsuitable for this climate, and it is, therefore, cheaper and better in ordering seeds to specify the kind and quantity required. Several of these "collections" were sent me during the year by residents in Penang and Sumatra for an opinion as to suitability and instructions for cultivation, with permission to take a portion for the Gardens. I am afraid in most cases the result to the purchaser was disappointment.

18. In the experimental nursery the most important event of the year is the heavy crop of fruit borne by three trees of Avocado pear (*Persia gratissima*), the introduction of which is a decided success, and the cultivation of which will be largely extended this season from the seed obtained. A few of the orange trees produced some fruit, but not so abundantly as could be wished. Lichee, loquat, and olives look promising, and we shall see in a year or two more whether these are deserving of extended cultivation. The great drawback to cultivation in these hill gardens is the excessive cost of carrying up manure.

Preservation of Coco-nut Trees.

19. Notices were served on 661 persons having on their premises dead trees or material suitable for breeding places for the beetles. Of this number, 23 were prosecuted for non-compliance with the orders, and fines inflicted amounting to \$30.50.

There is a general feeling, I believe, that the working of this Ordinance is for the public good, but its good effect can be insured only by frequent inspection and insistence on the orders being complied with.

Maintenance of Forest Reserves.

20. No addition has been made to the Forest Reserves, and the work of the year has been mainly protective. The total area under protection is the same as last year, viz., 10,887 acres in nine separate blocks with boundaries aggregating 65 miles.

21. The cost of protecting small acres from fire and the inroads of illicit timber cutters must necessarily be comparatively much more expensive than larger ones, and the amount expended on this work (\$966.62 as shown in Statement of Expenditure annexed) is the least with which efficiency can be expected, and any reduction of the present number of guards renders efficient protection impossible.

22. Twenty-seven persons have been prosecuted during the year for cutting timber and causing damage by fire, and fines inflicted amounting to \$215.

23. In accordance with the recommendation of the Retrenchment Committee, it has been decided to transfer from 1st January, 1895, the management of all Crown forests in the Settlement to the Officers in charge of the Land and District Offices, and as this is the last Annual Report it will fall to my lot to write on these forests, it is desirable to point out the present position.

24. From a direct revenue-producing point of view, there is no great scope for forest operations in a small and mountainous island like Penang, but at the same time the importance of preserving, and, as far as possible, especially by natural reproduction, improving the existing forest cannot be overestimated.

25. Previous to my arrival in the Settlement, in July, 1884, a general report on the condition of the forests of the Colony, and forest conservancy generally, had been laid before the Legislative Council by the late Mr. N. CANTLEY, then Superintendent of Botanic Gardens, Singapore, but no active measures had been taken to carry his suggestions into effect.

26. After consultation with Mr. CANTLEY and a preliminary inspection of the area and contents of Crown forests in Penang, it was decided to demarcate certain areas, with a view to future revenue, within which no further cutting should be allowed for a number of years in order that the better class of timber-trees which were fast disappearing might have a chance of re-establishing themselves by means of natural reproduction. It was intended, if necessary, to artificially re-stock, where necessary, land within these reserves with high class timber, but this has not been done, except on a small scale, partly on account of the expense, but mainly because there is every reason to believe that efficient protection during a sufficiently long period is all that is necessary to effect the same purpose.

27. Considerable improvement has already taken place in the character of young trees springing up within the reserved areas, but ten years is a very short period in the life of the best hardwood trees found in this Settlement, many of which require at least from 80 to 100 years to reach a serviceable size and condition. Really good seed-bearing seasons occur only at intervals of several years. The best since I have been in the Settlement was in 1887, and I can now point to thousands of young trees of the very best kinds such as Damarlaut and Meranti (*Shorea* and *Hopea* sp.) as the result of that year's seed crop.

28. The greater portion of the reserves are, however, on the crest and slopes of steep hill-sides, and their value, from a revenue-producing point of view, is not likely to be considerable, so long as timber is obtainable in much more easily accessible localities, but their maintenance for climatic purposes is most important. Whatever difference of opinion may exist as to the effect of forests on rainfall, there can be none as to their use in storing and regulating the water supply.

29. At the time these hill reserves were demarcated, cultivation had already, in places, crept up beyond the limit at which, had there been any choice, the boundary line would have been carried, but it was decided from the beginning to interfere as little as possible with cultivation, which consists mainly of cloves and nutmegs, and consequently the boundary line was opened above these Gardens. I point this out now so that in case of these Gardens at an altitude of much above 1,000 feet being abandoned, as has already happened in two or three cases, the boundary should be altered so as to include these lots within the hill reserves.

30. That protection from encroachment and illicit timber cutting by means of Forest Guards is necessary, is proved by the fact that from 1889 to 1894, 256 prosecutions were instituted by this Department for forest offences, mainly under these two headings, and I am satisfied that a very great number of cases escaped detection.

31. Acting on the principle laid down in paragraph 26, no licenses for cutting timber within the reserved areas have yet been issued, although many applications have been received, and a rate much higher than that now paid for timber growing on Crown land outside the reserves would willingly be paid. All revenue collected from Crown forests outside the reserves has been credited to the Land Department, so that without violating one of the first principles laid down at the beginning of the work, it has not been possible for the Forest Department to show a revenue. This, of course, makes no difference to the actual revenue of the Colony, but it is not in accordance with the general rules of forest conservancy.

APPENDIX A.

Revenue and Expenditure—Gardens and Forest Department, Penang, 1894.

REVENUE.	EXPENDITURE.	AMOUNT.
		\$ c.
	Salaries,	3,171 29
	Purchase of Plants and Seeds, ...	201 70
	Pots and Plant Tubs,	166 66
	Cartage and Manure,	84 63
	Planks for Plant Cases, & Repairs, ...	61 47
	Tools and Materials, for Current Repairs,	243 56
	Material for renewing Plant Sheds, ...	330 30
Grant—Maintenance of Waterfall Garden, ... \$4,500.00	Freight on Plant Cases,	24 60
	Paper and Cabinet for Herbarium, ...	59 50
	Road Metal,	29 60
	Periodicals,	7 75
	Advertisement,	7 20
	Miscellaneous Petty Expenses, ...	107 37
		\$4,495 63
	Balance,	4 37
		\$4,500 00
Grant—Maintenance of Grounds of Government Hill Bungalow and Experimental Nursery, \$600.00	Salaries,	\$477 50
	Purchase of Seeds,	10 79
	Purchase of Manure,	72 52
	Purchase of Tools, &c.,	38 86
		\$599 67
	Balance,	0 33
		\$600 00
Grant—Expenses of carrying out Provisions of Coconut Trees Preservation Ordinance, \$700.00	Salaries,	\$464 00
	Fixed Allowance,	120 00
	Cutting down dead Trees,	39 00
		\$623 00
	Balance,	77 00
		\$700 00

APPENDIX A,—Continued.

Revenue and Expenditure—Gardens and Forest Department,
Penang, 1894,—Continued.

REVENUE.	EXPENDITURE.	AMOUNT.
		\$ c.
	Salaries of Forest Guards, ...	421 37
	Transport and Field Allowances, ...	93 80
	House Rent for Assistant Superintendent, ...	360 00
	House Rent of Sergeant of Forest Guards, ...	36 00
Grant—Maintenance of Forest Reserves, ... \$1,000.00	Coolies clearing Boundaries, &c., ...	37 00
	Oil for Stations, ...	9 70
	Tools, ...	6 25
	Miscellaneous, ...	2 50
		\$966 62
	Balance, ...	33 38
		\$1,000 00
	Pony Allowance, ...	\$432 00
Grant—Travelling and Personal Allowances, ... \$550.00	Travelling and Personal Allowances, ...	117 74
		\$549 74
	Balance, ...	0 26
		\$550 00
Plant Sales, ... \$948 24		
Bath Receipts, ... 65 85		
Rents, ... 12 25		
Total Revenue, ... \$1,026 34	Total Expenditure, ...	\$7,234 66

C. CURTIS,
Assistant Superintendent of Forests.

APPENDIX B.

Principal Contributors and Recipients of Plants and Seeds, 1894.

CONTRIBUTORS.	RECIPIENTS.
The Director Royal Gardens, Kew.	The Director Royal Gardens, Kew.
The Director Botanic Gardens, Java.	The Director Botanic Gardens, Java.
The Supt. Botanic Gardens, Calcutta.	The Supt. Botanic Gardens, Calcutta.
The Supt. Botanic Gardens, Hongkong.	The Supt. Botanic Gardens, Hongkong.
Agri-Horti. Society, Rangoon.	Agri-Horti. Society, Rangoon.
Agri-Horti. Society, Calcutta.	Agri-Horti. Society, Calcutta.
Messrs. F. Sander & Co., St. Albans.	Messrs. F. Sander & Co., St. Albans.
Messrs. J. Veitch & Sons, London.	Messrs. J. Veitch & Sons, London.
Messrs. S. P. Chatterjee & Co., Calcutta.	Messrs. Damman & Co., Naples.
Messrs. Stanley Price & Co., Calcutta.	Messrs. S. P. Chatterjee & Co., Calcutta.
C. H. Swindon, Esq., Calcutta.	O. Bartels, Esq., Brisbane.
C. Marries, Esq., Gwalior.	Chief Commissioner, Tongkah.
E. Versman, Esq., Langkat.	C. H. Swindon, Esq., Calcutta.
Luang Narison, Tongkah.	W. D. Barnes, Esq., Ipoh.
W. Scott, Esq., Taiping.	Public Gardens, Taiping.
D. Blaze, Esq., Penang.	District Officer, Butterworth.
Dr. Legg, Perak.	District Officer, Balik Pulau.
G. Peche, Esq., Moulmain.	Col. Walker, Taiping.
J. D'A. Pereira, Esq., Singapore.	J. D'A. Pereira, Esq., Singapore.
Miss Mackintyre, Penang.	Municipal Commissioners, Penang.
Hon. L. Surowongsee, Penang.	G. Peche, Esq., Moulmain.
J. W. Hodge, Esq., Penang.	Capt. Davis, Rangoon.
T. A. Wooldridge, Esq., Penang.	Capt. Winter, Rangoon.
J. F. MacFarlane, Esq., Penang.	T. A. Wooldridge, Esq., Penang.
Mrs. Baldwin, Tapah.	J. F. MacFarlane, Esq., Penang.
Mrs. Woodgate, Tapah.	J. W. Hodge, Esq., Penang.
Capt. Winter, Rangoon.	Mrs. Baldwin, Tapah.
Capt. Davis, Rangoon.	C. Maries, Esq., Gwalior.

APPENDIX C.

BOTANIC GARDENS,
Penang, 30th October, 1894.

To

The Hon'ble the Resident Councillor.

SIR,—In accordance with instructions in Circular Departmental No. 19, dated 1st August, 1894, I have the honour to submit, for the information of His Excellency the Governor, the following Report on a recent trip to Perak for the purpose of collecting botanical specimens for the Herbarium, for cultivation in the Garden, and for exchange.

2. Left Penang by the s.s. *Taw Tong*, at 3 P.M. on the 15th instant, and arrived at Telok Anson at 6 A.M. the following morning; at 2 P.M. proceeded to Tapah Road Station by rail, and arrived there at 3 P.M. From Tapah Road Station to Tapah is an hour's drive by gharry, but, owing to detention, it was 5 P.M. when I reached the Town.

3. The following morning, October 17th, commenced work by collecting along a bridle-path in the direction of a place called Kalindi for a distance of about four or five miles. The afternoon, and in fact all the afternoons during my stay, turned out very wet, and little collecting could be done. There are many interesting plants in this locality, especially palms, of which I procured seeds of several species. It is also a good agricultural country, suitable for many tropical products, particularly Liberian coffee, of which there are promising plantations in the neighbourhood of Tapah.

4. On the 18th, worked up the left bank of the Batang Padang River, and collected a number of ferns, orchids, &c. Many well known plants of interest were observed, one of the most noticeable being a gigantic specimen of a large fern *Angiopteris evecta*. Rain came on about noon, and nothing more could be done until 5 P.M., when it cleared up, and I managed to collect several specimens of a fine orchid—*Cælogyne pandurata*.

5. On the morning of the 19th, left Tapah for Kuala Dipang, distant about 18 miles. This is a limestone region of which I had heard much, and was the object I had in view on leaving Penang. I did not proceed direct, but stopped first at about 1½ miles from Tapah to see a Liberian Coffee Estate of which about 100 acres has been planted. The two-year old coffee is very fine and promises to be a good investment. At six miles from Tapah I halted again to examine the trees that had been felled for a new road. Here I collected some fine specimens of *Cælogyne Lowii*, a plant named after the late Resident of Perak, and originally collected by him in Borneo. About noon, I reached Kampar, a large mining village containing probably 10,000 Chinese. Remained here until 2 P.M., and then went on to Kuala Dipang in pouring rain. The distance from Tapah to Kuala Dipang is about 18 miles.

6. *October 20th.*—The village of Kuala Dipang is at the foot of Gunong Bujang Malaka, and near the junction of the Kampar and Dipang streams. One side of the valley is limestone, and the opposite granite. The flora of the limestone, to which I mainly confined my attention during the limited time at my disposal, is, as I expected to find, quite different to anything I had previously seen in Perak. The general features is much nearer that of the Langkawi Islands and Panga on the mainland, but the same families and genera are here represented by different species. Begonias, balsams, alocacias and gesneriaceæ are numerous in individuals, but not one species, so far as I saw, is identical with those found in Langkawi and Panga. Here at the foot of the hills are patches of deep rich reddish soil, not of sufficient area for a large estate, but excellent for small cultivators requiring say 40 or 50 acres in a patch. In places there occurs in considerable numbers a species of *Laportea* which the Malays call "Jelatang Gajah." I was warned to avoid this plant, and for some time did so, but in a moment of forgetfulness I brushed one lightly with the back of my hand. The stinging sensation is exceedingly painful and continued in my case for about thirty-six hours. Cold water appears to increase the pain. Natives say that if any considerable portion of the body comes in contact with this plant, diarrhœa and vomiting is caused, and the pain continues four or five days.

7. On the 21st, I again worked the limestone range, beginning at a place called Sungei Siput, about 2 miles from the Rest House. Mining operations are going on here at about 500 feet up the face of the cliff, and the material is sent down on rotan slides stretched from the working out into the valley, their total length being about 700 feet. In the hope of finding new plants, I was induced to go up the ladder to this working, but I must say, I was by no means comfortable until I found myself safely down again. Several interesting plants were collected in the neighbourhood of these mines.

8. On the 22nd, time being limited, I hired a gharry and drove to the foot of Gunong Mesa, distant from Kuala Dipang Rest House about 5 miles. This is an isolated limestone hill, on the top of which there is a trigonometrical station. From this point there is a very fine view of the surrounding country, but the flora is poor compared to the hills I had been on the two previous days. On another little isolated hill I collected a new begonia and a balsam. On my return to the Rest House at noon, I met an Englishman who has a mine on Bujong Malaka at 3,000 feet elevation. He invited me to accompany him there, which I should gladly have done had time permitted. Having packed up the plants collected, I commenced the return journey at 4 P.M., and slept in the Rest House at Kampar.

9. *October 23rd.*—Raining heavily all night, and no sign of clearing at day-break. Waded about for an hour in a swamp to collect plants of *Vanda Hookerii*. At 10.30 left for Tapah, but stopped half-way and struck into the jungle for three hours to hunt up a plant I once received from this locality, but did not find many.

10. *October 24th.*—Packed up plants collected at Tapah before leaving, and those that had been collected by a gentleman, who rendered me great assistance, during my absence. Dispatched these in a bullock-cart to Tapa Road Station, and followed in a gharry at 9.30. Train left at 11 A.M., and reached Telok Anson at noon. Went straight on board the s.s. *Flying Dragon*, and arrived in Penang at 6 A.M. on the 25th.

11. The result of this trip is, in spite of the unfavourable weather, very satisfactory. A number of orchids and other ornamental plants, about 500 in all, have been added to the Garden, some of which are undoubtedly new and undescribed. Others are well known, but in demand for the purpose of exchange. I also made the acquaintance of several gentlemen who will from time to time contribute to the Gardens plants that strike them as being of interest, and to whom in return we shall be able to give assistance in the matter of seeds and plant of economic value. One gentleman, who had some experience in growing vanilla in the Seychelles, asked for plants to try in Perak, which will be sent him. I was also able to be of some assistance to another gentleman in pointing out the first appearance of "Green Bug" on coffee, an insect with which they are apparently and fortunately unacquainted in Tapah, and advising as to means of checking it at once.

12. This is, I believe, the first time that any member of the Gardens and Forest Department of this Settlement has visited Batu Padang or Kinta for the purpose of collecting plants. What is known of the flora is mainly through the collections of dried plants made by Mr. WRAY and Dr. KING'S Collector. As neither of these gentlemen collected living plants to any extent, I confined my attention principally to this. The area explored by me is, of course, very trifling, and it is to be hoped that some day an opportunity may occur of extending our knowledge of this region.

I have, &c.,

C. CURTIS,
*Assistant Superintendent of
Gardens and Forests.*

Report on the Gardens and Forests, Malacca.

1. MR. GOODENOUGH was in charge during the year. Nothing could be done beyond ordinary upkeep for want of funds.

Experimental Nursery.

2. About 30,000 young clove trees were raised and distributed among the Chinese tapioca planters, together with 300 nutmeg trees and a few other mixed fruit trees.

Forest Reserves.

3. The boundaries have been regularly patrolled and kept open. I regret that the inspection paths have had to be abandoned, and nothing could be done to the Brisu or Merlimau Reserves. The area of the Forest Reserves in Malacca is 42,000 acres.

Licenses.

4. The permits issued for collecting damar, wood-oil, fibre, toddy, etc. brought in a revenue of \$625.72, and the fruit trees at Panchor were farmed out for \$105.50.

Fires.

5. Three fires occurred during the year, but fortunately did no particular damage, being confined toalang and brushwood. The origin was unknown in each case.

6. There were no prosecutions during the year.

General.

7. In accordance with the recommendations of the Retrenchment Committee, the Forest Department has been handed over to the charge of the Collector of Land Revenue and District Officers stationed at Alor Gajah and Jasin, respectively. For this purpose, I visited Malacca in November, and made the necessary arrangements for the transfer.

W. FOX,

Assistant Superintendent, in Charge.

Revenue and Expenditure, Forest Department, Malacca, 1894.

REVENUE.		EXPENDITURE. (VOTE \$2,000.)	
	\$ c.		\$ c.
Sale of Timber, ...	296 51	Salaries of Forest Guards, ...	881 41
" Fruit (Forests), ...	147 96	" at Experimental	
" Clove Trees, ...	97 00	Gardens, ...	426 86
Tenths on Damar, ...	70 50	Pony Allowance, ...	432 00
Ornamental Plants, ...	54 31	Field Allowance, ...	117 00
Kabong Toddy and Fibre, ...	39 00	Transport, ...	84 00
Wood Oil, ...	33 00	Miscellaneous, ...	58 63
Fruit crop (Garden), ...	37 39	Balance, ...	00 10
Plants supplied to Government,	97 66		
Timber " "	137 50		
Miscellaneous Receipts, ...	62 10		
Total, ...	\$1,072 93	Total, ...	\$2,000 00

J. S. GOODENOUGH,

Acting Assistant Superintendent of Forests.

W. FOX,

Assistant Superintendent, in Charge.

1893

ANNUAL REPORT OF THE BOTANIC DEPARTMENT, SINGAPORE.

1. During my absence on leave till July 2nd, Mr. FOX took sole control of the Botanic Gardens, and on my return he applied for a year's leave and left in July.

Mr. J. GOODENOUGH who, in accordance with the retrenchment scheme, had been discharged from the Department, was taken on temporarily in November as Assistant.

The Herbarium Keeper, TASSIM DAUD, was discharged in September, and AHMAT KASSIM was taken on in his place. The Mandor of the Economic Garden, XAVIER, broke down in health, and left at the end of the year.

Visitors.

2. The number of visitors to the Gardens was as large as usual, and the Regimental Band played once or twice a month for a portion of the year, and proved very attractive.

There were a few cases of theft of flowers, but they were of no great importance, and there were no prosecutions.

Aviaries.

3. The improvements made in the aviaries last year have produced satisfactory results, the animals being more thriving and looking better.

Among the additions to the collection of animals were:—

One tigress (*Felis tigris*), presented by Mr. D. H. WISE, Acting Resident, Pahang; three jackals (*Canis aureus*), presented by Captain BROWNE; three orang utans (*Simia satyrus*), purchased; one honey-bear (*Ursus malayanus*), presented; one Borneo red monkey (*Semnopithecus* sp.), purchased; one Indian mungoose (*Herpestes griseus*), purchased; three black Celebes monkey (*Macacus niger*), purchased; two kijangs (*Cervulus muntjac*), purchased; one sparrow hawk (*Accipiter* sp.), presented; one Afghan partridge (*Caccabis chukar*), presented. A deer (*Cervus equinus*) was born in the Gardens, and a hybrid monkey, by a kra (*Macacus sinicus*) out of a beruk (*Macacus nemestrinus*) was bred—a very rare occurrence, if indeed it has ever happened before. The little animal is growing well and strong.

The pair of herons (*Ardea sumatrana*), which have been so long in the Gardens, laid three eggs, as did a box tortoise (*Cistudo amboinensis*). A large python (*Python reticulatus*) laid a large number of eggs, apparently unfertile.

The old deer-sheds being very unsatisfactory and in a state of decay, were pulled down and a new and stronger enclosure is being built. The constant rain at the close of the year prevented the work being finished.

Plant-houses.

4. The large plant-house needed very extensive repair, as much of the wood-work was rotten, and a number of beams were replaced. As in the case of the new deer-sheds, the rain caused much delay in executing the work, to which was added some difficulty in obtaining good timber, as Balau, the best timber now procurable at a reasonable rate, is getting scarce.

The orchid-house fell down shortly before my return; the upper part has been replaced by an iron structure, and the stages are being replaced with banks of coral-stone and earth. Most of the old houses and stages have now been reconstructed in this manner, which in many respects is immensely superior to the old plan of planks supported on posts or brickwork pillars. The centre of the stage consists of earth, which is enclosed by walls of coral rock cut into blocks, and the top is covered with cement.

Lawns and Flower-beds.

5. These have been kept up to their usual standard during the year, and a large number of plants have been planted out where necessary.

Among the more interesting plants which flowered for the first time or which have seldom flowered here were *Gongora maculata*, *Vanda hastifera*, *Renanthera Storiei*, *Costus igneus*, *Alpinia involucrata*, *Nicolaia elatior*, *Loxococcus rupicola*, *Anisoptera glabra*, *Allamanda Williamsi*, *Garcinia Hanburyi*, *Tricholæna teneriffæ* (a newly introduced fodder grass), *Lespedeza Sieboldi* (also a fodder plant), *Clerodendron myrmecophila*, *Aristolochia unguifolia*.

A superb plant of *Todea barbara*, stated to be over a hundred years old, was presented to the Gardens by Baron VON MUELLER, and two plants of the rare *Asplenium subaquatile* from Borneo, were also received. A large tuber of *Amorphophallus titanum* was presented by Mrs. WILLIS SMITH.

Both the Vanillas which produce the commercial Vanilloes, viz., *V. planifolia* and *V. pompona*, flowered and fruited this year.

Herbarium.

6. During my absence no collections of herbarium specimens were made. The most important additions were 1,503 specimens from the collections of WALLICH, and HANCE selected by myself from the duplicates of the British Museum Herbarium, and presented by the Trustees of that institution.

Five hundred and thirty-eight (538) specimens from the Peninsula and India, presented by Dr. KING.

Sixty-six (66) specimens of grasses and ferns of North America, received in exchange.

Two hundred and forty-three (243) specimens from Bonthain Peak, Celebes, presented by Mr. A. H. EVERETT, and a small collection made in Province Wellesley and Penang, by myself in December. A small number of specimens of various kinds were sent to the Royal Gardens, Kew, and to Dr. KING.

The cabinets for wood specimens being too small to contain the collection, some more have been added, and the old ones repaired and varnished.

Bulletin.

7. An Agricultural Bulletin dealing with sago and its cultivation and with soils, was published early in the year.

Forestry.

8. In December, in accordance with instructions, I visited Penang and Province Wellesley to look into the remaining forests with a view of taking steps for their better preservation, and a report was duly forwarded to the Hon'ble the Colonial Secretary on the subject.

Library.

9. The following works were added to the Library in addition to the usual journals, bulletins and reports:—

Greshoff.—Nutzige Indische Pflanzen, Part I, presented by Colonial Museum, Amsterdam.

Schlich.—Manual of Forestry, presented by Author.

Trimen.—Flora of Ceylon, Vol. III, presented by Ceylon Government.

Ridley.—Flora of the East Coast of the Malay Peninsula, presented by Author.

Ridley.—New species of *Thismia*, presented by Author.

Wallich's Catalogue, presented by the Trustees of British Museum.

Beddome.—Ferns of Southern India, presented by the Trustees of British Museum.

Dunal.—Monograph des Anonacees, presented by the Trustees of British Museum.

Dunal.—Histoire des Solanacees, presented by the Trustees of British Museum.

Mohl.—Vernieschte Schriften, presented by the Trustees of British Museum.

Mohl.—Über des Winterliche Färbung, presented by the Trustees of British Museum.

Mohl.—Bau des Vegetabilischen Zellmembran, presented by the Trustees of British Museum.

Radlkofer.—Serjania, presented by the Trustees of British Museum.

Bureau.—Loganiaceæ and Bignoniaceæ, presented by the Trustees of British Museum.

Soubeiran.—Acclimatation des Cinchonas, presented by the Trustees of British Museum.

Chevreul.—Absorption de l'Azote, presented by the Trustees of British Museum.

Sprengel.—Introduction to the study of Cryptogams, presented by the Trustees of British Museum.

Sprengel.—Tentamen Supplementi ad syst. vegetat. Linnæi, presented by the Trustees of British Museum.

Victorian Exhibition.—Indigenous Vegetable Substances, presented by the Trustees of British Museum.

Wight's Catalogue, presented by the Trustees of British Museum.

Taylor, T.—Arbores Mirabiles, presented by the Trustees of British Museum.

Ægineta.—Pharmacia Simplicia, presented by the Trustees of British Museum.

Salm Dyck.—Cactææ, presented by the Trustees of British Museum.

- Turpin.—*Organographie Vegetale*, presented by the Trustees of British Museum.
- Jessen.—*Lebensdauer der Gewächse*, presented by the Trustees of British Museum.
- Gris.—*Recherches Microscopiques sur Chlorophyll*, presented by the Trustees of British Museum.
- Richard, A.—*Elements de Histoire Naturelle Medicale Bot. II, III*, presented by the Trustees of British Museum.
- Kunze, G.—*Index Filicum*, presented by the Trustees of British Museum.
- Baker, J. G.—*Synopsis of Selaginellas*, presented by the Trustees of British Museum.
- Baker, J. G.—*Rhizocarpeæ*, presented by the Trustees of British Museum.
- New Commercial Drugs.—No. 11, presented by the Trustees of British Museum.
- Prain.—*Vegetation of Coco Group*, presented by the Trustees of British Museum.
- Cooke, M. C.—*Index fungorum Britannicæ*, presented by the Trustees of British Museum.
- Preiss.—*Enumeratio Plantarum Australiæ*, presented by the Trustees of British Museum.
- Trelease.—*Structures which favour Cross-fertilization*, presented by the Trustees of British Museum.
- Nordlinger.—*Der Holz-ring*, presented by the Trustees of British Museum.
- Brandel, V.—*Insect-fressende Pflanzen*, presented by the Trustees of British Museum.
- Trelease.—*A yellow Opium-mould*, presented by the Trustees of British Museum.
- Mercklin.—*Prothallium des Farnes*, presented by the Trustees of British Museum.
- Klinge.—*Graminaceæ et Cyperaceæ Wurzeln*, presented by the Trustees of British Museum.
- Gaudichaud.—*Recherches des Vegetaux*, presented by the Trustees of British Museum.
- Bucé.—*Clove Tree in Dominica*, presented by the Trustees of British Museum.
- Dcaisne.—*Maladie des Pommes de Terre*, presented by the Trustees of British Museum.
- Hasskarl.—*Plantæ Javanicæ rariores*, presented by the Trustees of British Museum.
- Munter.—*Krankheiten der Kartoffeln*, presented by the Trustees of British Museum.
- Roemer and Schultes.—*Mantissa*, 1827, presented by the Trustees of British Museum.
- Catalogue of Plants in Hort. Bog. cult*, 1866, presented by the Trustees of British Museum.
- De Vries.—*Protreplicus*, presented by the Trustees of British Museum.
- Dickie.—*Contributions to the Physiology of Fecundation*, presented by the Trustees of British Museum.
- Todaro.—*Cultivated Plants in Palermo Gardens*, presented by the Trustees of British Museum.
- Trimen.—*Herman's Ceylon Herbarium*, presented by the Trustees of British Museum.
- Von Mueller.—*New Papuan Dilleniaceæ*, presented by the Trustees of British Museum.
- Von Mueller.—*New Melastomaceæ*, presented by the Trustees of British Museum.
- Von Mueller.—*New Goodeniaceæ*, presented by the Trustees of British Museum.
- Von Mueller.—*Leguminous Trees*, presented by the Trustees of British Museum.
- Von Mueller.—*Descriptions and Notes on Papuan Plants*, No. VIII, presented by the Trustees of British Museum.
- Martens.—*Algæ of Burma, etc.*, presented by the Trustees of British Museum.
- Milde.—*Index Botrychiorum*, presented by the Trustees of British Museum.
- Fries.—*Symbolæ ad Floram Daliæ*, presented by the Trustees of British Museum.
- Wallich.—*Hedychium*, presented by the Trustees of British Museum.
- Prain.—*Notes on Lokas, a new Chinese dye*, presented by the Trustees of British Museum.
- Ferguson.—*All about Spices*, purchased.
- Index Kewensis*, Vol. 5, purchased.

Statement of Receipts and Expenditure, for the year 1895.

4,512 13

Economic Garden.

10. Considerable improvements have been made in the Economic Gardens. In the lower half the ground was turfed so as to prevent the damage caused by rain wash, which has had a good effect on the trees. Many half dead trees have been removed and a number of new ones planted, especially in the arboretum.

The top of the hill has been partially cleared and planted with cloves, nutmegs, Sisal hemp, tea, coffee and cola-nuts.

Among these is a small lot of the new coffee (*Coffea stenophylla*) a plant spoken very highly of. It is growing steadily and well, and at present does not appear to be affected at all by disease. Plants have been distributed to coffee planters in different parts of the Peninsula for experiment and observation.

There is still a great deal of land lying fallow in this garden, the smallness of the vote hitherto being insufficient to allow of clearing and planting, but as the vote has been increased for 1896 to \$1,500, it is hoped to clear and plant a great deal more of this land. This is all the more necessary now on account of the rapid development of agriculture in the Peninsula and its neighbourhood. Rami, indigo, Para rubber, coca, spices, as well as fruit trees, are in great demand and hitherto the gardens have been unable to supply a sufficient quantity of these and other economics.

The expenditure is as follows:—

	\$	c.
Mandor's Salary, ...	144	00
Coolies' Salary, ...	714	71
Tools and Stores, ...	19	44
Bricks, Cement, etc., ...	43	70
Manure, ...	66	50
Balance, ...	11	65
<hr/>		
Total, ...	\$1,000	00

Revenue.

	\$	c.
Fruit crop, ...	13	00
Grass, ...	15	00
<hr/>		
Total, ...	\$28	00

Inspection of Coco-nut Trees.

11. As the staff of this department was reduced to a single coolie, the amount of work that could be done was not very great, especially as during most of the year there was no assistant to the Officer in charge of the Gardens, so that it was impossible for him to visit the plantations and supervise the work of the coolie.

One hundred and forty-nine (149) notices to destroy trees and stumps were served, and 448 trees and 8 stumps were removed. There were no prosecutions.

The refuse tan bark at Rochor is still being burnt, and in some places the old accumulations have been built on so effectively as to prevent any lodging of the black beetle there. But the red beetle seems to have increased in numbers again in some places, especially in Gélang, and strong measures must be taken to reduce them.

The vote for the year was \$350.

Expenditure:—

	\$	c.
Salary of Coolie, ...	96	00
Transport, ...	27	35
Balance, ...	226	65
<hr/>		
Total, ...	\$350	00

Government House Domain.

12. The Government House grounds were handed over to the charge of the Botanic Gardens in January, after a lapse of 8 years, previous to which they were under the control of the Superintendent of Gardens. They were found to be in a very neglected state, and a great deal of work had to be done in cleaning and planting. The Mandor, MATHIAS, resigned in March, and was replaced by JAMES. The tennis lawn in front of the House was raised, levelled and re-turfed, at a cost of \$52.92, and a piece of ground near the stables was planted with fruit trees and vegetables.

The grass on the grounds was let out for five dollars a month, during the latter half of the year.

Vote,	\$2,360.00
Expenditure :—	
Mandor's Salary, ... \$	180.00
Coolies' Salary, ...	1,959.65
Re-making Tennis Lawn, ...	52.92
Materials and Tools, ...	62.91
Manure, ...	18.25
Miscellaneous Expenses, ...	15.45
Balance, ...	70.82
Total, ...	\$2,360.00

Revenue from grass cutting, ... \$25.00 •

H. N. RIDLEY,
Director.

Botanic Gardens Department, Penang.

The Assistant Superintendent of Forests was absent on leave in England for six months during the year, and in his absence, there being no European Officer of the Department available, the work was carried on by the Overseers of the Government Hill Garden and the Waterfall Garden.

2. In accordance with the retrenchment scheme, the supervision of Forest Reserves in this Settlement was transferred to the Land Office Department on the 1st January, 1895, and a report on their condition and progress will, no doubt, be made by the Collector of Land Revenue.

Waterfall Botanic Garden.

3. This Garden continues to increase in interest and popularity, and the number of visitors from passing steamers, as well as residents, is considerable. It is, in fact, the one place to which strangers are nearly always taken if they have friends in the Island, or are directed to go if they have none.

4. Further progress has been made with sloping and turfing the banks of the stream in places where slips have occurred, or were imminent, and this has absorbed a large proportion of the amount of labour available after the ordinary routine works, such as mowing, weeding, maintenance of roads, watering, &c. had been provided for.

5. A new masonry dam fifty-nine feet wide and eight feet high has been constructed a short distance above the second bridge, and in addition to raising the level of the stream and preventing slips, forms an effective cascade, especially during the rains.

6. One thousand five hundred and seventy (1,570) lineal feet of rough masonry drains have been constructed alongside the steeper portion of the carriage roads where the wash is most destructive.

7. Preparation for re-constructing No. 2 plant-shed with light angle iron was commenced in December by lifting the more valuable plants and removing them to a temporary shed. Material for this purpose, to the amount of \$490, was purchased out of the balance of 1895 vote, and the remainder, or at least as much as can be spared after payment of other liabilities, will be paid out of the current year's vote. This is a rather big undertaking to provide for out of the ordinary Maintenance Vote, but it has to be faced, for until these old wooden plant sheds are replaced by iron, we shall have constant expenses in the matter of repairs.

8. A great number and variety of trees and shrubs have been planted out in beds and clumps, and the general appearance of the grounds and plant-sheds made as attractive as possible.

9. During the early part of the year, there was a good show of orchids in the sheds and of annuals in pots and beds. At the beginning of the rains when the annuals had finished flowering, the beds were filled with *Coleus*, *Dracænas*, and other bright coloured foliage plants.

10. The usual interchange of plants and seeds with various correspondents has been continued, but owing to the absence on leave of the Assistant Superintendent, the numbers distributed by this department were less than they should have been.

11. Plant sales realised \$939.92, which, as in previous years, was paid in to revenue account. These sales represent upwards of four thousand plants, mostly in pots. Ornamental plants are most in demand, but fruit trees and trees for shade form a fair proportion. These plants are sold at low rates, as it is desirable to encourage their cultivation, but the result is that the more plants are sold the less money and labour there is available for the general up-keep of the garden, for pots cost money, and plants cannot be propagated without labour.

12. A large number of interesting and valuable plants has been added during the year, the greater proportion having been selected by the Assistant Superintendent from Botanic Gardens and nurseries while on leave in England, and brought out by him on his return. This selection, which filled eighteen cases and measured over ten tons, was attended to and watered, when necessary, during the voyage, and there is no doubt that this is the surest way of introducing certain plants that travel badly.

13. The thanks of this department are specially due to the Director, Royal Gardens, Kew; to Messrs. F. SANDER & Co., St. Albans; Messrs. JAS. VEITCH & SONS, Chelsea; and Messrs. HUGH LOW & Co., Clapton, for the greater portion of this fine collection.

14. A short trip to the Kinta District of Perak was made during the last ten days of the year for the purpose of collecting living plants and botanical specimens for the herbarium, with satisfactory results. On my return, I submitted a short report on the journey, a copy of which I annex to this report (Appendix B).

15. More room for the accommodation of the herbarium specimens is much needed; for, although the collection is mainly Penang plants, and altogether Malayan, the present Office is much too small for the herbarium as well as Office work.

16. The total expenditure for maintenance of this garden is \$4,484.43 as shown in statement annexed (Appendix A), but if from this is deducted the amount of revenue collected amounting to \$973.32, the actual cost is only \$3,511.11.

Government Hill Gardens.

17. Nothing new of importance has been done in these gardens, the amount of money available for labour being barely sufficient to keep the grounds of Government Bungalow in order and maintain a supply of flowers and vegetables.

18. The grounds of Belle Vue Bungalow badly require attention, but with the present labour staff it is impossible to do this work justice.

19. The Experimental Nursery has been kept clean, and many of the fruit trees look well, though in want of manure. If ever the long-talked of tramway to the top of the hill becomes an accomplished fact, none will derive more benefit than those engaged in gardening pursuits. At present the cost of carrying up any considerable quantity of manure is prohibitive.

Preservation of Coco-nut Trees.

20. The Inspector with the assistance of one Notice Server and one Climber, has been employed alternate months in Penang and Province Wellesley.

21. One thousand four hundred and twenty-five (1,425) notices have been served on persons having on their premises trees, stumps, or rubbish, suitable breeding places for the beetle; and as the result, 3,608 dead trees, 3,856 stumps, and 209 heaps of rubbish have been destroyed.

22. Seventy-nine (79) persons were prosecuted for non-compliance with the notices served on them, and fines inflicted amounting to \$170.

C. CURTIS,

Assistant Superintendent of Forests.

Penang, 18th January, 1896.

APPENDIX A.

Revenue and Expenditure—Botanic Gardens Department, Penang, 1895.

REVENUE.	EXPENDITURE.	AMOUNT.
		\$ c.
	Salaries, ...	3,135 42
	Purchase of Plants and Seeds, ...	126 50
	Purchase of Pots and Tubs, ...	101 47
	Purchase of Tools and Materials, ...	236 61
	Purchase of Lime and Manure, ...	65 70
	Purchase of Planks for Plant Cases, &c., ...	86 36
Grant—Maintenance of Waterfall Garden, ... \$4,500.00	Purchase of Iron for Plant Shed, ...	490 00
	Cartage, ...	45 90
	Freights, ...	81 40
	Periodicals and Books, ...	40 53
	Miscellaneous and Petty Expenses, ...	74 54
	Balance, ...	\$4,484 43
		15 57
		\$4,500 00
Grant—Expenses of carrying out Provisions of Coco-nut Trees Preservation Ordinance, ... \$700.00	Salaries, ...	\$641 80
	Balance, ...	58 20
		\$700 00
Grant—Maintenance of Experimental Nursery, ... \$200.00	Salaries, ...	\$158 70
	Manure, ...	21 00
	Tools, ...	15 94
	Balance, ...	\$195 64
		4 36
		\$200 00
Grant—Travelling and Personal Allowances, ... \$330.00	Pony Allowance (6 months), ...	108 00
	Expenses in connection with collecting Plants in Perak, ...	87 96
	Balance, ...	\$195 96
		134 04
		\$330 00
Plant Sales, ... \$939.92		
Bath Receipts, ... 26.40		
Rents, ... 7.00		
		\$973 32

C. CURTIS,

Assistant Superintendent of Forests.

BOTANIC GARDENS,
Penang, 7th January, 1896.

To

The Hon'ble the Resident Councillor.

SIR,—I have the honour to report that, in accordance with your permission, I proceeded to Perak on the 21st December last, for the purpose of collecting plants for exchange and cultivation in the Botanic Gardens, also botanical specimens for the herbarium and distribution. I arrived at Ipoh, Kinta, at noon on the 22nd, and at once commenced exploring the hills in the vicinity. By the aid of two European residents, who knew the exact localities, I was enabled in a short time to get collected about 2,000 plants of what is locally known as "Kinta Weed" (*Vanda Hookerii*), and a good number of "Tapah Weed" (*Arundina bambusæfolia*); the greater portion of which I purpose sending to England in exchange for plants received and brought out by me on my return from leave in September last.

Near some hot springs between Ipoh and Tanjong Rambutan I obtained several interesting ferns and other plants suitable for pot culture. Also three plants of *Arisæma fimbriata*, a plant not hitherto recorded from the Peninsula, but abundant in the islands to the North of Penang. The water at these springs is so hot in places that it is painful to keep one's hand in it. It is very clear, but without the strong sulphur smell noticeable in some of the hot springs in North Celebes.

On the morning of the 26th, I left Ipoh for Kuala Dipang, leaving the Malay man I took with me from Penang to complete the drying out of the botanical specimens, to pack the living plants and bring the whole direct to Telok Anson by rail to meet me on the 29th, which he did.

On the way from Ipoh to Kuala Dipang I examined the limestone hills at three or four different places, having different aspects, and found several new plants. One of these is a new balsam, the second species I have discovered in this district.

On the 28th December, being the last day of my stay at Kuala Dipang, I went some distance up Gunong Bujong Malacca, to a Sakai clearing, and got one of the men as guide for the day. We did not get very far up the mountain—probably not more than 1,500 feet—for we struck a ravine so exceedingly rich in interesting plants that the two men I had with me were loaded in a couple of hours.

Many of the plants collected were not in flower, but they are of great interest, and undoubtedly new to Gardens if not to botanists.

One of the most interesting is a very distinct begonia with narrow almost lanceolate leaves quite unlike any other species of this genus with which I am acquainted. It is found growing on huge water-worn boulders in damp shady places.

Small graceful palms suitable for pot culture are abundant, both in species and individuals, especially on the dry ridges, but unfortunately only a few seeds were obtainable. This is, I believe, owing to the fact that the monkeys eat them as fast as they ripen. It is very desirable that a more extended examination of the flora of this mountain should be made at the season when the greater number of plants are in flower, if one could ascertain when that is. In Penang, May and June are the best months and probably it is the same on this mountain.

There are Chinese miners working much higher up than the point I reached and, I believe, there is a survey hut on the very top, so that there would be no difficulty in obtaining shelter for a few nights.

I left Kuala Dipang to catch the train at Kampar on the morning of the 29th, intending to return to Penang the same evening, but on arrival at Telok Anson found there was no boat until the following day. This was unfortunate, as had I known in time it would have given me another day in the jungle.

From an agricultural point of view, Kinta is the best district I have seen in Perak, and from what I hear, will before long be a large coffee-growing district. Many other products would do equally well in such rich soil, but the present tendency is all in favour of coffee. Ipoh is a large and flourishing town, very hot in the day time and badly in want of shade trees.

I have, &c.,

C. CURTIS,
Assistant Superintendent of Forests.

ANNUAL REPORT OF THE BOTANIC DEPARTMENT, SINGAPORE. 1896

1. During the greater part of the year, Mr. FOX was absent, returning on November 17th. I visited Penang and the Dindings in March, returning on April 9th, and was away also, in Selangor, from May 9th to June 11th, being engaged in reporting on the forests. During these periods, Mr. J. GOODENOUGH acted for me, and remained as Assistant till July 7th, when he was engaged as Mining Surveyor in Selangor. He was replaced by Mr. MELVILLE, who remained till Mr. FOX's return.

2. The Herbarium-keeper, AHMAT KASSIM, was discharged in August, and J. S. ISAAC took his place. The Upper Garden Mandore, YUSUF, replaced XAVIER as Mandore of the Economic Gardens, and a man named JUMAT was employed in his stead. He proved unsatisfactory and was replaced by one NATHANIEL, who was also quite unsuitable, and on October 15th, ANIFF, who had formerly been employed here, returned from Ceylon and resumed the post. Owing to the demand for coolies for the Native States, it was very difficult to obtain a sufficient supply for the Gardens in the early part of the year, and the high price of provisions and the fact that private employers and other establishments had raised the price of wages, in some cases very considerably, caused much discontent. There was a serious outbreak of beri-beri also in the lines in the spring, but, I am glad to say, only one death.

Not only was the supply of coolies deficient during part of the year, but the class of coolies and mandores obtainable now is very inferior to what it was in previous years, and wages, on the whole, are a little higher. The Javanese watchmen, having proved unsatisfactory this year, were discharged, and Sikhs were taken on in their place, and prove more suitable.

There were a number of petty thefts and a few more serious ones, due chiefly to the action of the Javanese watchmen in collusion with some of the coolies. The worst case was a charge against five soldiers of stealing plants and assaulting the Sikh watchman; one soldier was convicted and sentenced to a term of imprisonment.

Visitors.

3. The number of visitors was quite up to the mark, and the Regimental Band played once or twice a month for part of the year, and was much appreciated.

Aviaries.

4. Some of the houses in the aviaries were repaired or re-constructed. The sheds in the deer-paddocks were closed in with planks, so as to darken them. This was found to relieve the animals very much from the annoyance caused by the flies.

Among the additions to the collections were five common deer, presented by Mr. J. F. CRAIG; one Axis deer, presented by Mr. KIEL; one mias, presented by Mr. G. P. OWEN; three common monkeys, presented by Mr. JELLEY and Mr. E. SCHULTZE; one Wawa (*Hylobates* var.), purchased; two slow Loris, presented by Mr. TRUMMER; one squirrel (*Sciurus bicolor*), presented by His Excellency the Governor; one grey squirrel from Siam, purchased; one wild cat (*Felis planiceps*), purchased; four whistling teal, presented by Mr. A. MAXWELL; two Mandarin ducks (*Aix sponsa*), presented by Mr. HANCOCK; one large python, presented by Mr. ZAVITZ; one monitor, presented by Mr. DENNARD; one large tortoise (*Emys* sp.), captured in the Dindings.

Some common monkeys were born, and another hybrid between *Macacus nemestrinus* and *M. sinicus*, but it died at birth. The black Celebes monkey (*Cynopithecus niger*) was crossed with a male Beruk (*M. Nemestrinus*) but, unfortunately, died in parturition. The female jackal (*Canis aureus*) produced four pups. Three of which grew well and strong, the fourth crept through a drain into the adjacent tiger's cage and was destroyed. The Sumatran heron continued to lay eggs, but none hatched. Among the deaths may be registered an eagle which had been in the Gardens for at

least twenty years, and a mouse deer (*Tragulus Kanchil*) which had been five years in captivity and was evidently very old. Both the remaining black swans on the lake were devoured by a large python, over sixteen feet long, which was eventually killed on the island in the lake.

Plant-houses.

5. The large plant-house underwent considerable repairs and one side, the roof was covered with attaps in place of the laths which were rotten. The orchid-house was finished and proved very successful, and the small fern-house was re-constructed, the tables being built of coral, and the roof made of split bamboo, which seems a very suitable covering for these plants.

Lawns and Beds.

A large portion of the hill near the new lake was cleared of fern, and turfed. New beds for the seedling palms were made at the foot of it, and many palms from the old beds removed there, the old beds being turfed over. The upper part of the new lake was excavated, and the banks raised and strengthened. This work was done by contract, and was rather laborious on account of the large masses of timber found in excavating. The road between the two parts of the lake was also raised. An addition of thirty-five yards was made to the fern rockery, and it was planted with ferns and other plants, and a small enclosure was made for growing roses in tubs. The avenue of Sabal Palmetto near the large lake was badly attacked by palm-weevils, and a number of the trees destroyed.

Among the more interesting plants which flowered here for the first time or have rarely flowered were *Galphimia glauca* (an ornamental shrub), *Citrus decumana* var. (the Bali pumelo), *Acalypha Sanderiana* (New Guinea), *Desmodium tortuosum* (the North American beggar-weed, a fodder plant), *Liparis pectinifera* (a new species from the Dindings), *Thunia Marshalliana* (Burma), *Dendrobium cinnabarinum* (Borneo), *D. inauditum* (Amboina), *Cœlogyne Rumphii* (Amboina), *Habenaria Susannæ* (Timor), *Thaumantococcus Daniellii* (West Africa), *Alpinia vittata* (New Guinea), *Zingiber spectabile* (Selangor), *Amorphophallus Rex* (Sumatra), *Pennisetum macrostachyum* (New Ireland).

Herbarium.

During the year, a considerable number of specimens were added to the herbarium. An extensive collection of plants from the interior of Selangor was made by the plant-collector during my stay there in the early part of the year, and a small number from the same district was sent by Mr. GOODENOUGH. Eighty specimens were received from Mr. CURTIS at Penang, 505 plants from Perak and India, presented by Dr. KING, and a specimen of the wild pumelo from Pahang, presented by Mr. MACHADO.

From Borneo were received a valuable collection of 223 ferns and 17 other plants from the Right Reverend Bishop HOSE, and a number of specimens from Sarawak by Dr. HAVILAND. From Java twenty-four specimens of *Zingiberaceæ*, presented by Dr. TREUB. A collection of mosses from Bonthain Peak, Celebes, was received from Mr. A. EVERETT. A small series of plant from New Guinea and Tenimber from Mr. PEREIRA. A specimen of the bastard teak from Christmas Island from Mr. KEYSER, and *Saccoglottis amazonica* from Mr. HART of Trinidad, and a collection of mixed plants, including Indian grasses named by Sir JOSEPH HOOKER, was received from Kew. A small collection was made by the Director in the Carimon Islands.

The wood specimens were re-arranged, and a number of local species added, together with a specimen of an unknown Sandal wood from the interior of Pahang, presented by Mr. MACHADO, and a remarkable scented wood from Christmas Island, presented by Mr. KEYSER.

The Guttas and India-rubbers were cleaned and re-arranged, and specimens of these and other economic products added to the collection.

The following specimens were sent in exchange to various botanists:—Over fifteen hundred to Dr. KING, Calcutta; 1,290 to the Royal Gardens, Kew; a named collection to Dr. TREUB, Buitenzorg; a small collection to the British Museum; and specimens of medicinal plants to the Pharmaceutical Society. A series of specimens of barks of chestnuts (*Castanopsis*) and mangroves, was sent to Dr. TRIMBLE of Philadelphia, who is experimenting on the tanning properties of these barks.

Library.

The following works have been added to the Library :—

Hand-list of Ferns, presented by the Royal Gardens, Kew.

Hand-list of Orchids, presented by the Royal Gardens, Kew.

Hasskarl.—*Retzia*, presented by the Royal Gardens, Kew.

Taubert.—*Gattung Stenomeris*, presented by the Royal Gardens, Kew.

Von Mueller.—New species of *Pycnarrhena*, presented by the Royal Gardens, Kew.

Von Mueller.—*Rhododendron Carringtoniæ*, presented by the Royal Gardens, Kew.

Baillon.—*Bulletin Mensuelle de la Société Linneene de Paris*, presented by the Royal Gardens, Kew.

Pierre.—*Flore Forestiere de la Cochinchine*, five parts, presented by the Royal Gardens, Kew and Calcutta.

India Museum Notes, presented by the Royal Gardens, Calcutta.

Annals of Calcutta Gardens, V, VI, VII, presented by the Royal Gardens, Calcutta.

Duthie.—Field and Garden Crops, presented by the Royal Gardens, Calcutta.

Duthie.—Indigenous Fodder Grasses, presented by the Royal Gardens, Calcutta.

Duthie.—Fodder Grasses of Northern India, presented by the Royal Gardens, Calcutta.

Agricultural Ledger, presented by the Royal Gardens, Calcutta.

Schlich.—*Manual of Forestry*, Vol. V. presented by the Secretary of State for the Colonies.

Annals de Jardin Botanique de Buitenzorg, presented by Dr. TREUB.

Koorders and Valetton.—*Boomsorten van Java*, Vol. IV, presented by Dr. TREUB.

Trimble.—*Tannins*, Vols. I, II, presented by the author.

Also, Gardens Report and Bulletins from the Gardens of Lagos (complete set), Jamaica, Barbados, Cape Colony, Madras, Ceylon, Michigan Botanic Department, State Agricultural College, U. S. A., Kolonial Museum Haarlem, St. Petersburg; Forest Reports, Punjab and Madras, Kew Bulletin and *Icones Plantarum*, from Kew Gardens.

Purchased :—

Vidal.—*Sinopsis de familias.....lenosas Filipinas*.

Decandolle.—*Prodromus*, Vol. IX.

Lodeman.—*Spraying of Plants*.

Beccari.—*Illustrationes de nuove e rare species Piantas*.

Cesati.—*Mycetum Borneense*.

Beddome.—*Supplement to Ferns of India*:

L. Wray.—*Practical Sugar Planter*.

Papers respecting the Culture of Sugar, East India Company—1822.

Reinwardt, Blume and Nees.—*Hepaticæ Javanicæ*.

Von Mueller.—Sir W. Macgregor's Highland Plants of New Guinea.

A. M. Ferguson.—All about Aloe and Ramie.

Do., All about India-rubber and Getah Percha.

Dr. Watts.—*Index to Dictionary of Economic Products*.

Hooker, Sir J.—*Flora of British India*, last two parts.

Bulletins.

During my stay in Penang, I investigated the cause of the nutmeg disease which was so destructive in 1860 and which was said to have re-appeared. I found it to be due to a small Scolytid beetle, and an account of the disease and others incident to the nutmeg and clove trees was published as a bulletin. Two more bulletins dealing with the cultivation of spices and with Ramie, Para rubber and diseases of coffee, together with an article by Mr. CURTIS on the cultivation of pot plants were prepared, and are in the hands of the printers.

Camphor.

During my stay in Selangor, I visited the camphor woods of Rawang, and obtained specimens of timber, leaves, etc. in order to experiment with them with a view of extracting the camphor, which commands an exceedingly high price. The material I brought being insufficient, the Resident sent down a beam of the wood, on which experiments are still being made at the Laboratory of the Government Analyst. The camphor oil, Borneol, is easily extracted by distillation, but the solid camphor resists, at present, any methods of extraction.

Exchanges.

The following exchanges of plants and seeds have taken place during the year. Five hundred and seventy-seven plants and four hundred and twenty-seven packets of seed. The former comprises a set of the new and beautiful begonias of the Rex type, selected by Mr. FOX and presented by Messrs. SANDER & CO. The same firm also presented a series of new caladiums and seven plants of that most beautiful African genus *Streptocarpus*. It is hoped that by hybridization between this genus and our own, nearly allied, one of *Didymocarpus*, we shall succeed in imparting a vigour to the latter which will enable it to be grown freely on the plains.

Two hundred and fifty-three plants and forty-one packages of seeds were sent out to various Botanic Gardens.

The following contributed to the Gardens :—

The Director, Royal Gardens, Kew.	
Do.,	Botanic Gardens, Calcutta.
Do.,	Do., Ceylon.
Do.,	Do., Buitenzorg.
Do.,	Do., Mauritius.
Do.,	Do., Saigon.
Superintendent,	Do., Brisbane.
Do.,	Do., Japan.
Do.,	Do., Port Darwin.
Do.,	Do., Madras.
Do.,	Do., Grenada.
Do.,	Do., Saharanpur.
Do.,	Do., Trinidad.
Do.,	Do., Lagos.
Do.,	Do., Jamaica.
Do.,	Do., Adelaide.
Do.,	Do., Washington.
Do.,	Horticultural Gardens, Nagpur.
Messrs. Sander & Co., St. Albans.	
" Carter & Co :—	
M. Cornu, Paris.	
Mr. O. Bartels, Brisbane.	
Rt. Rev. Bishop Hose, Sarawak.	
Mr. Pereira, Singapore.	
" Grosman.	
" Micholitz.	
" H. Walker, Sandakan.	
" Dumas.	
" McBain.	

BOTANIC GARDENS, SINGAPORE.

Statement of Receipts and Expenditure, for the year 1896.

RECEIPTS.		EXPENDITURE.			
	\$ c.	<i>Salaries.</i>	\$ c.	\$ c.	
By Balance in Bank, ...	1,435 76	Herbarium-keeper, ...	187 99		
„ Government Grant,	8,500 00	Mandore, ...	149 20		
„ Sale of Plants and		Carpenters, ...	305 97		
Flowers, ...	1,601 68	Masons, ...	175 56		
„ Interest, ...	32 58	Printer, (Label), ...	120 00		
		Plant Collector, ...	120 00		
		Office Peon, ...	96 00		
		Aviary-keeper, ...	96 50		
		Garden Police, ...	361 73		
		Garden Coolies, ...	2,890 91		
		<i>Bills.</i>		4,503 86	
		Tools & Stores, ...	544 48		
		Timber, ...	856 90		
		Lime, Bricks, etc., ...	603 27		
		Pots and Tubs, ...	314 12		
		Birds' & Animals' Food, ...	1,039 53		
		Manure & Cartage, ...	226 30		
		Plants & Seeds, ...	261 71		
		Wardian Cases, ...	146 66		
		Books, Papers, etc., ...	191 65		
		Uniforms for Police and			
		Peon, ...	116 30		
		Freight on Plants, ...	39 58		
		Repairs to Buildings, ...	65 00		
		Subscription to Telephone, ...	97 50		
		Laterite, ...	35 40		
		Petty Expenses, ...	312 04		
		Excavating Lower Lake and			
		raising Road, ...	600 00		
		Miscellaneous, ...	240 78		
				5,691 22	
		Balance, ...		10,195 06	
				1,374 96	
				\$11,570 02	
	\$11,570 02				

Economic Garden.

An additional vote of \$500 enabled much more work to be done here than in previous years. A large amount of ground was cleared of fern and dug over, and partly turfed, especially on the hill facing Dalvey Road where a number of trees were planted chiefly belonging to the orders *Bignoniaceæ*, *Laurinæ*, *Proteaceæ*, *Myristicaceæ* and *Euphorbiaceæ*.

On the top of the main-hill, which was turfed, a collection of *Coniferæ* was planted, and further patches of land were cleared and planted with *Guttiferæ* and *Anacardiaceæ*. In the lower part of the Garden, the ground was cleared, and beds made for different kinds of bananas, vanilla, male bamboo, coca, vegetables, ramie, and Mauritius hemp, for all of which there have been considerable demands, but the year will be always remarkable for the enormous demand for ramie plants, of which a very large number have been supplied to the Native States, Borneo and Sumatra, and, in a less degree, to Singapore. The propagation of this plant occupied a very large share of the labour, as the original stock in the Garden was by no means large, it being a plant seldom asked for till this year. Next to ramie, Para rubber attracted planters, and a very large amount of seed (2,810) and plants were purchased.

A number of planters and others interested in cultivation of economic plants visited the Garden to study the methods of propagation and culture.

Vote, ...	...	...	\$1,500
Expenditure :—			
		\$	c.
Mandore, ...	...	180	00
Coolies, ...	...	909	66
Manure, ...	...	101	50
Materials and Tools, ...	...	132	46
Laterite, ...	...	39	50
Lime and Bricks, ...	...	40	98
Balance in Bank, ...	...	95	90
Total, ...	...	\$1,500	00

Inspection of Coco-nut Trees.

As mentioned in last year's Report, the red beetle increased enormously, owing to the reduction of the staff to one coolie, so that it was imperative to add an Inspector, and in May, AHMAT BIN HAJI OMAR was appointed.

Three hundred and sixty-six notices were served on persons who had dead or dying trees or rubbish, likely to serve as breeding grounds for beetles. One thousand two hundred and sixty trees, and two thousand two hundred and ninety stumps, and twenty-five piles of rubbish and cow dung destroyed. There were thirty-two prosecutions for non-compliance with the notices, and fines amounting to \$95 were inflicted.

The vote for the year was, ...	\$350.00
Expenditure :—	
Salaries, ...	\$189.29
Transport, ...	71.23
Removing trees, ...	39.55
Miscellaneous—Uniform etc., ...	9.20
Balance, ...	40.73
	\$350.00

Government House Domain.

During the year, twenty-six coolies and the mandore JAMES were employed on the Domain. One of the lawns was dug up and entirely re-turfed with Doub-grass (*Cynodon*). The plant-houses were entirely re-roofed and brick pillars built to support the staging. One hundred and fifty new tubs and pots were purchased, and most of the plants re-potted. An additional piece of ground was prepared and planted with vegetables. The great extent of grass which constantly requires cutting takes up most of the coolies' time, sixteen men being usually employed on this work.

Vote, ...	\$2,360
Expenditure :—	
Mandore's Salary, ...	180 00
Coolies, ...	1,896 66
Re-making Tennis Lawn, ...	63 90
Materials and Tools, ...	147 75
Manure, ...	60 11
Miscellaneous, ...	3 20
	<hr/>
	\$2,351 62
Balance, ...	8 38
	<hr/>
	\$2,360 00

Revenue :—

Sale of grass, ... \$ 50 00

H. N. RIDLEY,
*Director.***Botanic Gardens Department, Penang.**

The only change of Officers during the year was the promotion of Mr. D'SILVA, Inspector of Coco-nut Trees, to the post of Forest Ranger in the Dindings. Mr. K. BALHETCHET succeeded Mr. D'SILVA in the month of August.

Waterfall Garden.

2. The most important work of the year has been the erection of a new iron plant-shed, 84 feet long by 60 feet broad and 16 feet 6 inches high in the centre, on the site of the old No. 2 shed. A portion of the material for this work was purchased in 1895, as mentioned in my Report for that year, and the remainder has been paid in 1896; the work of erection being done entirely by the Garden Carpenter and Coolies. The supports are steel rails set in 3 feet of concrete, and the roof of bent angle iron in 2 spans of 30 feet each, covered with bertam chicks. The interior is entirely of rock-work planted up largely with local plants, tree ferns being an important feature. Much interest is shown in this shed, and the question as to the cost often asked by residents in the Colony with a view to copying it on a smaller scale. Altogether the material cost \$910, and I calculate that, to erect a similar shed and construct the rock-work, in or near town, the cost would be almost equal to that of the material. All the stone required here was obtained in the Garden, and cartage cost very little. This attraction and permanent addition to the Garden has been made without any increase to the grant for maintenance, but necessarily some other works have had to remain in abeyance.

3. The fernery, which was in a bad state of repair, having originally been constructed of material that was used for the Agricultural Show, had to be temporarily renewed, partly with wood, as funds would not admit of it being done in iron this year. In doing this, however, we used old, but substantial iron water pipes for the supports and set them firmly in concrete so that on the next occasion light T iron can easily be substituted for the present wood-work without interfering with the beds, and without involving much labour or expense.

4. Minor repairs were done to the other plant-sheds; and this must continue to be an annually recurrent item of expenditure, involving a good deal of labour and damage to plants so long as wood structures are used in this climate.

5. In the palm shed, the front stage, 129 feet long, has been built of rough stonework in lieu of the old wooden one, and this about terminates the use of wood stages for pot plants in this Garden.

6. The longest bridge across the main stream at the top of the grounds, 48 feet long, built in 1888, is in need of renewal. Some new timbers have been put in so as to keep it open to traffic for another year, if possible, but it is important that provision be made for this work in the Estimates for 1898, as it is a matter that cannot be done out of the ordinary maintenance vote. I hope that, as in the case of the two smaller bridges, already done, lower down the stream, it will be re-constructed of iron this time.

7. A great deal of work has been done at odd times, as labour could be spared, towards filling in and raising the ground in the pot plant nursery, and thus increasing the area which is much too restricted for the increased work, as there is no other suitable site available.

8. A further portion of the river bank has been sloped and turfed, roads repaired, trees and shrubs planted, lawns mowed, &c. as found necessary.

9. Plants and seeds in considerable numbers have been exchanged with various Botanical and Horticultural establishments, and with private individuals. Plants to the value of \$792.75 were sold and the amount paid into revenue account.

10. A matter of some interest to the planting community is the raising of a pretty large batch of Borneo sugar canes from seed. The seeds were sown early in November and germinated in five days. They were pricked off when from a month to six weeks old in a mixture of leaf-mould and sand in equal parts, and many of them are now (January 14th) over 6 inches high. There are in all over 3,000 plants. Subsequent sowings of other varieties under exactly the same conditions proved a failure, probably because the seeds had not been collected at the right stage, but I do not despair of succeeding with the others as well. Cane seeds would appear to retain their vitality only a very short time, for a second sowing of Borneo cane from the same lot of seeds as the first which came up so well, after an interval of only a fortnight, did not produce a single plant.

11. Ramie, to which considerable attention is being directed at present, has been distributed in small numbers, and a stock is being worked up with a view to meeting the demand which is almost certain to spring up within the next few months. Unfortunately the area of land at my disposal, suitable for this work, is very limited, being confined to the small Nursery at the Chitty Temple. In the Waterfall Garden there is hardly a square yard of level land and the soil is besides unsuitable for nursery work.

12. At the request of the Director, and to meet the growing demand for information by amateurs in the Settlement, a paper on the cultivation of plants in pots has been prepared which will be published in the Agricultural Bulletin of the Malay Peninsula.

13. Two short botanical excursions for the purpose of collecting both living plants and herbarium specimens were undertaken during the year, one to the Langkawi Islands in the month of April, and the other to the Siamese Malay State of Kasum in November. During these trips, I was enabled to add considerably to the number of plants cultivated in the Garden, and to the botanical knowledge of the regions visited.

A short account of the latter trip was furnished to the Hon'ble Resident Councillor on my return, a copy of which is annexed (Appendix B).

14. The total expenditure in connection with the Waterfall Garden amount to \$4,485.87, and the revenue collected from sale of plants, &c. to \$839.95, as shown in Appendix A annexed.

Government Hill Gardens.

15. 1896 proved an exceptionally wet year, the rainfall on Government Hill being a little over 150 inches, consequently a large amount of labour was expended in repairs to paths in the grounds of Government Bungalow. A number of roses, grafted in the Waterfall Garden, were planted out to replace the old ones that were worn out, and are growing vigorously.

A pretty regular supply of vegetables has been kept up, but it is a matter of some difficulty to grow much during the wet weather. From November to March is the best season for growing vegetables, but the cost of transport of manure, and the limited area of ground available, prevents cultivation on any considerable scale. Potatoes planted in October ripened a fair crop in seventy days, but several were diseased.

Table maize, which is deserving of much more attention than it gets in this country, as it grows in the plain just as well as on the hill, was ready for use in 60 days. Indian saved seed proved better than American.

16. Levelling and turfing the site for the tennis court at the new Convalescent Bungalow has been completed, but much requires to be done to these grounds in the way of planting, &c. when there is money available for carrying up manure.

17. The experimental nursery has been kept clean and some of the more important fruit trees manured, but beyond this, little could be done on the money available.

Preservation of Coco-nut Trees.

18. The Inspector of Coco-nut Trees was employed half the year in Penang and the other half in Province Wellesley under the direction of the District Officers. Two thousand and twenty-one (2,021) notices were served on persons having on their premises dead trees or heaps of rubbish likely to prove suitable breeding places for beetles, calling on them to destroy the same within a specified time. Sixty-four (64) of these persons were summoned for failing to comply, and of this number, 57 were fined in small amounts aggregating \$99.

General.

19. I must again refer to the need of more office space, or a separate building for herbarium specimens. The present two rooms are too small for both purposes.

C. CURTIS,

Assistant Superintendent of Botanic Gardens.

APPENDIX A.

Revenue and Expenditure—Botanic Gardens Department, Penang, 1896.

REVENUE.	EXPENDITURE.	AMOUNT.
		\$ c.
	Salaries of Gardeners and Coolies,...	3,182 62
	Purchase of Plants and Seeds, ...	80 96
	Do. Pots and Tubs, ...	62 69
	Do. Tools and Materials, ...	302 80
	Do. Lime and Bricks, ...	26 79
	Do. Planks for Cases &c., ...	48 29
	Do. Material to complete Iron Plant Shed, ...	420 13
Grant—Maintenance of Waterfall Garden, ... \$4,500.00	Do. Material to renew Nursery, ...	66 14
	Do. Material to repair Bridges, ...	96 79
	Do. Periodicals, ...	9 25
	Cartage and Manure, ...	58 19
	Miscellaneous Petty Expenses, ...	88 79
	Freight on Plant Cases, ...	42 43
		4,485 87
	Balance, ...	14 43
		\$4,500 00
	Salaries, ...	165 37
Grant—Maintenance of Experimental Nursery, ... \$200.00	Purchase of Seeds and Manure, ...	31 68
		197 05
	Balance, ...	2 95
		\$200 00
Grant—Expenses of carrying out Provisions of Coco-nut Trees Preservation Ordinance, ... \$700.00	Salaries, ...	647 29
	Balance, ...	52 71
		\$700 00
	Pony Allowance, ...	216 00
Grant—Travelling and Personal Allowances, ... \$330.00	Expenses in connection with Botanical Tours, ...	112 40
		328 40
	Balance, ...	1 60
		\$330 00
Plant Sales, ... \$792.75		
Bath Receipts, ... 47.20		
Total Revenue, ... \$839.95	Total Expenditure,	\$5,658 61

C. CURTIS.

Assistant Superintendent of Botanic Gardens.

APPENDIX B.

BOTANIC GARDENS,
Penang, 7th December, 1896.

To

The Hon'ble the Resident Councillor.

SIR,—Regarding the botanical tour recently made in the Siamese Malay States, on which I promised to report as soon as I had potted up the plants and attended to other matters requiring immediate attention, I have the honour to submit the following:—

I left Penang in the S.S. *Petrel*, which is at present the only steamer trading between this port and Tongkah, on the afternoon of the 9th November, and arrived there the following day, the voyage occupying about 23 hours. There was very heavy rain during the night on the way up, and I began to fear that I had undertaken the trip too early in the season, but fortunately my fears proved to be groundless for I had fairly dry weather all the fortnight I was away. On arrival in Tongkah, I called on Prah NANISON, the Acting Chief Commissioner, expecting to get the use of the steam-launch to go to Kasum, but unfortunately the launch, like pretty well everything else in all the places I visited, is sadly out of repair and cannot be used. He, however, kindly offered me the loan of a boat, and promised to have it ready the following morning, and also furnished me with letters to the Governors of Kasum and Pongah. At this season the wind is unfavourable for getting from Tongkah to the places I wished to visit, and unfortunately the mast of the Commissioner's best boat snapped at the foot before we had been an hour under sail, so that we had a long row into Pulau Sirih for repairs, where we remained all night.

On the second day we tacked about without making much progress until 5 P.M. when we landed on Pulau Panjang to do some cooking, and while this was being done I collected a few plants. *Cirrhopetalum medusæ* appeared to be abundant on rocks in this island. At 6.30 P.M. started again with a fresh breeze standing straight across for the picturesque islands near the entrance to the Kasum River under shelter of one of which, Pulau Prabat, we anchored until 5 A.M., when we got under way again. At 7 A.M. landed on a small island to cook and collect plants; the most interesting kinds found here being two species of begonia and two of pogonia, the native name of one of the latter being "elephant ear." From this place we proceeded slowly against wind and tide to Kasum which was reached between 3 and 4 P.M., so that I had actually been about 49 hours from Tongkah.

The scenery among the islands before entering the Kasum River is magnificent. Scores of islands of the most fantastic forms rising abruptly from the sea to a height of several hundred feet. Similar scenery may be seen in Langkawi, but on a much reduced scale. On arrival in Kasum I sent my letters of introduction to the Governor with a request for an empty house if possible. In a short time I received a message that the Governor was suffering from fever and would not be able to see me for two or three days, but a house was being prepared for me. This was the one decent looking house in the village originally intended, I was told, for a Post Office, but as soon as the men commenced clearing it out it was found to be unsafe, so I had to go into a Chinese attap house in the main and only street. For a place of its size, and it is a village of about 100 houses, and perhaps 700-800 inhabitants, Kasum is the most miserable looking place I ever set eyes on. The main street is overgrown with weeds and in places knee deep in mud. On either side are tall bamboo leaning at all angles with the remnants of banners dangling in the breeze, the remains of the decorations of some religious festival long past. The houses are of plank and attaps with very sharply pitched roof and a sort of covered five-foot way in front, but it is only in places that one can cross from one side of the street to the other without sticking in the mud. A few days' residence in this place has a most depressing effect. The morning after arrival, I collected orchids, &c. along a road that was commenced 3 or 4 years ago and cut for a distance of about 4 miles to a place called Wattam where there is a Bhuddist Temple in a cave in the limestone rock with numerous figures rapidly going to decay. One of the figures in a reclining position is about 45 feet long. I spent some time in botanizing on this hill and collected several interesting plants. One of the priests showed me a plant of *Dendrobium Farmerii* fastened on a block of wood which he assured me was very rare, and, so far as my experience goes, it is so, for I only collected two plants of it during the time I was there.

When the road to this place was commenced it was intended to carry it on to Pongah and fine hard-wood beams were brought in for bridging the streams and posts for telegraph wires. The wires were never put up and the beams are lying alongside the streams rotting.

On the second day, the Governor sent me a man who spoke Malay to accompany me anywhere I wished to go and to assist me generally. Two days I went down the river to the limestone hills, and on another day walked across to Pongah and slept there, returning by another route the following day. The distance I estimate to be about 10 or 12 miles. Pongah is not so nice a place as it was in the old Raja's time, things are fast going to decay. The road from the landing which he planted up with shade trees and kept in good order is now almost impassable in places, and the building in which I stayed on a previous visit and was most hospitably entertained leaks like a sieve, and as it rained the night I was there it was difficult to find a dry spot. It is interesting to note that several natives have a few orchids growing around their houses and one has quite an interesting little collection and this, they told me, was the result of my previous visit. *Dendrobium Farmerii* is evidently the kind they prize most, and shows good taste on their part, but it is scarce, and they set a value on them that prevented me from buying. This is abundant in Mergui, and Pongah is apparently about its southern limit. One very interesting *dendrobium* I saw in a garden which I was most anxious to get, but the owner would not part; he, however, gave some flowers to dry which will, I hope, be sufficient for determination, but I have little doubt it is an undescribed species. On the limestone islands I collected a great number of interesting and some, I believe, perfectly new plants, among the latter being a ginger, balsam, and arum.

Many plants were observed that it was quite impossible to get at, but, on the whole, I made a very satisfactory collection. The ginger which I believe to be new and of which I only saw a single flower, although it had been flowering freely not long previously grows in the chinks of the hardest rocks where it is impossible to get at the roots without blasting them out. I saw hundreds but only succeeded in getting about half-a-dozen, three of which I have sent to Kew. Of the balsam I dried a good series of specimens, and collected a nice lot of seeds, and of the arum tubers.

In one place I saw enormous clumps of *cyrtopodium*, but quite out of reach, and also a small growing *ærides* (*Ærides affine*). For miles round Kasum the virgin forest have all been destroyed by the paddy planters, and the present vegetation is composed largely of bamboos, of which, three or four species are so abundant that they may be said to be the prevailing feature of the vegetation on all the low hills. In spite of this great destruction of forest, only sufficient rice for local consumption is produced, and the present price is about the same as in Penang. Fowls are abundant and cheap costing only 6 or 7 cents each; but then these do not require much labour to raise.

A lazier lot of men it would be difficult to find, and the only thing that really livens them up is a cock-fight, then the village turns up like one man. Before going across to Pongah, I asked the Governor of Kasum to lend me a boat to return to Tongkah, but he said he had no suitable boat and that he always went in one of the Chinese tongkangs that come for fire-wood. He promised to arrange for me to go back in the same way, but when the time for starting came, the Chinaman said he had not enough wood yet, but perhaps he might go to-morrow or next day. To remain another day meant probably missing the *Petrel* and having to remain a week in Tongkah, so I begged them to find me a *prau* of some sort, which they eventually did, and we got away on the ebb tide about 2 P.M. At about 7 P.M. we stopped at one of the islands for the men to eat, and they were inclined to stay there all night, but we got them on board and hoisted sail to a fair wind; one of the two men I took from Penang steering, and the other looking after the sail. None of the three men I got from Kasum were boatmen, and they did not understand sailing a boat. By 3 A.M. we had rounded Pulau Sirih, and were in sight of the Tongkah light, so that in returning with a fair wind, we did in 13 hours what it took 49 to do in going.

It was fortunate it did not rain either in going or returning, for we had no cover, not even a *kajang*. I had a whole day to spare in Tongkah, but there is not much to collect there unless one had time to go back to the wooded hills. There is no more sign of advancement here than in any of the other places. Everyone says that the population is diminishing rapidly. For every Chinaman that goes into Tongkah three or four come away.

I have, &c.,

C. CURTIS,

Assistant Superintendent of Botanic Gardens.

STRAITS SETTLEMENTS

ANNUAL REPORT

ON THE

BOTANIC GARDENS

FOR THE YEAR

1897

BY

H. N. RIDLEY, Esq.

Director



PUBLISHED BY AUTHORITY

SINGAPORE :

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1898

1899

ANNUAL REPORT OF THE BOTANICAL GARDENS, SINGAPORE.

The only changes in the staff during the year were the replacement of YUSUF, the Mandore of the Economic Gardens, by a man named JOSEPH, on account of the illness of the former; and the resignation of the Plant-collector MAT, who had been employed in the Gardens and Forests Departments for nine years.

2. The coolies worked well, and a sufficient supply was easily obtainable. There were a few cases of petty thefts, and four prosecutions, fines amounting to \$36 being inflicted.

3. One new plant-house was built on the site of the old seed-house. It is a span-roofed house, of three spans, partly covered with glass and partly with split bamboo. It is sixty feet in length and thirty-six wide. This house has proved remarkably successful, being very suitable for begonias, aroids and ferns, and specially so for raising ferns from spores. The large plant-house, in which a great deal of the wood-work is rotten, has been partly renewed. In two of the aisles the wood-work has been replaced by iron rods and arches, which will be covered with chicks. The remaining aisles will be done in 1898. To put the whole building in a proper state of repair will be a very expensive business, for which the Garden funds are not sufficient, so that it will have to be done piecemeal. The alcove of arches covered with creepers leading from the bandstand hill towards the plant-sheds was removed, and the sides of the walk lined with rock work, which was planted with various ornamental plants.

Flower-show.

4. A flower-show was held at the Town Hall in May, which was well attended, and the plants exhibited were on the whole up to the standard.

Bulletins.

5. Two bulletins were published this year. One dealing with spices, and the other with Para rubber, coffee diseases, pot-plants and other subjects.

6. Among the more interesting plants which flowered in the Gardens for the first time were:—*Capparis frondosa*, *Garcinia Hanburyi*, *Zizyphus xylophyllus*, *Erythroxylon ovatum*, *Bauhinia strychnoidea*, *Bertholletia excelsa* (the Brazil nut), *Derris sinuata*, *Eugenia* (new species from the West Indies), *Mezoneuron sumatranum*, *Didymocarpus cyaneus* (n. sp.), *Saintpaulia ionantha*, *Strophanthus hispidus*, *Landolphia Heudelotii*, *Dichopsis gutta* (Gutta percha), *Balanostreblus ilicifolius*, *Coccoloba uvifera*, *Bougainvillea Sanderiana*, *Ficus maculata*, *Alpinia comosa*, n. sp. from Kedah, *Zingiber citrinum* (n. sp. Selangor), *Phrynium Jagorianum*, *Tainia plicata*, *Zeuxine clandestina*, and *Pancratium tortuosum*; and *Pandanus Houlletianus* produced fruit, which was previously unknown.

The most noteworthy ornamental foliage plants introduced this year include a very fine series of begonias from SANDERS, *Elatostemma vittatum*, and other ornamental species from Buitenzorg, *Kaempferia calophylla*, a new species from Selangor, and *Colocasia gigantea* (Selangor.)

Aviaries.

7. The aviaries were entirely reconstructed, the old wood-work wherever possible being replaced in iron. Among the additions to the collections were two wild pigs (*Sus cristatus*) presented by Mr. FERNANDEZ; one brush-tailed porcupine (*Atherura macrura*) presented by the Director; one wild cat (*Felis bengalensis*) presented by Mr. GOEDHARDT; two grey squirrels (*Sciurus* sp.) purchased; one phalanger presented by Mr. HALL; one bear (*Helarctos malayanus*), from Borneo, presented by Mr. E. MAXWELL; a kanchil (*Tragulus kanchil*) presented by Mr. MORTON; one peacock (*Pavo muticus*) presented; four Chinese coots (*Porphyrio* sp.); 2 hornbills (*Buceros* sp.) purchased; four Borneo Argus pheasants presented by Mr. Bruderer; one black swan presented; two large pythons (*Python reticulatus*), about 20 feet long, presented by the Sultan of Johore; two black and yellow snakes (*Dipsadomorphus*) captured; two crocodiles purchased; one terrapin (*Cyclemys platynota*) presented by Mr. S. FLOWER. One hybrid monkey between *M. nemes-trinus* and *M. cynomolgus*, and one kijang (*Cervulus muntjac*) were born in the Gardens.

11/90

Exchanges.

8. The following were the exchanges of plants and seeds during the year. Five hundred plants and one hundred and nineteen packets of seeds were sent to various cultivators and Botanic Gardens, and eight hundred and sixty-six plants and three hundred and eight packets of seeds were received.

The following contributed to the Gardens:—

Mr. Burckhardt.
 „ Micholitz.
 „ R. Little.
 „ Grossmann.
 „ Goedhardt.
 „ E. M. Holmes.
 „ A. D. Machado.
 „ Damman & Co.
 Dr. Smit.
 „ Dohrn.
 Mr. Pereira.
 Bishop Hose.
 Lieut Kelsall.
 Mr. R. Schlechter.
 „ J. H. Osmond.
 Mrs. Pennefather.
 Mr. Choa Kim Keat.

Dr. Ellis.
 Mr. St. V. B. Down.
 Messrs. Sanders & Co.
 Botanic Gardens, Kew.
 Do., Calcutta.
 Do., Buitenzorg.
 Do., Saigon.
 Do., Tokio.
 Do., Nagpur.
 Do., British Guiana.
 Do., Sydney.
 Do., Brisbane.
 Do., Durban.
 Do., Jamaica.
 Do., Trinidad.
 Do., Barbadoes.

Herbarium.

9. A small collection of plants was obtained in the Langkawi Islands in the dry season, and while on leave I obtained a number of plants in Selangor near the Batu Caves and along the Pahang track, and also in Sumatra on the Mandau River near Siak, and in Borneo at Labuan, Kudat, Sandakan and Labuk Bay. One hundred and ten plants from the Malay Peninsula were sent by Dr. KING. Forty-seven specimens of Scitamineæ of the Malay Islands were presented by Dr. KOORDERS. A number of specimens from Borneo were sent by Dr. DENNYS. Specimens of plants and timbers from Christmas Island were presented by Mr. LEACH; and specimens of dried plants from Java by Lieut. HARVEY, R. E. A collection of European plants was received in exchange from M. RICHTER.

Five hundred and thirty-three specimens of Malay plants were sent to Dr. KING and a small collection of orchid specimens to Mr. SCHLECHTER of Cape Town. Specimens were also sent to the Pharmaceutical Society and the Natural History Museum and to the Royal Gardens, Kew.

A number of wood specimens, chiefly from Singapore, were added to the wood collection, and a new cabinet made for their reception.

Library.

10. During the year, a catalogue of the library was printed, and a new book-case was purchased.

The following are the additions to the library:—

Catalogue of Welwitsch's Angolan Plants, presented by Director, Natural History Museum.

Jenman.—Minor Agricultural Industries of British Guiana, presented by the Author.

Dyer.—Notes on Mycorrhiza, presented by the Author.

Mathieu.—Estimate of the Cost, etc. of a Ramie Plantation, presented by the Author.

Wildeman.—Prodrome de la Flore Algologique, presented by the Author.

Mercklin.—Beobachtung an den Prothallium, presented by the Author.

Harms.—Die Nomenclatur bewegung, presented by the Author.

Coville.—Notes on the Plants used by the Klamath Indians, presented by U. S. A. Department of Agriculture.

Webber.—The Water Hyacinth, presented by U. S. A. Department of Agriculture.

Dodge.—Descriptive List of Fibre Plants, presented by U. S. A. Department of Agriculture.

Dodge.—Report on the Culture of Jute and Hemp, presented by the Author.
 King.—Materials for the Flora of the Malay Peninsula, Parts 8 and 9, presented by the Author.

„ New Indian Trees, presented by the Author.

„ Indian Species of Vitis, presented by the Author.

King and Pantling.—New Orchids from Sikkim, presented by the Authors.

New Hand-list of Tender Monocotyledons, presented by the Director, Kew.

Massee.—Monograph of Geoglosseæ, presented by the Author.

Christy.—New Commercial Drugs, presented by the Author.

Boorsma.—Mededeeling, Part XVIII, presented by the Author.

Bijlert.—Onderzoek eenige Groondsorten van Deli, presented by the Author.

Also the Reports of the United States Department of Agriculture, India Museum Reports, Record of the Botanical Survey of India, India Museum Notes, Agricultural Ledger, Annals of the Botanic Gardens, Buitenzorg; and Bulletins and Annual Reports from the Botanic Gardens of Kew, Ceylon, Lagos, Trinidad, Jamaica, Cape of Good Hope, Natal, Brisbane, Guiana, Sierra Leone, West Australia, Mysore, Madras, Queensland, Barbadoes, St. Lucia; and the Koloniaal Museum, Haarlem.

The following works were purchased :—

Currey.—Fungi of Pegu.

Mitten.—Musti Indiæ Orientalis.

Clarke.—Indian Begonias.

Hanbury.—Cassia moschata.

Hooker.—Balanophoreæ.

Miers.—Barringtoniaceæ.

Eeden.—Hoot-sorten.

Stapf.—Flora of Mount Kinabalu.

Hart.—Cacao.

Collins.—On the Collection of India-rubber.

Seeligmann.—Le Caoutchouc.

Notaris.—Épatiche de Borneo (2 papers).

La Coste.—Musci Archipelagi Indici.

„ Synopsis Hepaticarum Javanicarum.

Hampe.—Musci Frondosi of Ceylon and Borneo.

Dozy and Molkenboer.—Musci Archipelagi Indici.

Baker.—Handbook of Amaryllideæ.

Sawer.—Odorographia.

Ward, H. M.—Timber and some of its Diseases.

Warburg.—Die Muskat Nuss.

Tubeuf.—Diseases of Plants.

BOTANIC GARDENS, SINGAPORE.

Statement of Receipts and Expenditure, for the year 1897.

RECEIPTS.		EXPENDITURE.			
	\$ c.		\$ c.	\$ c.	
By Balance in Bank, ...	1,374 96	<i>Salaries.</i>			
„ Government Grant,	8,500 00	Herbarium-keeper, ...	187 50		
„ Sale of Plants, Seeds		Mandore, ...	229 00		
and Flowers, ...	2,901 95	Carpenters (two), ...	311 50		
„ Interest, ...	27 29	Mason, ...	140 82		
		Plant-collector, ...	110 00		
		Printer (Label), ...	120 00		
		Peon, ...	96 00		
		Aviary-keeper, ...	94 34		
		Police, ...	346 99		
		Coolies, ...	3,634 01		
				5,270 16	
		<i>Bills.</i>			
		Tools and Stores, ...	557 93		
		Laterite, Sand, etc., ...	200 00		
		Timber, Lime, Bricks, etc., ...	925 58		
		Pots and Tubs, ...	251 73		
		Birds' and Animals' Food, ...	1,236 53		
		Manure and Cartage, ...	157 12		
		Buildings (Aviary and Plant-			
		house), ...	1,221 71		
		Freight on Plants, ...	155 26		
		Books, Papers, etc., ...	578 92		
		Garden Seats, ...	150 00		
		Plants and Seeds, ...	270 49		
		Subscription to Telephone, ...	97 50		
		Wardian Cases, etc., ...	163 60		
		Petty Expenses, ...	308 47		
		Miscellaneous, ...	437 71		
		Rice Allowance, ...	116 50		
				6,829 05.	
		Balance, ...	...	12,099 21	
				704 99	
				\$12,804 20	
	\$12,804 20				

Economic Garden.

A considerable part of the hill in this Garden was cleared, dug and planted with grass, and some fresh land was opened in the swampy portion near the ramie beds, but the greatest amount of labour was expended in clearing the scrub around the Para-rubber trees. This had grown up so high as to make it impossible to find the seeds of the trees, which fell among it.

The demand for plants and seeds of Para rubber was greatly in excess of the supply, but 21,035 plants and 10,875 seeds were supplied to planters in Singapore, Selangor, Malacca, Pahang, British Borneo and elsewhere. Various experiments were made as to methods of propagation, tapping and yield of rubber, the results of which have been published in a Bulletin on the subject. A large number of planters and others interested in the cultivation of this plant from different parts of the Peninsula, Java, Sumatra and Borneo visited the Garden to see the rubber trees and the various methods of cultivation and preparation of the rubber.

The demand for ramie, which was very large last year and at the beginning of this, fell off considerably, as rubber came into favour. This is partly at least due to the low price offered by manufacturers for the ribbons. Nearly four thousand plants and a few boxes of seed were disposed of.

Experiments were made also with *Curculigo recurvata*, the "Lumbah" of the Malays. It is a well known ornamental plant belonging to the order *Hypoxidæ*, and supplies from its leaves a fibre of considerable value used by the Dyaks. The plant grows easily, but it remains to be seen whether the yield of fibre per acre will be enough to recommend its cultivation.

Over a hundred plants of gutta-percha from Sumatra were planted out for experiment. Among the economic plants of importance introduced this year, *Kickxia Africana*, the African tree rubber, occupies the first place. It had been received on one or two previous occasions, but always dead: the plants received this time were in grand condition. From the same establishment came also *Landolphia senegalensis*, one of the African rubber vines. It appears that the *Landolphias* are stouter growing plants than our *Willughbeias* and *Melodinus*, and will probably be more satisfactory to cultivate, so that an additional species is welcome.

Pentadesma butyracea (*Guttiferæ*), the butter and tallow tree of Sierra Leone, was also obtained from Kew. It produces a valuable oil.

The new green aloe, *Furcroya macrophylla*, a good fibre plant, was received from Barbados, and *Lahia kutejensis*, the Borneo durian, which is stated to possess the full flavour of *Durio zibethinus* without its odour, was received from the Botanic Gardens, Buitenzorg.

Upkeep of Economic Garden.

Vote,	\$1,500.00
Salaries of Mandore and Coolies,	\$1,330.83
Attaps, Baskets, &c.,	43.74
Tools, &c.,	67.96
Flower-pots,	35.00
Manure,	17.50
Balance in Treasury,	4.97
Total,	<u>\$1,500.00</u>

Inspection of Coco-nut Trees.

Three hundred notices were served on persons who had dead or dying trees or piles of rubbish. One thousand five hundred and seventy-five dead trees and two hundred and sixty-nine stumps and thirty heaps of rubbish and cow-dung were destroyed. There were only nine prosecutions, and fines amounting to \$21 were inflicted.

The vote for the year was \$350.00

Expenditure :—

Salaries,	\$240.00
Transport,	92.74
Uniforms, &c.,	5.05
Balance,	12.21

Total, \$350.00

Government House Domain.

The Mandore JAMES left in the early part of the year, and ANIFF, Mandore of the Botanic Gardens, took his place till a man named SAMUEL was employed. The Javanese coolies behaved very ill in the first part of the year, and finally ran away. Two were summoned and fined, the others could not be found. After this, Klings were employed for grass-cutting, and Javanese for pots and house work. A lawn in front of the house was re-made entirely, being raised and re-turfed. Some beds for Vandas and Renantheras were made, and the whole of the East side and part of the West side of the park was fenced in.

Vote, \$2,360.00

Expenditure :—

Salaries,	... \$2,005.19
Tools,	... 182.85
Attaps, Rollers, etc.,	32.63
Planks, etc.,	24.62
Manure,	47.48
Flower-pots,	25.82
Tubs, ...	24.00
Balance,	17.41

Total, ... \$2,360.00

H. N. RIDLEY,
Director.

Singapore, 25th January, 1898.

Botanic Gardens Department, Penang, 1897.

Visitors to the Waterfall Garden have been more numerous than in any previous year, particularly those with an especial interest in matters horticultural and botanical. Among the number was His Majesty the King of Siam, who was very pleased with the Garden, and selected a number of plants for cultivation in Bangkok. The Director and Curator of the Buitenzorg Gardens, the Superintendent of the Hongkong Gardens, and the Curator of the Calcutta Gardens were also among the strangers that visited us, and made selections of plants.

Personal visits and letters from gentlemen interested in planting matters, requesting information, mainly respecting rubbers and ramie, have been numerous, and much time has been taken up with purchasers of plants.

2. An interesting addition to the Garden is a glass case at the West end of the Fernery, with soft granite boulders inside, on which are planted a collection of filmy ferns (*Trichomanes* and *Hymenophyllum*). During the Jubilee holidays, which I spent on the Perak hills, several species which do not occur in Penang were collected and brought back in good condition, and, although coming from an altitude of 3,000-4,000 feet, they are all, with the exception of *Trichomanes maxima*, making satisfactory growth. Among the rocks on which these are growing are planted *Bertolonias*, *Sonerilas*, and other small-growing *Melastomaceæ*, which can only be grown to perfection in the moist atmosphere of a glass case.

3. The octagonal plant-shed, in which there is a good collection of specimen foliage plants in pots and tubs, has been re-covered with nibong laths instead of clicks; and the potting-shed, which was in a bad state of repairs has been roofed with corrugated iron. Minor repairs were also done to the wood-work and coverings of the other plant-sheds.

4. One thousand and eight lineal feet of carriage road have been re-metalled with stones obtained in the course of cutting down a bank to raise the ground in the pot-plant nursery.

5. Considerable improvements in the grounds have been effected by continuing the sloping and turfing the banks of the stream near the entrance gate, and also just below the second bridge. Eight new beds have also been formed, and planted with cannas, roses, and flowering shrubs; and a number of large palms and other things that had outgrown the space available in the plant-sheds have been planted in various parts of the Garden.

6. Owing to the unusually heavy rainfall (175 inches), the maintenance of roads and paths has been an important labour item, and for the same reason it has also been an unfavourable season for a great number of flowering plants. Cannas, which are grown in large masses, have, however, been very fine during the whole year. Their principal requirements being an abundance of water and manure, the past season has suited them admirably.

7. The area of land in connection with this Garden available for experimental agricultural work is too limited to admit of work being done on a sufficiently large scale.

8. The seedling sugar-canes mentioned in my last annual report have made satisfactory progress, but, owing to want of suitable ground in which to plant them, the greater number, when about a foot high, were handed over to the Managers of the Caledonia and Prye Sugar Estates. Unfortunately the weather set in dry soon after those at Prye were planted, and a great many died.

Of those planted out in the Nursery here—about 600 plants in all—there were very few losses, and the growth has been rapid.

The first lot of 300 plants were planted out on the 15th February, that is, when just three months and ten days old.

In August, 2,000 canes, from ten to fourteen feet high, were cut from this lot for further trial on the estates to which the seedlings were sent. About fifty stools of those judged to be the most promising and showing the greatest amount of variation were allowed to remain for the purpose of obtaining seed, but up to the present, and they are now almost a year planted, there are no signs of flowers. The seeds were all from a purple cane, known here as the "Borneo," but the progeny are of various colours, a good number being green ones. Scarcely one is exactly typical "Borneo," although, as regards foliage, all bear more or less evidence of their parentage. Fuller details are given in a paper which will appear in the next Agricultural Bulletin.

9. In order to test practically the time required to grow a crop of ramie from seed, a sowing was made on the 12th February, on a carefully prepared bed of light soil with protection from sun and rain. The seeds were covered very lightly, and, considering the quantity sown did not germinate freely. On the 2nd March the young plants were from four to six inches high, and at the end of that month they were planted out in beds two feet apart. The first cutting was made in the middle of August, or just exactly six months from the time the seeds were sown. Two months later they were ready to be cut again, and with an adequate supply of manure and water this may be taken as the average time (*i. e.*, every two months) at which cuttings may be made.

We have in cultivation three very distinct varieties, but none of them produce in our soil clean long stems, unless liberally manured. The conclusion I have come to is that ramie will have to be cultivated as highly as sugar-cane, and that the idea that it can be grown as a paying crop on poor land unsuited for anything else is entirely wrong. Selection of the right variety is also a point to which intending planters should pay particular attention.

10. The soil of this Garden is by no means the kind that I should choose for planting Para rubber, as it is dry and gravelly, but there are a few trees here that were planted in 1886. The largest of these has a girth of about thirty-six inches at three feet from the ground, and as many inquiries were received respecting the quantity of rubber to be obtained from a tree, &c., this one was tapped as an experiment in June. The first day's collection yielded only half an ounce, but by renewing the cuts on seven subsequent occasions, one pound of dry rubber was obtained, being an average of two ounces for each time. This is very poor, compared with the results obtained in Singapore and in Perak, but, as I have already mentioned, the tree is growing in unsuitable soil, and the weather was at the time very wet. The climate appears to suit this tree, and the only important item of expenditure after a plantation is once established is the cost of collecting.

Many applications for seeds were received, but our whole crop consisted of about six hundred seeds only.

Seeds should be planted as soon as ripe, as they retain their vitality for only about a fortnight. If planted as soon as ripe, they germinate in about 12-14 days. An attempt to propagate this tree from cutting was not a success.

11. Plants and seeds in about the same proportion and numbers as in previous years have been exchanged with the various Botanic Gardens and Societies with which we are in correspondence, but the number of pot-plants sold is greater than in any previous year, the total receipts from this source being \$916.96, which has been paid into Revenue account.

12. Provision having been made in the Estimates 1898 for an additional room for keeping herbarium specimens, a large number, that had been accumulating for years, have been mounted, and as soon as the room is ready will be systematically arranged so as to be readily available for reference.

13. A short botanical tour of three days' duration for the purpose of collecting living plants was made in the company of the Director to the Langkawi Islands in February; and in May I attended the Singapore Flower Show and obtained a good many desirable additions to the collection already in cultivation.

14. The total expenditure in connection with the maintenance of the Waterfall Garden, as shown in statement annexed, is \$4,498.11, and the receipts from sale of plants and use of swimming bath to \$974.76, showing an actual cost of \$3,523.35.

Hill Experimental Nursery.

15. Nothing of importance has been done in the Experimental Nursery, and it is not intended in future to spend much on it beyond keeping the fruit trees, &c. clean. None of the European fruits introduced are likely to be of any commercial value in this country, unless the olive should do so, which is still doubtful. Peaches, apples, and figs have been produced, but not in sufficient numbers to warrant any further expenditure in this direction. The terracing of every foot of land required, and the cost of carrying up manure renders it undesirable to plant anything here that can be grown equally well elsewhere.

Two men are employed here during four days in the week, the remainder of their time being employed in keeping in order the grounds of Convallescent Bungalow.

Government Hill Bungalow.

16. The unusually heavy rainfall on the hill of 175.85 inches, which is, I believe, an unique record for Penang, was, during a great portion of the year, unfavourable for the cultivation of both vegetables and flowering plants. Some difficulty was also experienced in the matter of labour, four out of six men accustomed to garden work having left at one time to take up employment on the railway in the Native States, on higher pay.

17. A small but fairly constant supply of vegetables was kept up during the whole year, a few native kinds being grown during the heavier rains. The European kinds planted were:—Beet, lettuce, cabbage, carrot, turnip, Khol rabi, leek, parsley, endive, cucumber, onion, peas, beans and celery. Some of these were of little account from July to October, but cabbage grown from cuttings did well in all weathers. A paper on the cultivation of vegetables in Penang has been written for the next Agricultural Bulletin.

18. Annuals and other flowering plants have been grown in variety in both pots and beds, but the show of flowers has not been so good as in drier seasons. Dahlias, salvias, begonias and coreopsis made a bright show in beds, and both *Lilium longiflorum*, and carnation marguerite promise to make a good show later on.

19. A number of young roses have been put in as the old stock was getting worn out. Tea and China roses are the only ones that are really satisfactory in this climate.

20. Orchids, of which considerable numbers do not grow satisfactorily in the Waterfall Garden, have been sent up and planted on the *Dacrydium* trees bordering the paths in the bungalow gardens at an altitude of 2,500 feet. Several species that cannot be got to exist for more than a few months on the plains have taken a firm hold of the trees and in some cases have already flowered.

About a dozen plants of *Vanda cœrulea* flowered in August and September, and one plant of *Vanda kimballiana*, a species that does not grow well on the plains. *Vanda tricolor* is growing well, and as the climatic conditions are very similar to those under which they are found growing in Java, I have hopes that they will eventually spread themselves over the hills.

Dendrobium aureum, *D. Jamesianum*, and *D. Cambridgeanum* have been most floriferous, all from growths made since they were fastened to the trees. Others, such as *D. nobile*, and *D. densiflorum*, of which there are several dozens of plants, will probably flower later on if we get a spell of dry weather. This season I shall add a good number of *D. Devorianum*, *D. Wardianum*, *D. crassinode* and others obtained during a recent trip to Burma, and which are now flowering in the Waterfall Garden, to the collection on the hill.

Through the kindness of correspondents in Burma, I have obtained a considerable number of Shan States and other orchids, and although most of them are small plants, not quite good enough for sending to Europe, they do very well for the purpose of finding out their suitability to the climate.

21. The plant-shed in which palms, ferns and foliage plants generally have for some time been grown for decorating the corridor, &c., has been removed to a spot alongside the Overseer's Quarters, where it will be more constantly under his eye, and also nearer a water supply in dry weather.

Preservation of Coco-nut Trees.

22. The Inspector of Coco-nut Trees has been employed during alternate months in Penang and Province Wellesley. Two thousand six hundred and forty-eight notices were served on persons having on their premises dead trees, manure, or other material in which beetles breed, calling on them to destroy the same within a specified time. For non-compliance, fifty-two were summoned and fined in small amounts, aggregating \$134.

When in Province Wellesley, this Officer works under the direction of the Senior District Officer, who directs his attention to the localities most needing attention, and signs the notices.

C. CURTIS,

Assistant Superintendent of Botanic Gardens.

APPENDIX A.

Revenue and Expenditure of the Botanic Gardens Department, Penang, 1897.

REVENUE.	EXPENDITURE.	AMOUNT.
		\$ c.
	Salaries of Gardeners and Coolies,...	3,373 44
	Purchase of Plants and Seeds, ...	93 22
	Do. Pots and Tubs, ...	105 35
	Do. Tools and Materials for current repairs, ...	494 03
	Do. Materials for re-roofing Potting Shed, ...	137 67
	Do. Material for Herbarium, ...	53 00
	Do. New Hand Cart, ...	16 50
	Do. Manure and Cartage, ...	100 39
	Freight on Plant Cases, ...	10 00
	Subscriptions and Periodicals, ...	14 79
	Miscellaneous and Petty Expenses,...	79 92
	Road Metal, ...	19 80
		4,498 11
	Balance, ...	1 89
		\$4,500 00
	Salaries, ...	159 16
	Manure, ...	15 16
	Miscellaneous, ...	24 30
		198 62
	Balance, ...	1 38
		\$200 00
	Salaries, ...	662 00
	Balance, ...	38 00
		\$700 00
	Pony Allowance, ...	222 00
	Personal Allowances, ...	64 46
	Passage Money, ...	30 00
		316 46
	Balance, ...	13 54
		\$330 00
Plant Sales, ... \$916.96		
Bath Receipts, ... 57.80		
Total Revenue, ... \$974.76	Total Expenditure, .	\$5,675 19

C. CURTIS,

Assistant Superintendent of Botanic Gardens.

STRAITS SETTLEMENTS

REPORTS

ON

FOREST RESERVES

SINGAPORE, PENANG AND MALACCA

FOR THE YEAR

1898

PUBLISHED BY AUTHORITY



SINGAPORE :

PRINTED AT THE GOVERNMENT PRINTING OFFICE

1899

REPORT ON THE FOREST RESERVES, SINGAPORE, FOR THE YEAR 1898.

1. There is little or no material for a report on the condition of the Forest Reserves in Singapore in 1898.

2. In former years there has been a certain amount of Revenue derived directly from them, chiefly from Bakau passes and permits for wood of other kinds, but the issue of these having, for the better protection of the Reserves, been stopped, there is now no revenue obtained from them.

3. Since these Reserves passed from the control of the Gardens Department into that of the Land Office, no money has been voted for their improvement, with I believe the natural result that any improvement which may have taken place in them has been simply due to natural growth and time. When under the Gardens Department, various experiments were tried in them, such as the planting of Para rubber in Sembawang, and of *jambu hutan* and other similar trees along some of the Reserve paths. Comprising as they now do large areas of la'ang and small valueless brushwood, it is a matter for regret that it is not thought advisable to try whether good could not be done by a small expenditure on planting of trees of some value as timber and on thinning the brushwood where there is a natural growth of some of the less worthless trees. There would, however, for many years be no perceptible difference in the Reserves and for many more years no return at all for the expenditure, while the consensus of opinion as to the extreme poorness of Singapore soil leaves it open to suggest that timber of commercial value might never be produced on it.

4. The total expenditure on the Reserves has amounted during the year in question to \$1,158.50 incurred merely in payment of the salaries, etc. of the Corporals and Forest Guards detailed to protect them as far as possible from encroachment and fire. Item by item* this amount was spent on 1 Corporal at \$9 a month, 2 Lance Corporals at \$8 each a month, and 7 Forest Guards at \$7 each a month. The salaries of these men are small and their chance of increases of pay no larger, while the temptation to look with a blind eye on illicit wood-cutting must be great, if any substantial (to them) *douceur* is offered by the offenders. I am of opinion that these men should at least be put with regard to periodic increments on the same footing as various other members of the subordinate staff, (peons, etc.) who have neither the same opportunities for, nor temptations to, dishonesty. I do not suggest that there has been a custom of yielding to temptation, but I am certain that only through very great vigilance on the part of the Collector and Forest Rangers and a combination of bad luck and recklessness on the part of the Guards could there be detection of connivance in illicit cutting on Coast reserves such as part of Kranji, Morai, and Tuas, etc.

5. The acreage reserved in the three Divisions of the island amounted to 1,241 acres, 1 rood, 24 poles, but this is not an exact figure, the area of part of the Seletar Reserve not being accurately known as yet. More than two-thirds of this were under the direct supervision of Forest Ranger NONIS, while the remaining third was divided between Forest Rangers RAPPa and RODRIGUES. The Forest Guards, as before, made report to them and they passed on their reports to the Collector—a somewhat round about system which has now been changed for the Malacca one of monthly written reports presented to the Collector of Land Revenue by the Guards themselves, but the same supervision by the Forest Rangers continues. I append the tabulated statements of the Forest Rangers named, showing in detail the condition of the Reserves in their charge (A B C).

6. Fires took place in the Jurong and Chan Chu Kang Reserves, but no convictions could be obtained. It will always (except in cases where incendiaries are caught

* Salaries ...	...	\$888.00
Rice Allowance ...	...	120.00
Uniforms, &c. ...	...	75.50
New Boat ...	...	75.00
		\$1,158.50

in the act) be hard to ascertain the origin of these Fires, but they are variously attributed to the negligence of road coolies or ordinary foot passengers (who smoke and drop matches, etc. about), to the desire of local shikaries and cattle-owners to provide food (fresh lalang sprouts and young grass) for the animals in which they are interested, and to the carelessness of coolies engaged in burning jungle or refuse with the wind blowing (and taking sparks with it) direct towards the Reserves.

7. The Collector himself paid 21 visits to the reserves during the year. The paths were in good order and no traces of illicit cutting were observed.

8. In the earlier paragraphs of this report I wrote somewhat disparagingly of the value of these Reserves. They will however eventually—when the Singapore-Kranji Railway is built—save Government from expending in the purchase of wood fuel very considerable sums. The large expanses of Bakau at Kranji, Morai, Tuas, Pandan and Seletar should, if the unreserved Bakau fails, prove with judicious management practically inexhaustible.

9. I did not take charge of the Land Office, Singapore, till the last day of 1898, and it is therefore with some diffidence that I sign this report dealing with the condition of the Reserves in a year when I had so little official connection with them:

W. L. CARTER,

Acting Collector of Land Revenue.

LAND OFFICE,
Singapore, 22nd August, 1899.

A.—Western Division.

No.	Reserve.	Area.	Nature of Jungle.	No. of Inspections made by Forest Ranger during the year 1898.	
1 †	Bukit Timah Forest Reserve ...	<i>a. r. p.</i> 847 0 00	Mostly big jungle	10 inspections	Total area: 3,584 <i>a.</i> 1 <i>r.</i> 35 <i>p.</i> Three men in charge—Quarters behind Bukit Timah Police Station. One Sampan in order and sails complete. Kept at Kampong Ayer Terjun.
2 *	Jurong Forest Reserve	412 0 16	Little jungle mostly swamp & lalang	22	
3	Pandan do. ...	2,140 3 '06	Do. ...	20	
4	Ulu Pandan do. ...	4 3 09	Jungle on hill top	4	
5	Bukit Panjang Forest Reserve ...	117 2 16	All lalang and swamp with very little jungle	4	
6	10th mile post Bukit Timah Road (do).	13 0 28	Jungle on hill top	5	
7	Chan Chu Kang Forest Reserve ...	49 0 00	Swampy jungle	11	
8	Toas Forest Reserve	1,601 3 32	Bakau, jungle and lalang	8	
9	S. Morai do. ...	314 1 05	Do. ...	4	
10	S. Buloh do. ...	770 2 16	Do. ...	1	
11	Kranji do. ...	756 0 32	Do. ...	20	Total area; 4906 <i>a.</i> 3 <i>r.</i> 11 <i>p.</i> Three men in charge. Quarters at 14th M. P. Kranji Road. One Sampan in order and sails complete. Kept behind Forest quarters Kranji (river).
12	Sembawang do. ...	1,046 3 38	Jungle & lalang	8	
13	Mandai do. ...	407 0 32	Do. ...	8	
14	13th mile post Kranji Road (do).	9 2 16	Do. ...	20	
		8,491 1 06	Total, ...	145 inspections	

† Three arrests were made during this year for wood-cutting at Bukit Timah Forest Reserve. Total fines \$24.

* There was only one case of fire during the year 1898 and this was at Jurong Forest Reserve where 5 acres of lalang land were destroyed.

B.—Eastern Division.

No.	Reserve.	Nature of Jungle.	Area.	No. of Inspections made by Forest Ranger during the year 1898.	No. of Bakau licences issued during the year 1898.	No. of licences issued for other wood during the year 1898.	No. of Arrests made during the year 1898.
1	Changi Reserve ...	Big jungle, Bakau, Brushwood, and Lalang ...	<i>a. r. p.</i> 1,393 0 00	27	...	...	...

Remarks.—Forest Station on the 12th mile Changi Road.
Two men in charge.
One boat for inspection of rivers and mangrove swamps.
There was no case of fire during the year.

C.—Northern Division.

No.	Reserve.	Nature of Jungle.	Area.	No. of Inspections made during the year 1898.	No. of Arrests made during the year 1898.	Remarks.
1	Seletar Reserve	Jungle, lalang and bakau ...	<i>a. r. p.</i> 1,492 1 08	11	...	Two men in charge. Quarters at 8½ mile post, Thompson Road. A boat is kept at Sungei Seletar.
2	Chan Chu Kang Reserve ...	Jungle and lalang ...	813 3 08	7	...	
3	Ang Mo Kio Reserve	Jungle and lalang ...	296 0 02	8	...	
4	Sempang Reserve ...	Jungle ...	5 0 00	5	...	
Total ...			2,607 0 18	31	...	

There was a fire in August in the Chan Chu Kang Reserve where 30 acres of lalang and brushwood were burnt. The cause of this fire was discovered and one SOH KAH was summoned for mischief by fire. Case was dismissed owing to insufficient evidence from witness. The extension of Seletar Reserve was surveyed but not calculated. Acreage not known.

11/97

REPORTS ON THE FOREST RESERVES IN THE SETTLEMENT OF
PENANG, FOR THE YEAR 1898.

North-East District, Penang.

STATEMENT OF AREAS.

					<i>a.</i>	<i>r.</i>	<i>p.</i>
D. Government Hill,	Lot 34 ¹	Mukim 15	}		5,185	0	32
"	" 134	" 17					
E. Highlands,	" 1	" 16			252	2	36
F. Penara Bukit,	" 32	" 14			233	2	31
I. Part of Relau Hills, 60 ¹ and 60 ¹¹	"	13			18	3	32

[Relau Reserve was proclaimed by Government Notification No. 249 of 1899.]

1. Two Forest Guards, and two coolies have been employed throughout the year in clearing the boundaries and looking out for illicit timber cutting and encroachments.

2. The boundary of the whole of the Penara Bukit block was re-opened early in the year. This was, in parts, a work of considerable difficulty, as some pieces of the line had totally disappeared.

3. The boundary from Penara Bukit down to Batu Feringgi has also been re-opened. This line had also disappeared in parts, and had to be re-opened by a Surveyor. Much of this work was very slow and laborious, the boundary being often lost in a dense growth of fern which it was no easy matter to remove. I am told that the boundary which runs up the valley under the Western Hill, below the coffee plantation, had never been cleared since it was originally laid.

4. The boundary from Batu Feringgi to Tanjong Bunga is not yet altogether cleared, but will be finished during the month. From Tanjong Bunga to the Hill Road, below the Half-Way House, the line required very little clearing. From the Half-Way House to Penara Bukit, the boundary has been cleared when necessary during the year, and is now completely open.

5. The boundary of the highlands reserve required no clearing.

6. During some months of the year very little work could be done, owing to bad weather, and to the coolies suffering from fever. The men were also much hampered by the distance of their quarters at Penara Bukit from their work; but I have now obtained permission to build a hut near Batu Feringgi where the men can in future sleep while working in the neighbourhood. Another small house should be built near the road below the Half-Way House for the same purpose. There used to be a Forest Guard's house near the coolie-lines at the Half-Way House, but the proximity of the coolies rendered the place uninhabitable, and it has long been abandoned.

7. There were 15 cases, mostly trifling, of wood-cutting in the Reserves, in 13 of which the offenders were convicted and fined. There were no encroachments.

8. The attached Table will show the expenditure on the Reserves in the North-East District.

9. The Revenue is of course nil, as all cutting is now absolutely prohibited, and there have been no planting operations.

10. I inspected the different parts of the boundaries on the following dates, besides paying numerous visits to other parts of the Reserves:—

Penara Bukit Reserve.

Upper Half, March 19th, June 18th and 24th.

Lower Half, October 25th.

Government Hill Reserve.

From Penara Bukit to Half-Way House. November 3rd and 15th.

Half-Way House to Tanjong Bunga. December 6th.

Tanjong Bunga to Batu Feringgi. December 2nd and 16th.

Batu Feringgi to Western Hill. November 20th.

Western Hill to Batu Itam. November 19th.

Batu Itam to Penara Bukit. December 30th.

Highlands Reserve boundary. May 13th.

11. A new Reserve on the tops of the Relau Hills has been created during the year. The boundaries of this block have not been opened yet, as the vote would not have stood the extra expense last year, but they will be taken in hand as soon as possible.

G. A. HALL,
Acting Collector of Land Revenue.

Expenditure on Forest Reserves, during 1898.

Salaries of Forest Guards,	\$192.00
Maintenance of Forest Reserves, (includes wages of 2 coolies, • purchase of tools &c.),	196.54
Total, ...	<u>\$388.54</u>

South-West District, Penang.

STATEMENT OF AREAS.

				<i>a.</i>	<i>r.</i>	<i>p.</i>
A.	Pantai Acheh, Lot	132	...	3,208	0	08
B.	Telok Bahang, ..	174	...	465	2	30
C.	" "	181	...	380	1	36
G.	Genting Hill, ..	247	...	21	2	14
H.	{ Passer Panjang Hill, 27 }		...	201	2	04
	{ Bukit Gemuruh, 190 }		...			

SIR,—I have the honour to report as follows on the Forest Reserves of this District, and the "Forest operations" carried on in 1898.

2. During the year under review, the number of Reserves has been increased by the establishment of a new one on Balik Pulau Hills, as recommended in Land ⁹⁵⁰₉₈. As directed in that paper, Mr. RIDLEY, the Director of Botanical Gardens, visited this tract of jungle with me on 29th June, 1898, and, his report being favourable, steps have since been taken to reserve the land in question. It will, however, I think, require re-survey and re-demarcation, as my Forest Staff are unable to find the correct boundary between this District and Mukim Paya Terubong in North-West District. I think also that it would be as well to publish a notice in the Gov-

ernment Gazette proclaiming this area reserved. The path round this new Reserve has not yet been cleared, partly because the Forest Staff have been too busily engaged in clearing the other paths, and partly owing to the fact that the correct boundary is not yet clearly defined. I have visited the Reserve at various points on 29th June, 1898, (with Mr. RIDLEY,) and again on 17th September, 1898, 23rd September, 1898, and 17th November, 1898. I have found no recent traces of timber-cutting therein. The Hill in question is, in fact, so close to the village of Balik Pulau that I do not anticipate that there will be any great difficulty in guarding against trespass in this Reserve, since wood-stealers will hardly dare to carry on their operations practically within sound of the District Office, and in momentary danger of being discovered.

3. The other Reserves have been patrolled regularly by the Staff during the year and, by myself, on the dates given below:—

Forest Reserve *A*, Pantai Acheh.—On 26th June, 1898, 8th July, 1898, and 10th December, 1898.

Forest Reserve *B*, Bukit Laksamana.—On 23rd January, 1898, with the Hon'ble Resident Councillor, and on 17th February, 1898, 7th October, 1898, and 19th November, 1898.

Forest Reserve *C*, Telok Bahang.—On 25th June, 1898.

Forest Reserve *G*, Ginting Hills.—On 11th February, 1898, 3rd November, 1898, and 3rd December, 1898.

Forest Reserve *H*, Pasir Panjang and Bukit Gemuruh.—On 8th May, 1898, 10th June, 1898, 26th July, 1898, 11th September, 1898, 3rd November, 1898, and 3rd December, 1898.

4. The work of clearing the paths has been going on continuously throughout the year, but I have been unable to get right round the Pantai Acheh Reserve, about $1\frac{1}{2}$ miles of path on the South-East being unpassable until late in December, when I had no time to visit the Reserve. This was not in any way the fault of the Forest Guards. They cleared the whole path during the year, but as they began on the South, that portion grew up again during the year and had to be re-opened. I have, however, visited the Reserve in question at various points in the neighbourhood of Pantai Acheh Village Site, when there is the greatest risk of trespass, and am glad to say that there are far fewer traces of wood-stealing than in former years. The apparently regularly used paths leading into this Reserve which I mentioned in my report for 1897 have been blocked, and none of the fences put up have been removed. It would seem therefore that the Chinamen of this village site are beginning to realize the fact that the Reserve in question is to be kept inviolate and that any trespass upon it will be severely punished. They have in consequence confined their attentions to the Crown Land in the neighbourhood. As this Reserve is the most important one in the District, I have had it more closely watched than the others whose comparatively inaccessible positions preclude any extensive wood-stealing from them, and the result has been on the whole satisfactory.

5. I attach a list of the number of cases of illicit timber cutting in the Reserves brought before me during the year. There were only six cases, and though I would not say that no other theft of wood has taken place in the Reserves, I think that this list accounts for the majority of the cases of trespass during the year. At any rate, in my visits to each Reserve, I have been able to discover no further traces of the removal of timber, and I have been round all the boundaries with the exception of a small strip of path on the boundary of Forest Reserve *A*.

6. The remarkable increase also in the number of passes taken out for cutting wood in Crown Land goes far, I think, to shew, that less timber has been removed illegitimately. The sum recovered under this head in 1898 was \$906.03, as compared with \$563.62 in 1896, and \$594.45 in 1897. I know of no reason for the use of more wood during 1898 by the people of this District, and I think, therefore, that some of the increase represents the value of wood which would have been stolen under other circumstances. The Forest Ranger and his Staff have worked very well throughout the year and as they have been continually visiting the various Reserves, they have made extensive wood-stealing unsafe if not impossible.

7. The work of clearing the boundaries has been an arduous one for the Staff, the rapid overgrowth having necessitated a second clearing of the majority of the paths at the end of the year, and it is unfortunate that their other work renders it impossible for the Forest Guards to do more actual guarding. There are in this District two Forest Guards, and two coolies engaged in clearing. They are all permanently stationed as before in Telok Bahang, the more important Reserves in this District being situated in the North-West of the island. They pay occasional sur-

prise visits to the Reserves in the South of the island, but are engaged most of their time in the neighbourhood of Telok Bahang. The greater part of the remaining Crown Land lies in this direction, and the time of one of the Forest Guards is almost entirely occupied in inspecting passes for wood-cutting on Crown Land and in examining the wood cut, to make sure that it is not in excess of that provided for in the pass. I fear that the new Reserve on Balik Pulau Hills will still further occupy their time in clearing, and that they will thus have less leisure than before for what is their proper duty, *i.e.*, patrolling and guarding the Reserves. If more coolies could be engaged for the necessary work of clearing the paths, the Forest Guards would be able to devote themselves exclusively to patrolling the Reserves. Unfortunately, however, there is no money available for the engagement of other coolies, and the Forest Guards have to do both duties as best they can. I think that at least one extra coolie should be employed for clearing the Forest Reserve boundaries in 1899.

M. S. H. McARTHUR,
Acting District Officer.

Cases of Illicit Timber-cutting in Forest Reserves.

Case No.	Name.	Forest Reserve.	Conviction.	Remarks.
D. C. 38/98.	{ 1. Secunder ... 2. Jamsah ... }	C.	Imprisonment.	{ 1. 4 months' R. I. 2. 3 weeks' R. I.
" 40/98.	{ 1. Peechay ... 2. Towshy ... }	A.	...	Cautioned & discharged. [ed.]
" 173/98.	{ 1. Tin Ah Ngi ... 2. Leong Ah Ham }	H.	Fine.	Fined \$5 each.
" 187/98.	Loh Ah Ngim ...	H.	Fine.	\$50 fined.
S. C. 72.	Lim Aw Foon ...	H.	Fine.	\$25 and cost.
S. C. 104.	Low Ah Yin ...	H.	Fine.	\$50 and cost.

Northern District, P. W.

1. There are two Forest Reserves in this District, one at Tassek Glugor and the other at Ara Kuda, the former is 3,055 acres in extent, and the latter 562 acres.

2. I took over the duties of Senior District Officer only at the end of November, so that I have not had time except just to visit them, but the Forest Ranger has visited them on an average about once a week, and there is one Forest Guard who lives close at hand and looks after both of them.

3. Two lalang fires took place in Tassek Glugor Reserve during the year but no timber was burnt. The fires are supposed to have originated by passers along the road by the Reserve carelessly throwing away matches, but no one was caught. No fire took place in the Ara Kuda Reserve.

4. There are very few valuable timber trees in the Reserves and no planting has been attempted. * * * * *

6. There were no prosecutions during the year for illicit timber cutting or other offences in the Reserves.

W. C. MICHELL,
Senior District Officer.

Central District, P. W.

1. The Forest Reserves in the Central District as notified in the *Government Gazette* of 5th June, 1896, are five in number, viz. :—

	<i>a.</i>	<i>r.</i>	<i>p.</i>
1. Bukit Seraya, Lots 679 and 680, Mukim XVII ...	112	0	04
2. Bukit Mertajam, Lot 815, Mukim XVII ...	162	2	01
3. Juru Hill, Lots 542 and 454, Mukim XII ...	525	0	10
4. Bukit Gajah Mati, Lot 637, Mukim XVI ...	6	1	16
" " 638 " ...	5	1	00
" " 654 " ...	70	2	37
5. Kubang Ulu Experimental Gardens, Lot 394 " , Mukim XX ...	3	2	03

To these has since been added—

6. Bukit Goa Ipoh, Lot 410, Mukim XX ...	341	0	02
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2. The Reserves were visited by the Forest Ranger and Assistant Forest Ranger, forty times during the year. I visited the Bukit Mertajam, Juru, and Bukit Seraya Reserves three times each, and Gajah Mati once. The Experimental Gardens at Kubang Ulu (a small plot of land by the road side) and the Goa Ipoh Reserve were visited at frequent intervals both by myself and the Forest Rangers.

3. In six cases, prosecutions were instituted for unlawful cutting of timber, chiefly in the Juru Reserve. Only two of these cases were of any importance. In one of them a Chinese Towkay of Bukit Tambun had taken out a timber pass to cut wood on unreserved land and had begun operations in an out of the way part of the Juru Reserve. He was convicted and fined the maximum penalty of \$100.

4. Juru Reserve is the only one in which there is any danger of illicit timber cutting. It is much larger than the others and there is more valuable timber in it. It is, moreover, possible to cut and remove timber from it without much difficulty. The other Reserves being for the most part merely the crowns of steep hills whose lower slopes are fully cultivated, it is impossible to cut timber in them without immediate detection, or to remove the timber when cut without great difficulty.

5. In the early part of the year, before the minute of His Honour the Officer Administering the Government forbidding all timber passes in the Forest Reserves was received, three passes for timber in the Juru Reserve were issued to the Public Works Department in connection with the building of the Bukit Minyak Bridge. No other passes have been issued since.

6. The boundaries of the Reserve have been fairly kept clean by the owners of the adjacent lands.

7. The Experimental Gardens at Kubang Ulu were visited also by Mr. CURTIS of the Penang Gardens. There are many trees of mahogany growing there, with some teak, rubber and eucalyptus trees. The planting is much too close and the trees, which have now attained a fair size, are likely to be choked for want of breathing space. As it stands, and unless some use is to be made of the young trees, the Reserve is merely ornamental.

8. Bukit Goa Ipoh Reserve includes a large extent of waste land at the foot of the hill, at present covered with lalang. Frequent fires during the dry season help the growth of the lalang by preventing forest trees from taking root and growing. I received many applications for land in this Reserve, all of which had to be refused. The utility of reserving this land is rather doubtful.

F. J. HALLIFAX,
District Officer.

Southern District, P. W.

STATEMENT OF AREAS.

	<i>a.</i>
Bukit Panchor	1,500

SIR,—I have the honour to report on the Forest Reserve in the Southern District in 1898.

1. The Forest Reserve has remained untouched during 1898. No cases of timber cutting have been discovered.

* * * * *

3. The Reserve has been watched throughout the year by a Forest Guard. It has been visited regularly by the Forest Ranger.

4. The District Officer paid two visits to the Reserve during the year.

5. No fires occurred during 1898.

6. No planting operations were undertaken.

7. No applications for timber were received.

R. J. FARRER,
District Officer.

The Dindings.

STATEMENT OF AREAS.

					<i>a.</i>
1.	Lumut	...	...	...	900
2.	Pangkor	...	...	...	1,250
3.	Tanjong Hantu	...	...	...	400
4.	Gunong Tunggal	...	...	...	700
5.	{ Bukit Segari	...	...	...	1,600
	{ Telok Sera	...	...	...
6.	Tanjong Burong	...	...	...	450

The Reserves have been regularly patrolled and the boundaries periodically cleared during the year.

No fires occurred and no cases of timber cutting or theft of jungle produce in the reserved areas were reported.

The head-quarters of the Forest Guards have remained as in 1897, viz., at Lumut (2), for watching the Lumut, Pangkor and Tanjong Hantu Reserves; at Bruas (3), for Tanjong Burong, Telok Sera and Segari; and at Beting Luas (2), for Gunong Tunggal.

The present Staff of Guards may be considered adequate for supervising the actual Reserves and preventing the felling of timber and the theft—except on a very petty scale—of Jungle produce; but it is certainly insufficient to check effectually the constant pilfering of small timber, rotans, getah, etc., which goes on in Crown Jungles other than the Reserves in all parts of the Territory. The care of the Reserves alone more than occupies the whole time of the Forest Guards, and the net result of their efforts during the past 12 months was 47 arrests, a figure which probably does not represent more than 5% of the actual number of offences committed. In my opinion, the present strength of the Forest Staff should be doubled, and Stations established at Pangkor, Tanjong Hantu, Segari and Sungei Rotan. A Station at Sungei Rotan is absolutely necessary if that district is to be properly looked after; to reach it, the Guards must, under existing conditions, walk $7\frac{1}{2}$ miles from their nearest head-quarters at Pangkalan Bharu, and must cover the same distance again on their return in the evening; they can hardly be expected to execute any very energetic patrol under the circumstances. The place, which is traversed by the trunk-road from Taiping to Chendrong Klubi, offers perhaps greater facilities than any other portion of the Territory for the illicit removal of timber, etc., into Perak. The small sum, however, which it was requested should be inserted for this purpose in the current estimates was disallowed, as was also the suggestion that a small vote (\$50 was named) should be allotted annually for the maintenance of Forest Reserves. At present there is not a single dollar available with which to meet any incidental expenditure connected with Forest work here, *e. g.*, the salving of timber which has been felled, but abandoned in the Jungle, and which, if brought to Lumut or Bruas and sold by auction, would more than repay the expense involved in its transport. It should also be mentioned that the Guards, although one of their chief duties is to keep the Reserve boundaries clear of undergrowth, are not even provided with "parangs" for the purpose.

Another point to which I would call attention is the necessity of providing the Guards with uniforms, as is done in Perak; hitherto they have not been supplied even with a badge to denote their authority, and small blame could be attached to any

individual who, under the circumstances, might decline to recognize it. In view of the fact that nearly 70 per cent. of the total revenue of the Dindings (apart from licences) is derived from its forests, it seems neither politic nor reasonable to stint the Department in such matters as these which, though they call for a most moderate outlay, are yet indispensable to the proper organization of forest conservancy.

The timber revenue here has more than trebled during the last four years, the figures being as follows:—

1895	...	...	...	...	\$3,990.26
1896	...	...	...	...	7,179.50
1897	...	...	...	...	9,824.67
1898	...	...	...	...	15,075.83

The Tanjong Burong Firewood Farm, which had been closed in 1897 in consequence of the Farmer persisting in cutting down trees of a diameter less than that permitted by his Agreement, was re-let early in the year to a new holder under much stricter conditions than before. Under the previous contract, the rent was \$60 per month and the Farmer might employ 100 coolies; the present contract fixes the monthly rent at \$80 and reduces the number of coolies to 60, the minimum diameter of the trees which it is now permitted to cut is 8 inches.

The contract expires at the end of 1899, and I understand that it is not the intention of Government to renew it.

In accordance with instructions issued last year, the dates on which the several Reserves were personally inspected by me are attached, *viz.*:—

<i>Lumut.</i>	<i>Pangkor.</i>	<i>Tanjong Hantu.</i>
June 25th.	May 21st.	January 14th.
July 16th.	June 23rd.	January 19th.
October 10th.	September 16th.	January 20th.
	October 15th.	September 23rd.
	December 13th.	December 21st.
<i>Telok Sera.</i>	<i>Bukit Segari.</i>	<i>Gunong Tunggul.</i>
June 2nd.	May 22nd.	July 9th.
July 13th.	July 27th.	October 1st.
July 27th.	August 17th.	
August 17th.	Sept. 28th and 29th.	
September 28th.	November 16th.	
October 13th.	November 23rd.	
November 16th.	December 7th.	
November 23rd.		
December 7th.		
		<i>Tanjong Burong.</i>
		July 22nd.
		December 12th.
		(and brief inspections weekly).

In addition to the above, numerous casual visits were paid to every Reserve, except Gunong Tunggul, the isolated position of which makes it very difficult of access.

A shelter-hut was built for the Guards at Sungei Panchor in September, and a sampan has also been provided for use in the same locality.

R. P. GIBBES,
Acting District Officer, Dindings.

Lumut, 6th March, 1899.

REPORT ON THE FOREST RESERVES IN THE SETTLEMENT OF MALACCA, FOR THE YEAR 1898,

RESIDENT COUNCILLOR'S OFFICE,
Malacca, 26th June, 1899.

SIR,—I have the honour to forward herewith the reports of the Collector of Land Revenue and the District Officers at Alor Gajah and Jasin, on the Forest Reserves of their District during 1898.

2. The two chief events of the year as affecting the Reserves were:—

(i) The closing of the Reserves by direction of His Honour the Officer Administering the Government on 8th August.

(ii) The enlargement of the Bukit Bruang Reserve by 2,715 acres.

3. Prior to the closing order permits to cut timber were issued to the Public Works Department, Government Contractors and others. The permits issued to the Public Works Department were for timber required for Government buildings, repair of bridges, etc., and were granted free. Other recipients of passes paid tenths of the value of the timber. The trees were cut under the supervision of the District Officers. The system was initiated and carried on by the Forest Department until its abolition in 1894.

4. The enlargement of the Bukit Bruang Reserve is a very good thing. The additional land consists of small scrub and lalang but will soon be covered with trees if carefully guarded from fires. The whole of this reserve is within easy reach of the town and any good descriptions of timber in it will therefore always be of considerable value.

5. An increase in the staff of Forest Guards was asked for during the year in order to more efficiently preserve the reserves from illicit cutting. It was decided that the present establishment was adequate for the purpose.

6. A small vote was however granted, for the present year, for the establishment of a nursery of forest trees. This is to be situated in the Bukit Bruang Reserve under the control of the Collector of Land Revenue and the special supervision of the Resident Councillor. It should be possible in a few years to plant up a large area of this reserve with valuable timber for the use of future generations. The reserve now contains a number of trees fit for felling and it would, in my opinion, be well if in this and the other reserves, a certain amount of timber were allowed to be felled for the use of Government and others.

7. My annual administration report, paragraphs 253 to 264, a copy of which is ** D.* attached, deals with Forest Reserve matters.

8. I enclose a map of the Settlement showing the reserves as they existed prior ** E.* to the appointment of Mr. CANTLEY as Superintendent, as they were then reformed in 1883-1888 and as they are now.

The areas at the three periods are:—

	<i>Before 1883.</i>	<i>1888.</i>	<i>1899.</i>
Bukit Bruang	Nil.	1,734	6,174
Brisu and S. Siput	3,890	2,247	5,268
Bukit Panchor	2,880	3,640	3,356
Sungei Udang	1,980	4,800	4,392
Ayer Panas	1,950	3,900	3,242
Merlimau	2,000	6,000	6,217
Bukit Senggeh	25,000 ^a	12,000	9,429
Bukit Sedanan	...	...	11,353
Total	37,700	34,321 ^b	49,431 acres.

9. Since the reserves were surveyed in 1885, probably quite fifty thousand acres of large unreserved forest have been felled for tapioca and other cultivation. On the other hand land then worked out and abandoned has again become covered

** D.*—Paragraphs 253 to 264 of Malacca Administration Report for 1898.

E.—Not printed.

(a) A very incorrect estimate.

(b) See Administration Report, 1888. Paragraphs 213 and 214.

with young trees and if the present system of reserve belts round large holdings is strictly maintained, all abandoned lands should quickly revert to forest. This rewooding by nature of abandoned lands may be seen going on all over the Settlement except in those localities where long stretches of lalang, unbroken by any belts of timber, have been allowed to become established. These are perpetuated, and only perpetuated, by the continual recurrence of fires, some caused by the careless lighting of roadside fires, by cart-men cooking their meals but too often by deliberate firing in order that the young lalang springing up afterwards may form a grazing ground for cattle. Such wanton mischief almost always escapes unpunished, it being apparently beyond the powers of Police or Forest Officers to detect the offenders in the sparsely populated districts where they occur.

* *F. 1 and 2 and 4 to 12.* 10. Attached to this report will be found extracts from previous reports giving information concerning the various reserves, the trees they contain, planting done in them and other matters which I have thought it may be convenient to collect and re-publish. I propose during the present year to endeavour to locate the plantations made prior to the abolition of the Forest Department and where the trees are found to have survived to have the plantations surveyed and a register compiled of them.

11. I hope that in the near future the Forest Department, abolished on the recommendations of the Retrenchment Committee of 1893, may be re-established and placed under a responsible Officer. The Officer required however is a Forest Officer pure and simple for the conservation and improvement of the Forest Reserves * * *

* *F 1.*—Paragraph 66 of Report on the Forests of the Straits Settlements for 1882.

F 2.—Paragraph 112 of Report on the Forests of the Straits Settlements for 1882.

F 4.—Paragraph 32 of Malacca Administration Report, 1881.
Paragraphs 44, 45 and 46 of Malacca Administration Report, 1882.
Paragraph 39 of Malacca Administration Report, 1883.
Paragraph 80 of Malacca Administration Report, 1884.
Paragraphs 90, 91, 92, 93, 94, 95, 100, 101, 106 of Malacca Administration Report, 1885.
Paragraph 53 of Malacca Administration Report, 1886.
Paragraphs 212 and 215 of Malacca Administration Report, 1888.
Paragraphs 131 and 134 of Malacca Administration Report, 1889.
Paragraphs 121 and 126 of Malacca Administration Report, 1891.
Paragraphs 94 and 97 of Malacca Administration Report, 1892.
Paragraph 73 of Malacca Administration Report, 1893.
Paragraphs 66, 67, 68 and 71 of Malacca Administration Report, 1894.
Paragraph 81 of Malacca Administration Report, 1895.
Paragraph 106 of Malacca Administration Report, 1896.
Paragraph 143 of Malacca Administration Report, 1897.

F 5.—Paragraphs 51 and 52 of Malacca Administration Report 1886.
Paragraph 224 of Malacca Administration Report, 1888.
Paragraph 126 of Malacca Administration Report, 1889.
Paragraphs 119 and 121 of Malacca Administration Report, 1890.
Paragraph 7 of Mr. RIDLEY'S Report, 1890.

F 6.—Paragraphs 68, 69, 71 and 72 of Malacca Administration Report, 1884.
Paragraphs 98 and 103 of Malacca Administration Report, 1885.
Paragraph 50 of Mr. CANTLEY'S Report, 1886.
Paragraphs 46, 54 and 55 of Malacca Administration Report, 1886.
Paragraph 216 of Malacca Administration Report, 1888.
Paragraph 132 of Malacca Administration Report, 1889.
Paragraph 130 of Malacca Administration Report, 1890.
Paragraphs 27 and 29 of Mr. DERRY'S Report, 1890.
Paragraph 95 of Malacca Administration Report, 1892.
Paragraphs 80 and 82 of Malacca Administration Report, 1895.
Mr. RIDLEY'S Report in Malacca 5196/96.

F 7.—Paragraph 93 of Malacca Administration Report 1885.
Paragraphs 43 and 47 of Mr. CANTLEY'S Report, 1886.
Paragraph 48 of Malacca Administration Report, 1886.
Paragraphs 221 and 222 of Malacca Administration Report, 1888.

F 8.—Paragraph 93 of Malacca Administration Report, 1885.
Paragraphs 43, 47 and 51 of Mr. CANTLEY'S Report, 1886.
Paragraph 49 of Malacca Administration Report, 1886.
Paragraphs 217 and 218 of Malacca Administration Report, 1888.

F 9.—Paragraphs 73 and 79 of Malacca Administration Report, 1884.
Paragraph 43 of Mr. CANTLEY'S Report, 1886.
Paragraph 47 of Malacca Administration Report, 1886.
Paragraph 220 of Malacca Administration Report, 1888.

F 10.—Paragraph 79 of Malacca Administration Report, 1884.
Paragraph 43 of Mr. CANTLEY'S Report, 1886.
Paragraph 223 of Malacca Administration Report, 1888.

F 11.—Paragraph 93 of Malacca Administration Report, 1885.
Paragraph 43 of Mr. CANTLEY'S Report, 1886.
Paragraph 50 of Malacca Administration Report, 1886.
Paragraph 219 of Malacca Administration Report, 1888.
Paragraph 35 of Mr. DERRY'S Report, 1890.

F 12.—Paragraph 214 of Malacca Administration Report, 1888.
Paragraph 129 of Malacca Administration Report, 1890.

* * * * *

12. I thoroughly agree with the remarks of Mr. KYNERSLEY in his Administration Report for 1894 :—

"There is much to be said in favour of a nursery in connection with a Forest Department but the attempt to keep up a Botanical Garden was a failure. Half the money voted for forests was spent in the Garden and the time of the Superintendent taken up in trying to grow plants in a sterile soil."

13. From my own experience and the perusal of the reports on my predecessors and of Forest Officers, I place the uses of the Forest Reserves in this Settlement in the following order :—

1st.—By far the most valuable. The preservation of the sources of the numerous small streams which flow from the hill ranges over which the greater part of the Reserves stretch.

2nd.—The maintenance of the average rainfall. I do not think the area of the Settlement and the addition to the Forest Land of the Reserves in it are large enough to materially affect this.

3rd.—Provision of timber for local use in the Districts adjacent to the Reserves.

4th.—Supply of valuable timber for export.

14. In concluding this report I would call attention to the advisability of passing a Forest Ordinance similar to the Ceylon "Forest Ordinance 1885". I attach a rough draft of such an ordinance drawn up by the Honourable C. W. S. KYNERSLEY, C.M.G., Resident Councillor of Penang, who was in charge of this Settlement for the first two months of this year during my absence on leave, to whom I am also indebted for the collection of much of the information, culled from old reports, contained in Appendix "F." * G.

15. Appendix "H" * gives the Expenditure on and Revenue from the Reserves in each District during 1898. The totals for the Settlement are :—

Expenditure,	...	...	...	...	\$1,485.48
Revenue,	...	...	...	...	371.86
Net Expenditure,	...	...	...	...	<u>\$1,113.62</u>

I have, &c.,

WALTER EGERTON,
Acting Resident Councillor.

A.

LAND OFFICE,
Malacca, 3rd March, 1899.

SIR,—I have the honour to report as follows on the working of the Forest Department in the Central District during the year 1898.

2. The only Reserve under the Land Office—Bukit Bruang was largely added to during the year. The original area was 3,459 acres and the additional land taken in, in two lots, 2,715 acres. The land round the Water Works which some years ago consisted largely of lalang appears now to be better covered with scrub and the lalang should soon disappear altogether.

3. There have been from time to time Nurseries of rubber and other trees started in the Reserve, two of these are doing well and are looked after by the Mandor at the Reservoir, a third had been somewhat neglected but is now being taken in hand again.

4. The Reserve is looked after by a Corporal and one Guard. One unsuccessful prosecution took place of a Chinaman who was supposed to have set fire to some scrub on the edge of the Reserve when clearing round a grave on adjacent land.

5. No cutting is allowed in the Reserve and there is no Revenue.

The Expenditure was :—

Salaries	...	...	...	...	\$192.00
Rice Allowance	...	...	...	...	36.00
Other Charges (Maintenance of Forest Reserves)	...	...	...	...	94.15
					<u>\$322.15</u>

* G.—Not printed.
H.—Not printed.

6. The Reserve at Bukit Bruang was visited on the 3rd February, 22nd July, and 26th August, and the Reserve at Sungei Udang on the 13th March, (with the District Officer, Alor Gajah). There were several other visits to the Bukit Bruang Reserve and Bukit Sebukor gardens, of the dates of which no record has been kept.

I have, &c.,

L. A. M. JOHNSTON,
Acting Collector of Land Revenue.

B

DISTRICT OFFICE,
Alor Gajah.

1. SIR,—I have the honour to submit the following report on the Forest operation during the year 1898.

Bukit Panchor.

2. A Corporal and a Constable are in charge. The lines are kept clear. I inspected this reserve on 3rd January, 2nd March, 10th June and 28th July, besides visiting it incidentally on several other occasions.

3. The crop of the durian orchards in the reserve were sold for \$137.50 and that of the duku orchards for \$70.

In addition to this \$25.08 was collected on account of jungle produce.

4. No illicit timber cutting was discovered in the Reserve during the year.

Sungei Udang.

5. There are a Corporal and a Constable in charge. The lines have all been reopened and staked out. At the back of the reserve where there is a large quantity of lalang, one encroachment was discovered which has been reported on to Government.

6. I inspected this reserve. on 20th January, 13th March, 17th May, 21st September and 7th November.

7. A considerable amount of wood was discovered to have been cut on the edge of the reserve near the road in the earlier part of the year, and the Forest Guards who had been evidently conniving at it, were dismissed. It was decided not to prosecute in this case.

8. A road contractor was prosecuted and fined for cutting timber in the reserve

9. There was collected \$6.05.

Brisu-Sungei Siput.

10. There are no Guards in charge of this reserve. The lines are entirely overgrown and it is impossible to inspect it except where it skirts the road. There were no prosecutions for timber cutting in this reserve during the year.

General.

11. The total revenue of the Forest Reserves was \$238.63 made up as follows:—

Bukit Panchor-Jungle produce, ...	...	\$25.08
Sungei Udang do., ...	...	6.05
Fruits at Bukit Panchor auctioned, ...	...	207.50
		<u>\$238.63</u>

12. Total expenditure was \$461, of which salaries accounted for \$432, \$26 for uniform and \$3 for implements.

I have, &c.,

H. MARRIOTT,
Acting District Officer.

10th January, 1899.

DISTRICT OFFICE,
Jasin, 4th January, 1899.

SIR,—I have the honour to submit the Annual Report on the Administration and Maintenance of the Forest Reserves in the Jasin District during 1898.

1. The expenditure on the Vote for Maintenance amounted to \$62.04, the Vote being \$100, and was distributed as follows:—

Wages of two coolies clearing lines of Merlimau Forest Reserve at	
\$7 per month from the 5th September	\$52.97
Tools	9.07

The Forest Guard is now paid from the Vote for Personal Emoluments.

2. It is impossible to say what amount of Revenue was derived from the Forests before instructions were received that no further timber felling or jungle produce collection was to be allowed, as the receipts are mixed up with those of the various penghulus for tenths on jungle produce. In future there will be no revenue derived from this source.

3. *Batang Malaka*:—This Reserve which was formerly under the charge of the Corporal at Bukit Senggeh has been guarded this year by a Lance Corporal who was added to the establishment and one Guard transferred from Bukit Senggeh. They have under their charge the Batang Malaka Reserve and the Northern boundary line of the Bukit Sedanan Reserve. I visited this reserve in September, and found that good progress had been made in clearing the boundary paths which were rather overgrown with "semak" and "resam," as the Reserve had been much too far from the Corporal's quarters to permit of efficient supervision. The boundary line to the North has never been opened up as the Reserve abuts on the unsettled boundary with the Negri Sembilan. From the Negri Sembilan side of the range which constitutes this Reserve, the timber in the distance has every appearance of being good. The nature of the ground is a protection in itself against illicit timber cutting and the timber as far as I could judge is good. At "Gapis" there is a "Mentra" settlement on a hill top inside the Reserve; these people were allowed to remain on their old squatting ground when the forest was reserved and have made no further extension of the ground cleared. There are a large number of pisangs and other fruit trees planted.

4. *Bukit Senggeh*.—This Reserve has been as hitherto under the charge of Corporal ASAN, but there is now only one Guard instead of two, one man being transferred to Batang Malaka. The forest to be preserved is of very large extent, comprising the Bukit Senggeh Reserve and nearly the whole of the Bukit Sedanan Reserve. I visited this reserve also in September, devoting a day to each part of it. The boundary paths of the Bukit Sedanan Reserve are all fairly clear and there is some good timber, but in places it is very inferior. On the Bukit Senggeh side, the boundary path to the South requires re-opening as it has got overgrown; in places it runs through "lalang" which adds to the difficulty of picking up the line. During the small-pox outbreak at Bukit Senggeh three of the sick people were conveyed some way into this Reserve and hidden there for some days before they could be traced.

5. *Ayer Panas*.—The same men as last year were in charge here, *i. e.*, a Lance Corporal and one Guard. I visited the Western portion in January and again in October. On the latter occasion I also went through the Eastern half. The paths are clear and much more numerous than in the other Reserves, the ground being level and paths having been cut intersecting the forest. The timber, as has been remarked in former years, is poor.

6. *Merlimau*.—A Lance Corporal and one Guard were allotted to this Reserve, being an addition to the strength. Owing to the Forest Station being occupied by Public Works Department's coolies, the men did not take charge until the beginning of June when new coolie lines had been built. The first work to be done was to clear the boundary paths which had been almost completely overgrown. In August I visited the Reserve to see what progress had been made in the work. I found that on the Southern side most of the path runs through deep swamp and is almost impassable as the tree trunks which were laid down by the old Forest Department were all submerged and rotted. In consequence of this two coolies were engaged in September to assist in getting the lines cleared, and when I again visited the Reserve in October fair progress had been made on the Northern and Western sides. It will however be necessary to obtain extra help again next year. The Chohong River is

the Eastern boundary and is much choked; this river is, I understand, to be cleared next year in connection with the revision of the Muar boundary. I attempted to get a "jalor" for the use of the Guard, but could not obtain a suitable one for the amount authorised; another attempt will be made next year.

7. Below will be found a tabulated statement of prosecutions for trespass and illicit cutting in the Reserves, none of the cases were serious, the object generally being to cut Umbai, rattan, etc.; in most cases more than one man was involved:—

	No. of Cases	Convictions.	Number involved.	Remarks.
Batang Malaka ...	1	1	3	"Ejok Cutting."
Bukit Senggeh ...	3	2	4	
Ayer Panas ...	2	1	2	
Merlimau ...	3	3	9	

The total fines paid were \$30.70.

Before the closing of the Reserves to cutting, the contractor building the New Office and Police Station obtained \$196.50 worth of timber for those buildings from the Ayer Panas and Merlimau Reserves and paid \$49.13 as royalty.

8. The timber in places is good, notably at Batang Malaka and Merlimau, but in the latter there are numerous traces of illicit cutting which took place during the withdrawal of the Guard; it appears indeed to me that if the Forest Department was re-established on its old basis and timber was properly thinned, the cost of the establishment could be at all events partly defrayed by the revenue which would be obtained.* At present the Forest Ranger has no time to inspect the Reserves and the District Officer can only make very occasional, somewhat cursory and lay inspections, this has been frequently brought to notice in former reports.

I have, &c.,

R. SCOTT,
District Officer.

* By such a system as this the Government could obtain good timber, stock it until seasoned and hand it over to its contractors. In this way the use of green timber in new buildings would be avoided and the durability of the work increased.

APPENDIX F III.

Tabular statement showing area of Forest Reserves in 1882, Mr. Cantley's recommendations, the action taken on them, the resulting Forest Reserves, subsequent modifications and the Forest Reserves as they now exist.

Reserve.	Area prior to 1882 and Mr. CANTLEY's report.	Mr. CANTLEY's recommendations.	Action taken on recommendations.	Area in 1883-1888.	Subsequent Alterations.	Existing Area.
Jus and Bukit Senggeh (includes reserve now known as Batang Malaka.)	25,000a squatters and villages within the reserve.	Re-adjust so as to exclude villages and squatters' holdings.	Carried out in 1887-1888.	Uncertain. From Administration Report 1888 para. 213-214 about 12,000 acres.	Part alienated for tapioca planting and other land added.	20,782
Kesang or Ayer Panas, ...	1,950	Add 2,000 acres at M. on map.	Acres added. Name altered to Ayer Panas.	3,900	500 acres alienated for tapioca in 1894 and some for tin Mining later.	3,242
Merlimau (or Payah Gemok.)	2,000	Double area by adding at N. or O.	Carried out. About 600 of old reserve cut out and 1,500 acres added at N. and 2,500 acres at O.	6,000	Much larger than proposed by Mr. CANTLEY.	6,217
Gading or Bukit Panchor. (Also called Malaka Pindah by Mr. Cantley).	2,880	Worthless. Should take in Panchor Hill range.	Carried out. Most of old reserve abandoned and new one formed. Name altered to Bukit Panchor.	3,640	Not traced.	3,356
Sungei Siput, ...	3,890	Only requires protection. Add land at V. and J. on East.	Portion of old reserve abandoned and land added at East and North.	2,247	Not traced.	5,268
Bukit Bruang, ...	Nil.	Make a reserve of 2,000 acres at Bukit Bruang.	Carried out. 1,920 acres reserved at Bukit Bruang.	1,920 (also given as 1,734.)	2,715 acres added in 1898. An addition was also made in 1890.	6,174
Sungei Udang, ...	1,980	Not mentioned in Mr. CANTLEY's report but map shows recommendation of an addition of about 2,000 acres in West.	2,000 acres added on South of old Reserve.	4,800	Area given in 1888 probably an estimate.	4,392

a. A rough estimate.

STRAITS SETTLEMENTS

ANNUAL REPORT

ON THE

BOTANIC GARDENS

FOR THE YEAR

1898

BY

H. N. RIDLEY, ESQ.

Director



PUBLISHED BY AUTHORITY

SINGAPORE:

PRINTED AT THE GOVERNMENT PRINTING OFFICE

1899

1898

ANNUAL REPORT OF THE BOTANICAL GARDENS, SINGAPORE.

Staff.

1. The only changes in the staff were the employment of a new Plant-collector named TALKA, in place of MAT resigned. The coco-nut trees inspection coolie was at first tried for this post, but proved unsatisfactory. A young Tamil lad SAHIB was taken on as apprentice to learn gardening work, and has proved very useful, and a boy, SIMON, was also employed as apprentice in the office. The coolies worked well, but there were some cases of mild beri-beri in the lines, and it will be advisable now to rebuild their quarters in another spot.

Visitors.

2. The number of visitors was as large as in past years. Many planters and others interested in cultivation visited the Economic gardens to inspect the various officinal plants. A considerable number of scientific botanists, passing through to Java, Ceylon or Japan, also visited the gardens. The Regimental band performed regularly once a month on moonlight nights, and was much appreciated.

Prosecutions.

3. There were a number of cases of petty theft, chiefly by mail passengers, but few of any importance. Three Chinese and one Malay boy were charged with taking flowers. One was discharged, and one escaped, the others were fined or imprisoned. One Chinaman was fined three dollars for cutting sago palms, and one Indian was fined for injuring a python by striking it with a stick.

Flower show.

4. A very successful exhibition of flowers and flowering shrubs was held in the Town Hall in March. It was remarkable for the exceptionally good show of orchids. Large foliage plants and fruits and vegetables were excluded, and the exhibition was especially one of flowers.

Bulletin.

5. A bulletin dealing with vegetables, shade trees, poisonous plants, Sugar cane, seedlings, and other subjects was published.

Aviaries.

6. The following animals were added to the collection :—One *Semnopithecus* sp. purchased; one other (*Aonyx leptonyx*) caught in Singapore, purchased; two Kijangs (*Cervulus muntjac*) were born, one in April, the other in September; the latter, however, died next day. One hybrid ape was born. Three Thalaugers (*Trichosurus Vulpecula*) one of which produced a young one, presented by Mr. HALL; one kangaroo rat presented; four black swans presented by Mr. LE SOUEF. Two whistling teal presented by Mr. DARE; one *Neops malayanus* presented by Capt. H. TALBOY; one seagull presented by Capt. H. TALBOY; one Australian parrot presented by Mrs. HUNTER; two black storks *Xenorhynchus asiaticus* from Pahang purchased; one horsfield's eagle purchased; six flamingos, 8 ducks and 2 gulls presented by Mr. DIXON of Cairo. The flamingos did not thrive and three were killed by large water tortoises, (*Trionyx*). The other water-fowl hardly survived the journey except one gull. Two pelicans, deposited; one cobra and some green vipers (*Lachesis wagleri*) were captured and one of the latter produced nine living young. A rare tortoise *Daimonia subtrijuga* from Siam presented by Mr. FLOWER; two large water tortoises (*Trionyx cartilagineus*) were caught in the lake in a trap.

Upkeep.

7. The borders and beds in the garden were all gone over, thoroughly trenched and renewed, and planted with fresh shrubs and plants. The flowerbeds round the band stand have been exceptionally bright this year owing to the introduction of a large number of novelties received chiefly from Mr. DAMMANN of Naples, who sent a very large collection of various seeds, in exchange for those of palms; among these new-bedding plants, were several kinds of *Salvia* of different colors, *Solanums*, *Rivinas*, the sweet scented Basils (*ocimum*), *Nicotianas*, *Cacalia*, and a good series of the Orchid flowered Cannas. Among the more interesting new introductions were, the following, *Lepinia taitensis*, (Southsea islands) *Ceropegia perforatum* (New Guinea) *Lonchocarpus cyaneus*, two new species of Coffee from Africa, *Tupistra* new-species, *Typhonium* new species from Perak. *Cinnamomum* sp, a wild clove bark from Ulu Lipis, *Begonia decora*, *Didymocarpus* n. sp. and *Renanthera angustifolia* (Perak), and a fine series of araucarias was received from Brisbane.

8. The following plants flowered for the first time, *Baphia nitida*, the camwood. *Carapa Guianensis*, (craboil tree) *Commelina Sellowiana*, *Streptocarpus hybrids*, *Cacalia coccinea*, *C. aurea*, *Mucuna pruriens varutilis* *Sarcochilus bisserratus* n. sp. (Perak) *Bromheadia schoenoides* n. sp. *Amomum micranthum*, *Hornstedtia Maingayi*. *Phrynium* n. sp. *Neyrandia Madagascariensis*, *Heptapleurum Hullettii*, and *H. Ridleyi* *Dendrobium anceps* (Burmah) *Büttneria* sp. (Pahang), *Garcinia Morella* (Ceylon.)

Nepenthes House.

9. A new glass-roofed house was built chiefly for pitcher plants, (*Nepenthes*) but it has also been used with great success for newly imported orchids and other delicate plants. Among the nepenthes are, *N. ampullacea*, *N. Rafflesiana* and several varieties, *N. gracilis* *N. Reinwardtii*, *N. sanguinea* and *N. albomarginata*.

The large plant-house has undergone large and expensive alterations. The whole of the central portion has been removed, the wood work being completely rotten. The walls are covered with bertam-chicks, made specially in Penang, supported on an arched-iron frame work carried on iron tubing pillars, and the central staging was covered with a circular roof of chicks carried on iron tubing and bars, from a brick pillar in the centre.

10. The following were the Exchanges of plants during the year, two hundred and thirty nine plants, and one hundred and ninety five packets were sent out to kindred institutions and Botanic Gardens and eight hundred and twenty four plants and four hundred and fourteen packets of seeds were received.

The following contributed to the Gardens :—

Mr. Micholitz.	Royal Botanic Gardens, Kew.
„ Pereira.	Do., Calcutta.
„ W. Nanson.	Do., Ceylon.
„ St. V. B. Down.	Do., Buitenzorg.
„ J. Goodenough.	Do., Hongkong.
„ A. Loher.	Do., Sydney.
„ Lease.	Do., Trinidad.
„ W. W. Bailey.	Do., British Guiana.
„ E. V. Carey.	Do., Brisbane.
„ Williams.	Do., Tokio, Japan.
„ Owen.	Do., Lagos.
„ Gerald Watson.	
Messers Dammann & Co., Italy.	
„ Behn Meyer & Co.	
„ Sander & Co.	
Mrs. Pennefather.	

Herbarium.

11. During the year no departmental botanical excursions could be made, but while on leave in July I visited the Kinta valley in Perak, ascending the hills of Bujong Malacca, and Gunong Keledang, and taking the plant collector, made large collections in the district. Although several botanists have visited this valley, a considerable number of novelties of interest were found, including a remarkable new species of *Tupistra*, the first of this Indo-Chinese genus discovered in the peninsula and a very fine *Bulbophyllum* with probably the largest flowers in the genus, a new

Typhonium, several new *Didymocarpi*, a *Zippelia*, and other striking plants. Later in the year I visited, on leave, the Negri Sembilan, botanically an almost unknown district, where among other plants a new *Shorea*, and a curious new *Phrynium* were obtained, and thence I visited Mount Ophir where many plants were collected. During my annual visit to Penang, Province Wellesley and the Dindings, I also collected a number of specimens. Plants from Singapore and Johore were also obtained during the year.

A continuation of the series of dried plants collected by Scortechini, Wray, and Kunstler, was contributed to the herbarium by Dr. PRAIN of the Calcutta Gardens, and specimens from the Papuan region, including the new palm *Livistona Woodfordi* Ridl; were presented by Mr. MICHOLITZ. Mr. CURTIS sent 104 specimens from Penang and Perak.

Forestry.

12. I visited Penang in June and inspected the forests on Government Hill, especially along the track of the proposed railway to the top from Ayer Hitam, and found that it would not in any way injure the forest. And also visited Balik Pulau to report on the proposed new reserve at Pondok Upik, a hill slope of about 300 acres, containing a quantity of good ordinary timber, but for reservation purposes of more value climatically to check denudation into the valleys at the base of the hills. A few days were also spent in the Dindings inspecting the forest conservation at Lumut, and the new boundary paths and timber factory at Gunong Tungul. All seemed in a satisfactory state and reports were sent in to Government on the state of affairs. India rubber (*Ficus elastica*) was noticed growing remarkably well in Lumut, and might well be propagated and planted out. And para rubber was sent to Lumut and Balik Pulau for planting in the forest reserves.

13. Duplicate specimens for naming or exchange were sent to the gardens at Culcutta and Kew, and ferns were sent to Dr. CHRIST of Basle; Mosses to Mr. MITTEN, Algæ to Mr. WEST, and Fungi to Mr. MASSEE of Kew, who reports that several of the latter were new to science. A number of specimens of timber were added to the wood-collection, including the Katinga wood of Siam, a very ornamental wood resembling Calamander wood, but produced by a wild citron apparently a variety of *Citrus Medica*. This was presented with a specimen of the leaves and fruits, by Hon'ble F. G. PENNEY. A small drying and preparing room was built on to the office for the work of the plant collector.

Library.

14. The following books have been added to the Library:—

Ferguson.—All about coco-nut planting (new edition) presented by the Author.

Obach E.—Gutta percha (Cantor Lectures) presented by the Author.

Raciborski.—Flora von Buitenzorg presented by the Author.

Penzig.—Die Myxomyceten der flora von Buitenzorg.

J. G. Kramers.—Een Reis in de Koffie.

Ianse Dr. J. M.—Noot-Muskaat Culteuer in Minahassa.

Bijlert Dr. A. V.—Onderzoek van eenige grond soorten in Deli (cont.)

Greshoff M.—Onderzoek naar de Plantstoffen (part ii).

Konigsberger.—Schadelijke en Nuttige Insecten van Java.

Zimmerman Dr. A.—Die Nematoden der Koffie Wortels.

Enchytraeden in die Koffie Wortels.

De Haan.—Regen val en Reboisatie in Deli.

Coville F. V.—Notes on Mushroom poisoning, presented by U. S. A. Department of Agriculture.

Nash V.—American Ginseng.

Farlow.—Edible and Poisonous Fungi.

Chesnut V. K.—Principal poisonous plants of North America.

Jeffrey E. C.—Gametophytes of Botrychium Virginianum.

Swingle and Webber.—Hybrids and their utilization.

Smith E. F.—Black Rot of Cabbage.

Dodge C. R.—Report on Flax culture.

Swingle W.—Grain smuts.

Walpers.—Repertorium 6 vols. presented, Royal Gardens, Kew.

„ Annals 6 vols presented, Royal Gardens, Kew.

Pierre Flore Forestiere de Cochinchine, 2 parts, presented by Royal Gardens, Kew.

Morris D.—Commercial Fibres.

„ Commercial India rubber.

Dyer.—Flora of Tropical Africa, vol. vii, part 2.

Hiern.—Catalogue of Welwitsch's plants presented by Trustees of British Museum.

Engler.—Systematik Pflanzengeschichte.

Soltwedel F.—Forms of Sugar cane, presented by Hon'ble J. B. Vermont.

Medley Wood J.—Natal Indigenous plants.

Koorders F.—Flora van Celebes.

Maiden.—Flora of Mt. Kosciusko, presented by Author.

Port Jackson plants, presented by Author.

Sterculia lurida, presented by Author.

Vegetation of Lord Howes Island.

Hallier H.—Monographie des Convolvulacées, presented by Author.

Neue Pflauzen aus dem Malaischarchipel.

Zwei Convolvulaceen.

Indonesischen *Æschynanthus* arten.

Birdwood, Sir J.—Memorandum on purchase of Carrot seed.

King and Pantling Orchids of Sikkhim Himalaya, presented Calcutta.

Christ Filices Sarrasinianæ presented by Author.

Filices Novæ

Ridley H. N.—New species of *Entada*, presented by Author.

New Malayan Orchids.

Sanders F.—*Reichenbachia*, Vol. II, presented by Author.

Rhea Fibre Company.—Rhea Treatment by Gomess process.

Niederlein.—Republic of Guatemala.

Some copies of Boxburgh's drawings of Indian *Alpinias* were presented by Dr. Prain of Calcutta.

And the following periodical publications :—

Kew Bulletin. *Icones Plantarum* (Royal Gardens Kew) Agricultural Ledger, Botanical Survey of India Reports, Forest Administration of India by Ribbentrop, (Government of India) Journal of Agriculture (Queensland) Berlin Notizblatt Haarlem Kolonial Museum reports and extracted bulletins by Greshoff; St. Petersburg Acta Hortæ petropolitani, Madras Forest Reports, and Agrihorticultural Society report, Garden Reports of Mysore, and Saharunpore, Queensland, British Guiana, Trinidad, Barbadoes, Jamaica, Lagos, Old Calabar, New South Wales, Trinidad, and Jamaica bulletins, Ceylon circulars, Buitenzorg Annual Report, Annales, and *Icones Bogorienses*, Zanzibar Annual Report, Cape of Good Hope, Agricultural Journal, Smithsonian Annual Report; Year book U. S. A. Experimental Station records, Missouri Annual Report, Merck's Annual Report, (Darmstadt) Planting opinion of Madras, Perak Museum Notes, Warburg's Tropenpflanzen Chemist and Druggist.

The following works were purchased :—

Betzins.—*Observationes*.

Somerwell, W.—Timbers and how to know them.

Tschirch, A.—*Indische Heil und Nutzpflanzen*.

Kurz.—Burmese Palms.

„ Indian Plants.

„ Burmese Plants.

Schneider.—Book of Choice Ferns.

Schiffuer, V.—*Conspectus Hepaticarum Archipelagi Indici*.

Warburg.—Papuanische Flora.

Cogiaux and Goossens.—*Dictionnaire Iconographique des Orchidees*, Gardeners Chronicle, Botanical Magazine, Tropical Agriculturist.

BOTANIC GARDENS, SINGAPORE.

Statement of Receipts and Expenditure, for the year 1898.

RECEIPTS.		EXPENDITURE.			
	\$ c.	<i>Salaries.</i>	\$ c.	\$ c.	
By Balance in Bank, ...	704 99	Clerk, ...	207 19		
Government Grant, ...	8,500 00	Mandore, ...	229 99		
„ Sale of Plants, Seeds		Carpenters (two), ...	310 91		
and Flowers, ...	2,867 60	Mason, ...	139 81		
„ Interest, ...	26 37	Plant-collector, ...	101 03		
		Printer (Label), ...	120 00		
		Peon, ...	107 00		
		Aviary-keeper, ...	94 86		
		Police, ...	338 75		
		Coolies, ...	3,393 67		
		Rice Allowance, ...	663 56		
				5,706 77	
		<i>Bills.</i>			
		Tools and Stores, ...	688 56		
		Laterite, Gravel, Sand, etc., ...	225 80		
		Timber, Bricks, Lime, etc., ...	890 41		
		Pots and Tubs, ...	148 00		
		Birds' and Animals' Food, ...	1,355 67		
		Manure and Cartage, ...	122 27		
		Buildings and Repairs, ...	470 92		
		Freight on Plants, ...	117 04		
		Books, Papers, etc., ...	377 80		
		Plants and Seeds, ...	86 00		
		Subscription to Telephone, ...	82 50		
		Wardian Cases, etc., ...	85 00		
		Petty Expenses, ...	335 24		
		Miscellaneous, ...	152 29		
				5,137 50	
		Balance, ...	...	10,844 27	
				1,254 69	
	\$12,098 96			\$12,098 96	

Economic Gardens.

15. A large block of land some acres in extent on the East side of the gardens, and running to the boundary stream was opened up, cleared of fern and bushes, and planted up with Ramie for which there was a large demand, Citronella, Lemon grass, and Cuscus, Earthnuts, Bananas and other plants. Para-rubber trees were planted in a row on each side, and plants of Balata gum. *Mimusops globosa*, *Kickxia africana* and *Castilloa elastica* were planted in various spots. The soil at this spot is very good and though the ground is very wet, water being met with at a depth of from a foot to two feet, it seems to suit certain plants very well.

Another patch of ground above the Dalvey Road entrance by the order Urticaceæ was cleared of weeds and useless trees dug and levelled. There are a number of Para-rubber trees at this point. A good number of additions were made to the Arboretum.

Para-rubber is still in great demand, and fortunately this year's crop of seed was a very fair one as compared with that of the previous year, 98,650 seeds being obtained as against 83,000 in 1897.

These seeds were distributed to planters and to Government plantations, together with 10,650 plants, in the following proportions:—

Selangor 76,700 plants and seeds. Johore 21,300, Borneo 5,500, Pahang 3,550, Penang 1,400, Dindings 400, Negri Sembilan 600, Madras 500.

Still this by no means covers the demand for this plant, which is enormous. The greater number as will be seen are required for Selangor where the plant appears to thrive remarkably well. Complaints have however been received thence as to destruction of seedlings by rats, which bite the tops off, as well as by mouse deer, and other animals. At the suggestion of Mr. BAILEY the dried bark and leaves of a small tree were sent to England for Analysis to see if much rubber was lost in drying; no report of the results has yet been received. Samples of bark and soil from the ground on which the plants are cultivated were also sent to Mr. PARKIN, at present investigating the physiology of the Para-rubber tree in Ceylon, and some experiments and calculations were made for him.

Measurements of average and large trees growing in the gardens were made. Of the oldest trees planted in 1884, the girth at 5 feet from the ground was 4 foot 2 inches in the smallest and 6 feet in the largest. Of the trees planted in 1888 a number were measured and gave an average of 4 foot 3 inches, the biggest being 5 feet the smallest 3 foot 8 inches. Mr. WICKHAM, a gentleman, who has spent many years in the Amazonas district and was the first to introduce the plant to the East, visited the gardens, and explained an improved form of tapping the tree by punctures, obviating the necessity of making the usual V shaped incisions. The advantage of this is that the bark is less injured and heals sooner and remains smooth instead of becoming rough as it does under the grooving system.

Of Ramie.

16. Fifty-one thousand (51,000) cuttings and four boxes of seed were sent to planters. Chiefly in Muar, Sumatra and Borneo. It is found very easy to raise this plant from seed, and in wet weather the seeds often germinate on the plant. Of the different strains grown in the gardens, one is very superior in its tall growth before flowering, this is being more extensively propagated than the other varieties.

Coca seed, (*Erythroxylon Coca*) was also in some demand, and 12,000 seeds and some plants were supplied to the Native States. The recent rise in the price of the drug has called planters attention to it.

Other plants in request were Vanilla (700 plants), Patchouli (550), fruit trees (550), *Coffea stenophylla*, *Willughbeia firma*, Chocolate, Rattans, Cola, and Citronella grass.

Plant Diseases.

17. A number of insect and fungus pests were reported from various plantations in the Native States and specimens sent for identification. Among these were samples of destruction of coffee, fruit-trees, ferns and other plants by the coffee locust, specimens of which sent to the Natural History Museum, in London, were identified as *Cyrtacanthacris nigroviridis* walk; curiously a very rare-insect in Entomological collections in Europe. It lays its eggs in slits in the bark of the trees causing the death of the branches. Destruction of the adult by children with sticks and clearing the adjacent land of grass was recommended. Towards the end of the year great damage was reported in the coffee by the Beehawk moth (*Cephonodes Hylas*) the

larva of which devours the leaves, and what was apparently the pupa of a sawfly was also sent from Selangor with samples of badly injured leaves.

The borer-caterpillar was still doing considerable damage, and still more harm was being produced by the red smut fungus. Indeed the state of some fields was very serious. The constant planting of sugar on the same fields was beginning to show effects of degeneration of the cane, which was not to be wondered at, considering the long period during which the fields had been cultivated without change or rest. Specimens of the borer moth sent to the natural history museum were stated to be a species of *Chilo* distinct from the *Chilo saccharalis* of the West Indies.

The seedling canes supplied by Mr. CURTIS were examined. They were growing well and steadily but naturally not as rapidly as from cuttings.

Enquiries as to the use of the mungoose in destroying the rats which formerly were so destructive to the canes elicited the fact, that the rats were practically exterminated by the mungoose, which bred and appeared to thrive very well.

Cloves.

During my stay at Balik Pulau I examined the clove plantations and noted that the borer which was very bad formerly here had almost disappeared but I observed a distinct disease near the same spot which I had never met with before. The boughs of the trees, almost always on the side away from the hill slope died and fell off, the tree eventually perishing. Investigation showed that the bark at the junction of the bough with the trunk was thickened and corky and broken up, especially at the spot where during rain the water ran from the branches down the trunk. The disease was evidently produced by a fungus between bark and wood and was similar to the injury caused by *Irpex* on Coffee trees. I could find no developed fungus on the trees, and though I sought on rotten timber lying around, the few fungi I found were too rotten to identify. I expect it will prove to be *Irpex* which apparently does not confine its parasitism to Coffee, for I found in Province Wellesley an Orange tree entirely broken up by it. The clove disease was very local, occurring in patches, all the trees in one spot being attacked. The cause of the disease was explained to the Chinese owners and the remedy, destruction by burning of all decayed wood on the ground urged on them.

Sugar.

18. At the request of the planters in Province Wellesley I visited two of the larger estates where the Sugar Rhinoceros beetle *Xylotrupes Gideon* was found to be doing much damage, I had previously found this beetle in the cane fields, but it seemed to be inflicting but little injury. Lately however it had taken to feeding upon the roots of the cane, being attracted by the decaying part of the cutting after planting, instead of confining its attention to decaying vegetable matter, its normal food. The larvae were very abundant in some fields, and were being destroyed by digging and searching for them. The large jungle crows were also at work, following the diggers and seeking the grubs. It was said that the pest had been exterminated in some fields by flooding. In other places however they were found living in the wet mud of the canal banks apparently unharmed. It was pointed out that patches of wood left in and near the cane fields were of the greatest importance to the planters as affording shelter for the crows and other insectivorous birds. A matter often overlooked as one wooded hill in the centre of the cane district had been let to a Chinaman to grow tapioca, the wood being mostly felled and the birds driven away.

Camphor oil.

19. Samples of Camphor oil from the *Dryobalanops* of Rawang were forwarded from Selangor by the overseer of Forests and transmitted to the Royal Gardens Kew and a report from Mr. J. C. UMNEY was received which stated that "the oil consists in all probability of the more volatile portions only, almost solely by Terpenes." So far as I know therefore it would have no medicinal virtue nor any commercial value over ordinary turpentine oil. It differs very considerably from Camphor (*Laurus Camphora*) oil imported into this country containing large quantities of Saffral.

Specific gravity at 15° C.=.856.

Optical rotation in a tube of 100 mm +29°.

It completely distils between 156°—160° C.

Upkeep of Economic Garden.

Vote for the year 1898 was, ...	\$1,500.00
Expenditure :—	
Salaries of Mandore and Coolies, \$1,346.00	
Tools and Stores, ...	70.65
Baskets, &c., ...	16.08
Manure, ...	37.50
Flower-pots, ...	23.00
Balance in Treasury, ...	6.77
	<hr/>
	\$1,500.00

Upkeep of Grounds at Government House and Domain.

Vote for the year 1898, ...	\$2,360.00
Expenditure :—	
Salaries of Mandore and Coolies, \$2,075.32	
Tools and Stores, ...	136.31
One Iron Label for the tree planted by Prince Henry of Prussia, ...	35.00
Cartage and Manure, ...	18.00
Flower-pots, ...	2.50
Buildings and Repairs (Plant house re-constructed), ...	70.00
Timber and Planks, ...	9.06
Shovel and Rubbish baskets, ...	13.08
Balance in Treasury, ...	00.73
	<hr/>
	\$2,360.00

Government House Grounds.

20. The Mandor SAMUEL having been dismissed a man of the name of ROGERS was employed and gave great satisfaction. The coolies worked well, and the grounds were kept in an excellent condition. The plant-houses were put in thorough repair, and a number of small trees were planted in spots where it was considered advisable to block out houses, or unsightly spots. During his visit to Singapore, PRINCE HENRY of Prussia planted a palm (*Oreodoxa oleracea*) on the lawn in front of the house.

H. N. RIDLEY,
Director.

Singapore, 10th February, 1899.

Botanic Gardens Department, Penang, 1898.*Waterfall Garden.*

In addition to the usual routine work of maintaining a public Garden in good order, considerable progress has been made in extending the area and developing the natural features of the grounds.

2. Outside the plant nursery a steep bank has been sloped, turfed, and the upper portion planted with ornamental flowering shrubs; and a further portion of the banks of the stream which intersects the garden has also been sloped and turfed.

3. Above the Office a new clearing has been made, one hundred and eighty feet broad, and extending up the hillside for a distance of two hundred and fifty feet, the whole sloped and turfed. On this land the best of the original trees have been left and where necessary others of an ornamental nature planted.

4. A carriage road seventeen feet wide has been made, and metalled, around the Band Stand where there was previously only a five foot path. It is not often the band plays in this garden as it is considered to be too far from town, but whenever it has done so some inconvenience has been experienced for want of room in which to draw up carriages. This has now been remedied.

5. In the vicinity of the Band Stand, nine new circular beds, twelve feet in diameter, have been made and planted with new orchid-flowering Cannas, one variety in each bed. The result of this massing of colour is very effective. Cannas do well here and an important feature is made of them. Planted out in heavily manured soil and liberally watered they are in full flower in two months and go on flowering for an indefinite period, but to grow them to perfection they require lifting and replanting after six or eight months.

6. Under the *Diospyros discolor* tree, opposite the Fernery and Orchid houses, rockwork has been constructed and the pockets filled with various kinds of ornamental plants in pots so that they can be changed or renewed at will. Permanent planting of rockeries under trees is never satisfactory, as the roots of the trees impoverish the soil to such an extent as to render impossible the cultivation, for any length of time, any but the most robust species of plants.

7. Outside the entrance to the garden, at the spot where building material for the hill Bungalows was formerly landed, and chair coolies congregated, a number of Crotons have been planted and fenced which when they grow up will be a decided improvement.

8. From this point to the Office, a distance of five hundred and twenty-five feet, the main entrance road has been remodelled and consolidated with the steam roller.

9. Three hundred and eighty-three lineal feet of side drains have been built with stones and Cement, and two cross drains on the main road bridged with Granite Slabs in place of wood which was becoming unsafe.

10. At the top of the grounds the old wooden bridge that spanned the main stream has been replaced by a substantial granite arch that is in keeping with the surroundings and will last for ever.

11. An additional room for herbarium specimens has been added to the office and the soil from the hillside that had to be cut away to make room for this building utilised in raising the ground in front. Sufficient material had been accumulated during previous years to fill this room at once. The arrangement is not yet complete but is sufficiently so to be useful for reference.

12. With the exception of the construction of stone bridge and herbarium which were budget items and carried out by the Public Works Department, all other expenses were paid out of the Vote for Maintenance of Waterfall Garden, and executed by the Garden Staff, the total expenditure being \$4,498.50 as shown in statement annexed (Appendix A.) Ironwork costing \$249.62 for re-roofing the Fernery was purchased and the work will be carried out this year. The Revenue from sale of plants and receipts from Swimming Bath amount to \$745.50 which has been paid in to Treasury account.

13. As great interest is being taken in Para Rubber and considerable capital invested in its cultivation, I have again tapped the best tree in the garden from which 11b. of rubber was taken during the rainy season in June, 1897. A sample of this was subsequently sent to Kew and through the kindness of the Director, submitted to Messrs HECHT LEWIS and KHAN for valuation who reported it as "beautiful rubber very well cured worth to-day (31. 8. 98) 3/3 per lb". This had simply been dried in the sun and kept in the office for about a year.

Being planted on dry gravelly soil this tree grows less rapidly here than those that are planted in moister and more suitable soil in Perak and elsewhere. At two-and-a-half feet from the ground it forks and the main stem measured at three feet from the ground in June, 1897, had a girth of 36 inches. Measured again in December, 1898, after an interval of eighteen months, it had increased five inches in girth and the cuts had quite healed up.

This tree is thirteen years old.

This time the tapping was commenced on the 16th November which is generally about the end of the heavy rains, but there is here no season that can be counted on as absolutely dry as in Burmah and India, and in fact rain fell frequently while the operation was carried on which was spread over a period of thirty-four days. Oblique cuts leading to perpendicular channels, was made in six places (subsequently increased to seven) at the bases of which were affixed by means of a lump of clay and a nail small tins to receive the latex. An ordinary carpenter's chisel was used for making and renewing the cuts, but both this and the tins can be improved on when the work has to be taken in hand by the practical planter. Earthenware glazed cups with a hole near the bottom so that the latex can be drawn off without removing them will effect a great saving in labour as much time is taken up in fixing the tins securely when removed every day, and some rubber is also lost in doing this. A better

cutting tool than an ordinary Chisel can also be devised for the work. At the beginning the milk comes slowly and at no time continues running for long. With two exceptions the cuts were renewed between 7 and 8 A.M. and the tins brought in at 11 A.M.; but the flow had always ceased before that time. The two exceptions were when the operation was performed in the evening, but as there is always a danger of rain during the night, and a very slight shower causes water to flow into the tins as nearly all the water trickling down the stem of the tree falls into the oblique cuts and is thence led directly to the tins the work is best done in this climate in the morning. Generally the latex had coagulated by the following morning, that is after standing about twenty hours, but on two occasions only partially so. In these cases, and also when rain water had got in the tins, a pinch of powdered alum was added which caused perfect coagulation in a short time. If the addition of alum does not affect the value of the rubber (and on this point I hope to be able to report later as samples have been sent to the Director of the Royal Gardens Kew with a view to ascertaining this) it facilitates working operations in wet weather, for a little water getting mixed with the latex does not matter provided the vessels do not overflow. All the rubber can be recovered by the addition of alum.

On the morning the incisions were first made only $\frac{1}{4}$ oz. of wet rubber was obtained, but by taking a thin shaving off the lower surface of the oblique cuts on fourteen subsequent occasions the following quantities were obtained at each operation in ounces:— $\frac{3}{4}$, $1\frac{3}{4}$, $3\frac{1}{4}$, $3\frac{1}{2}$, $3\frac{1}{4}$, 6, 9, $6\frac{1}{2}$, $8\frac{1}{2}$, 6, $6\frac{1}{2}$, 10, $8\frac{1}{2}$, 8. Total 5 lb $1\frac{1}{2}$ oz of wet rubber which weighed when dry exactly 3 lb. As will be seen from this the last three tappings gave a better result than any previous three and operations were only suspended as it was not advisable to make the cuts any wider. The time occupied in affixing the tins and renewing the cuts averaged half-an-hour on each occasion, or seven-and-a-half hours in all. It may therefore be taken that a man at say 30 cts. per day could attend to at least fifteen trees per day and that the cost of collecting will not exceed 10 cents. per lb. With larger trees and better appliances it will be probably much less. I have lately visited Bertam Estate in Province Wellesley where Mr. D. LOGAN planted about 2,000 young trees nine months ago and the growth is very satisfactory. From planters in Selangor I hear that the prospect is most encouraging the trees making very rapid growth. It is evident however that the land selected should be sufficiently drained to prevent the young plants being submerged for in one spot where this has happened at Bertam many have died, and those that are alive do not look nearly so well as others on slightly higher land.

14. Six plants of *Castilleja elastica*, kindly contributed by Mr. GERALD WATSON of Selangor, were planted on the 1st October and at the end of December had made shoots 1-2 ft. long. Previous to this there was no plant of this in the garden and it is too soon to form an opinion as to its suitability for cultivation here.

15. Seedling sugar canes, raised here, which were distributed last year, do not in the opinion of the planters promise to be of exceptional merit. A further distribution has been made this year, two cart loads going to Batu Kawan, of which we have not as yet received any report. I had hoped that some of the best seedlings growing in the Nursery would have flowered this season so that seeds of a second generation could be tried but not one has done so.

16. Of interesting new plants that flowered during the year *Boca paniculata*, Ridl. deserves the first place on account of the long time it continues to bloom. The flowers are of a good size about $1\frac{3}{4} \times 1\frac{1}{4}$ in. of a pleasing mauve-blue colour, borne on a panicle 3 ft. high. The first flower opened on the 26th June and it has been in continuous flower ever since and has at the present time (7th January '99) twenty open flowers and about forty buds. Individual flowers last 5-6 days and for three months the daily number of fully expanded flowers was from forty to fifty. On the 19th October before commencing to gather seed 1,160 capsules, open flowers, and buds were counted, but no account was kept after. This plant, the only one that has yet flowered out of a dozen, I found growing abundantly on the face of a limestone cliff, but in places difficult of access, in the Kinta District of Perak in 1894. I think it does not flower until at least four or five years old and that after doing so it dies.

17. *Didymocarpus cyanea*, Ridl; mss. of which a large batch from seeds have been flowering freely and attracting the attention of visitors is a new species from iKasoom, a place in Siamese territory about two hundred miles North of Penang. It is one of the most easily grown and striking of the genus. Several other new species of this order have flowered during the year, of which drawings have been made, among them two new *Didissandras* from Perak.

18. Among Orchids some novelties have been flowered as well as a great number of better known kinds from various tropical countries. Of those collected locally

I think the most interesting was a plant of *Tainia Maingayü*, H. K. F. which though previously described from dried specimens had not been, so far as I am aware, in cultivation. It has a scape 2-3 ft. high with 10-14 flowers 5-6 inches across, of a reddish brown colour, and lasts in flower five weeks. This is said to have been collected by Maingay in Penang but I have got it only in Perak and there in only one locality. *Liparis venosa* Ridl. is another charming little plant that flowered in the garden.

19. During a short trip to Perak in August a great number of living plants and seeds were collected, as well as specimens for the herbarium and distribution. A report on this trip was furnished the Hon'ble Resident Councillor on my return, a copy of which is annexed (Appendix B).

20. A successful Flower Show was held in the Town Hall in February, the gardens being considered too far off for the convenience of exhibitors, followed by a Promenade Concert on the evening of the second day.

21. Plants and seeds have been exchanged to about the same extent as in previous years and there has been the usual amount of correspondence on horticultural, botanical, and planting matters. Rubber is the subject in which a good number are interested and to as many as I have had an opportunity I have recommended the Kew Bulletin of October last containing information up to date on Para Rubber. All interested in the subject should get it. Seeds of this tree are in great demand and any quantity could be disposed of here at a good price.

Government Hill Gardens.

22. The Governor's Hill Bungalow garden has been maintained in fairly good order but Mr. O'KEEFE, the Overseer in charge, reports that frequent changes among the Tamil Coolies and the irregular attendance, especially immediately after pay day, causes much trouble and inconvenience.

23. From January to June the Garden was at its best both as regards flowering plants and vegetables, of which a pretty regular supply has been kept up. From July to the end of November but little can be done with flowering annuals and only a very limited number of kinds of Vegetables can be grown, on account of the heavy rains.

24. At the Flower Show held in the Town Hall in February, a nice collection of Vegetables from this garden was exhibited, the Leeks and Beet being specially noticeable and somewhat of a surprise to most of the visitors.

25. Burmese and other Orchids planted on the trees have flowered freely. *Vanda Coerulea*, which flowers during the rains, had on one of my visits in August over thirty flower spikes. Plants of *Azalea indica* obtained from Japan flowered well and deserve to be more extensively cultivated in the hill gardens.

26. Repairs to paths, rendered necessary by the heavy wash, is a constantly recurring demand on labour, and the slipping of banks during rains is by no means infrequent. Carrying water a long distance whenever there is a spell of dry weather is also a matter of great importance as regards labour. Taking these and other matters into consideration a larger staff is required, in proportion to the area of the grounds than in the Waterfall Garden.

Experimental Nursery.

27. During the past two years little has been done to the Experimental Nursery beyond keeping it clean. Two men only have been kept here and a portion of their time has been devoted to keeping clean the paths round the Convalescent Bungalow so that the actual expense is not much, but small as it is, it is scarcely worth keeping up.

28. It is conclusively proved, I think, that fruits &c. from temperate climes for which this Nursery was originally intended require greater elevation than is obtainable in Penang and the steepness of the site and nature of the soil render it unsuitable for the experimental cultivation of most kinds of plants.

29. A piece of level, or moderately level, land within easy distance of the Waterfall Garden for the introduction and trial of plants likely to be of commercial value would be a useful acquisition, but I know of no Crown Land available and the cost of purchase would be a considerable item. There is plenty of land within the limits of the present garden but it is all too steep for this purpose.

C. CURTIS,

Assistant Superintendent of Botanic Gardens.

APPENDIX A.

Revenue and Expenditure of the Botanic Gardens Department, Penang, 1898.

REVENUE.		EXPENDITURE.	
	\$ c.		\$ c.
Government Grant— Maintenance of Water- fall Garden, ...	4,500 00	{ Wages of Gardeners and Coolies, ... Tools and Material, ... Plant Tubs and Pots, ... Planks for Plant Cases &c., ... Attaps and Chicks, ... Plants, ... Manure and Cartage, ... Freight on Plants, ... Road Metal, ... Furniture for Office, ... Do. Herbarium, ... Iron for re-roofing Fernery, ... Periodicals and Book Binding, ... Miscellaneous Petty Expenses, ...	3,304 24 171 63 171 13 89 98 40 98 34 73 75 70 11 20 77 30 37 00 77 30 249 62 48 00 109 69
		Balance, ...	4,498 50 1 50
			4,500 00
Government Grant— Upkeep of Grounds of Governor's Hill Bungalow, ...	1,000 00	{ Wages of Gardeners and Coolies, ... Manure, ... Plants and Seeds, ... Pots and Tubs, ... Tools, ... Attaps, ...	696 60 150 30 49 29 34 30 61 74 7 40
		Balance, ...	999 63 37
			1,000 00
Government Grant— Expenses of carrying out Provisions of Coco-nut Trees Preservation Or- dinance, ...	700 00	{ Salaries, ... Inspectors Transport Allowance, ... Petty Expenses, ...	552 00 120 00 2 12
		Balance, ...	674 12 25 88
			700 00
Maintenance of Experi- mental Nursery, ...	200 00	{ Wages, ... Plants and Seeds, ... Tools, ...	161 50 20 46 17 31
		Balance, ...	199 27 73
			200 00
Travelling and Per- sonal Allowances, ...	330 00	{ Pony Allowance, ... Expenses of Botanical Tour, ...	240 00 88 75
		Balance, ...	328 75 1 25
			330 00
Plant Sales, ... Bath Receipts, ...	695 40 50 10		
Total	745 50		

APPENDIX B.

Notes on a Botanical Tour in Perak by the Assistant Superintendent of Forests, Penang.

Leaving Penang at 6 P.M., on the 29th July, I arrived at Teluk Anson the following morning at 8 A.M., just 5 minutes too late to catch the train for Ipoh where I proposed making my base for a few days.

As the next suitable train did not leave until 2.25 I drove out with Mr. L. HAWKINS to see the Coffee and Rubber plantation under his charge. The Coffee looks well although there had been an unusually long drought at the time of my visit. Given suitable soil the success of this cultivation in Perak is assured, but the present low price must be a great disappointment to those who invested heavily two or three years ago.

Para Rubber, with which a commencement has been made, and for which the soil appears to be adapted, look well, but a new enemy, supposed to be Mouse Deer, has taken a fancy to this tree and eats the tops off. All the plants so eaten sprout again still the check is considerable and if constantly repeated must eventually kill them. This is a factor that has not hitherto been taken into account in connection with this tree and shows that it will be necessary to keep the "lalang" and jungle growth clear, so that there be no harbour for these animals, until the tops of the trees are high enough to be out of their reach, or else to fence in the area to be planted.

The journey by train from Teluk Anson to Ipoh occupies about three hours and can hardly be called pleasant during the hottest part of the day. At Ipoh I took up my residence in the Rest House and the following morning started out to explore the neighbouring limestone or marble Hills. Quite close to the railway a Singapore Company have commenced quarrying marble and three Italians I was told, have been recently imported from Europe for this work. Many interesting plants were collected during the morning but the most interesting thing to me was the finding of several trees of "Gutta Rambong" (*Ficus Elastica*) in a truly wild state. Every one interested in the subject knows that "Gutta Rambong" is collected by Sahkis and brought in for sale, and the tree has long been recorded in botanical books as a native of Perak but curiously enough neither Mr. RIDLEY nor myself had ever collected this tree in the Peninsula. All that I had seen hitherto had undoubtedly been planted but these trees were growing high up on the rocks and had sent their aerial roots down the face of the cliffs.

Every tree I saw had been tapped, and in some cases tapped to death. I obtained leaf specimens only as none of the trees were in fruit. Another interesting plant from a botanical point of view, very abundant here, is *Lowia*, a genus named after Sir HUGH LOW, a former resident of Perak and a keen botanist.

On the 1st August I spent the morning in visiting some private gardens in Ipoh but gardening is not greatly to the fore in this town. Shade trees are badly wanted all over the place for walking or driving on those intensely white and hot roads during the heat of the day is killing. A half-hearted attempt at planting has been made in places but the fencing has not been sufficient to protect the trees from the ravages of goats &c. By the 9 A.M. train I went to Batu Gajah in hopes of seeing the District Magistrate and obtaining from him information as to getting men for going up Gunong Bujong Malacca &c., but being a public holiday he had gone to Ipoh. I took the liberty of inspecting his plant house and its contents, especially the plants brought down from Bujong Malacca. The European residences at Batu Gajah are beautifully situated commanding a fine view of the surrounding country.

In the hospital grounds I noticed the largest tree of *Jacaranda mimosifolia* I have yet seen. No doubt it is the same age as the oldest of those planted in Penang but it is much larger than any here. All the trees of this kind in this part of the world are I believe from seeds or plants distributed from the Penang Gardens and the oldest cannot be more than twelve years planted. There is also in the same grounds a fine clump of Palms and a Kayu Rue (*Casuarina*) that look somewhat different to typical *Casuarina esquisetifolia* of which I obtained seeds. On the 2nd August took the morning train at 6.40 to Sungei Siput and called first to see Mr. FORREST who is opening out land for Coffee, Coco-nuts &c. not far from the Station. However he had gone out and the boy said would not be back until the evening, so I retraced my steps through the village and proceeded along the Kuala Kangsar road so far as Kamuning Estate, though I did not at the time know what Estate it was. This seemed to be a favourable place for collecting so I worked around the edge of the clearing collecting living plants for cultivation and specimens for the herbarium

until it was time to return to Sungei Siput to catch the train for Ipoh. The Coffee on this Estate is the finest I have yet seen. Para Rubber planted alongside the road through the Estate do not appear to grow so well as they do in damper soil.

On the 3rd August I went out to some hills about three miles from Ipoh on the Gopeng road to the only habitat I know of *Habenaria Kingii*, an interesting orchid with greenish flowers. Of this I succeeded in getting some thirty plants and a few other things of interest. It is a difficult spot to work as all the rocks are surrounded by swamp. Since I last went along this road a good deal of Coffee has been planted and other smaller cultivations have increased considerably. Before going out in the morning I visited Mr. BARNARD who kindly presented two or three interesting plants for the gardens.

At 5.30 on the morning of the 4th I left Ipoh for Melimbau, a village near the foot of Gunong Kledang. In a rikisha it took half-an-hour to reach so that I was able to start collecting up the hill while it was still cool. There is a good road up the Kledang and a Government Bungalow near the top. The distance from the foot is four and a half miles. Going slowly and dipping into the jungle here and there it was near noon when we got to the top. The lower slopes of this hill have been cleared of all big trees for fire-wood or Charcoal and I noticed several wood-cutters at work. About half way up there occurs, and more or less from there to near the top, a magnificent Palm with a stem six or seven feet high and immense paddle-shaped leaves which the Malays call "Daun Sang'." I spent a lot of time in hunting for seeds of this but without success.

We dug up a few young plants, but Palms are always difficult to transplant and I do not expect to save more than one or two. "Daun Sang" occurs I am told all through this range, I saw some leaves used for the side of a native house at Sungei Siput, and if any one in the locality can send ripe seeds it will be a most acceptable contribution to the Penang Gardens. Near the top there grows a very pretty Indian Primrose (*Didymocarpus*) with orange flowers quite new to me and I believe undescribed. Palms of many kinds are a marked feature of the vegetation on this hill, "Rotans" and "Bertam" being very abundant.

On the 5th I packed all plants collected during the previous five days and forwarded them to Penang, and on the following day left for Kuala Depang. Kuala Depang is not the pleasant place it once was. This, the most charmingly situated of Rest Houses, has been turned into a Police Station.

There are, however, two rooms used by Government Officers when on duty, one of which I occupied for two nights before going up Bujong Malacca. It is a pity that this house should be occupied by the Police, for Government Officers, unless they are more fortunate or sounder sleepers than myself, cannot get much rest when in this place.

On Monday at 8 A.M., I left Kuala Depang with four Malays engaged on the spot, and my own man and boy from Penang, to ascend Gunong Bujong Malacca. The Malays were a very poor sample but as my time was limited I took the first that offered. We went on climbing slowly until about 11 A.M., when we came to a Chinese Kongsy-house at a place called "Kadongdong." Here the men decided it was time to stop and cook their rice and as the spot looked like a promising collecting ground I raised no objection but poked about among the boulders for an hour while they got "makan." Their style of hill-climbing suited me all right but would have been a frightful nuisance to anyone whose object was simply to reach the top.

After leaving this Kongsy-house, in which there are five men, at only a few minutes' walk distant there are two ways up to Ulu Palas, the one to the left being longer but not so steep. This we decided to take in going up and to return by the other. I was very pleased afterwards that the men told me of this longer route as it proved more interesting botanically than the other.

At about 3.30 (watch stopped) we arrived at another Kongsy-house in a large valley which the Chinese call "Amokong" and the Malays "Ulu Palas." The Palm "Palas" (*Licuala spinosa*) from which the stream takes its name, is very abundant along all the ridges of this mountain. In this mining Kongsy-house in which there are six men, but had apparently at one time been many more, we decided to spend the night and go to the top in the morning. After a brief rest I started out to examine and collect plants in the neighbourhood but the Malays were all asleep inside of ten minutes, and as they were at the other end of the house I saw nothing more of them until the next morning. Washing for tin has been going on in these streams for years and it is a bit difficult at this point to make out just exactly where the original water-courses came in, but so far as I could see there are at least three different streams which join at this spot.

Grubbing for tin has capsized trees in all directions so that it is easy to get to examine the orchids and various other plants growing on them. There had been no rain for some time previous to my visit and many of the smaller things such as filmy ferns both on rocks and trees were quite shrivelled up. Many larger plants of a succulent nature were hanging limp and languishing for rain. They got it before I left. During the night I thought the matter over and came to the conclusion that if I took my bedding, provisions, &c. to the top and slept there it would take the kind of men I had a long time to get up, and I should get but few plants carried. Consequently I decided to leave my boy with all the things at the Kongs-house, take all the men out with me to carry plants and return at night.

From this point none of the men knew the path to the top, but they knew that higher up the stream, there was one more Kongs which if we could find some information could be obtained so we kept to the stream until we struck it. Here some of the men spoke Malay and one came with us to show the path until a point was reached, after which there could be no mistake.

There is a pretty stiff bit before getting on to the last ridge but the whole distance from Kuala Depang to the top could be done in a day by one in pretty good training and desirous of doing the thing quickly. The height I was told is 4,090 feet but judging from the vegetation I should have thought it more. The hut on the top is in excellent order and water is obtainable at a much less distance from the top than I expected. We remained on the top for about an hour, admiring the view and refreshing the inner man, after which we commenced to retrace our steps and collect things spotted on the way up.

Up to this time I had not seen a spot of rain since leaving Penang but during the night it came on heavy and as the Kongs-house leaked like a sieve, things were a bit uncomfortable. On the way down we got another thorough soaking so that by this time the vegetation will be looking much better than when I was up. Altogether it is a most interesting mountain. On the top there are a great number of the fir tree that grows on Government Hill "Kayu Rue Bukit" (*Dacrydium elatum*) but they are smaller and more stunted. Most of the Orchids have rather insignificant or dull coloured flowers but they are very abundant. Some of the ground Orchids are of great interest. Two kinds of Rhododendrons, a pitcher plant, and scores of other things of great interest were noticed and collected. All the way up Palms abound, but the animals, monkeys I think, manage to get all the seeds before they are quite ripe. On the rocks are an abundance of Ferns, Begonias, Indian primroses and other small-growing plants in great variety. Having a day to spare after coming down, I tried Bujong Malacca again from the Kuala Depang Valley side. It is much steeper than the usual path to the top and I did not find anything strikingly different to what I had already collected the previous days. On the morning of the 12th I went out to some rocks near Kuala Depang to get a Begonia and one or two other things noted previously and later in the day went on to Kampar, where I remained the night in the Rest House.

Arrived in Penang on the morning of the 14th.

C. CURTIS.

REPORTS ON THE OPERATIONS UNDER "THE COCO-NUT TREES PRESERVATION ORDINANCE," DURING 1898.

Singapore, 18th January, 1899.

THE Inspector and Tree-climber made daily visits to the various coco-nut tree plantations saw-mills and tanneries. Three hundred and fifty-four (354) notices were served on persons owning infected or dead trees, or piles of cow-dung, saw-dust, refuse, tan-bark or other vegetable refuse containing beetles, and 1,636 trees and forty piles of saw-dust and tan-bark, etc. were destroyed. A hundred trees for which no owner could be found were destroyed by coolies employed by the Department, and more would have been done on abandoned lands near Balestier Plain and Gélang had the vote permitted it. There were twelve prosecutions for non-compliance with the notices, and fines to the amount of \$28 were inflicted. Some trouble was caused by the persons prosecuted, who would, on receipt of the summons, cut down a single tree and apply for further time as the work was not finished. The Magistrate would grant an extension, and no more work would be done till a second summons was taken out, when the owner would either ask for a further extension of time, or quickly cut down the trees and state in Court that the work was done, when the case would be dismissed without any penalty being inflicted. Meanwhile his neglected trees were infecting those of his neighbours. The attention of the Magistrate being called to this trick, it was put a stop to.

Vote for 1898,	\$350.00
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Expenditure.

Salaries of Inspector and Tree-climber,	...	\$238.45
Extra coolies employed temporarily,	...	14.00
Transport,	...	93.52
Uniform,	...	3.50
Balance,	...	0.53
		<u>\$350.00</u>

H. N. RIDLEY,
Director.

RESIDENT COUNCILLOR'S OFFICE,
Penang, 4th February, 1899.

SIR,—I have the honour to forward a return furnished by the Assistant Superintendent of Forests of the operations of the department under "The Coco-nut Trees Preservation Ordinance."

2. Mr. CURTIS thinks that there is enough work in the Province to keep the Inspector employed all the time.

3. No return is kept of the number or kind of beetles destroyed, as this is not done by the department, the duties of the staff being confined to inspecting plantations and warning and prosecuting the owners.

I have, &c.,

J. K. BIRCH,
Acting Resident Councillor.

*The Hon'ble
the Colonial Secretary, S. S.*

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Information furnished by the Inspector under "The Coco-nut Trees Preservation Ordinance," for the Annual Report of the Assistant Superintendent of Forests, Penang, for 1898.

No. of dead Coco-nut Trees destroyed.	No. of Coco-nut Trunks destroyed.	No. of Dung-heaps destroyed.	No. of heaps of Padi-husk destroyed.	No. of Notices issued.	No. of Summonses issued.	Amount of Fines recovered.	Remarks.
<i>Penang District.</i> 581	2,824	233	33	584	16	25 00	4 Summonses cautioned and discharged.
<i>Balik Pulau District.</i> 248	1,103	102	16	233	5	11 50	
<i>Province Wellesley, Northern District.</i> 702	1,449	118	44	512	31	40 00	2 Summonses withdrawn and 4 discharged.
<i>Province Wellesley, Central and Southern Districts.</i> 208	376	70	28	160	9	8 50	3 Summonses more not yet come for hearing.
1,739	5,752	523	121	1,489	61	85 00	

C. CURTIS,

Assistant Superintendent of Forests.

Penang, 21st January, 1899.

RESIDENT COUNCILLOR'S OFFICE,
Malacca, 23rd January, 1899.

SIR,—In reply to your letter C. S. 477/99 of the 16th instant, I have the honour to inform you that no operations have been carried on under "The Coco-nut Trees Preservation Ordinance" for several years in this Settlement.

2. The Settlement is, I am glad to say, practically free from beetles.

I have, &c.,

C. W. S. KYNNEERSLEY,
Acting Resident Councillor.

The Hon'ble
the Colonial Secretary, S. S.

STRAITS SETTLEMENTS

ANNUAL REPORT

ON THE

BOTANIC GARDENS

FOR THE YEAR

1899

BY

H. N. RIDLEY, Esq.,

Director.



PUBLISHED BY AUTHORITY

SINGAPORE :

PRINTED AT THE GOVERNMENT PRINTING OFFICE.

1900

11/15

1899

Annual Report of the Botanic Gardens, Singapore.

Staff.

1. Mr. CURTIS, Assistant Superintendent of the Penang Botanic Gardens, having gone home on leave in May 1st, it was necessary to send Mr. FOX to Penang to act for him during his absence. He left for Penang in April 26th and returned November 6th. The plant-collector, TALKA, left early in the year and was replaced by a Malay KASDANI. The apprentice SIMON left at the same time. The coco-nut trees inspection coolie PACKAY, who had been employed for ten years, died of small-pox, and was replaced by a Malay, and an extra coolie was employed for part of the year in cutting down dead and dying trees on abandoned coco-nut estates. The coolies worked well and there was no difficulty in obtaining as many as were required. The beri-beri which had been troublesome among them for the past two or three years entirely disappeared on the destruction of the old cooly lines and there was hardly any sickness of any kind among them after the new lines were built.

Visitors.

2. The number of visitors was as large as usual, and a good number of scientific botanists, planters and others interested in botany visited the gardens. The Regimental band played on moonlight nights and was much appreciated. There were but few thefts and those of a very petty nature and there were no prosecutions.

Flower Show.

3. A most successful exhibition of flowering plants, ferns and begonias was held in the Town Hall in April. The display of flowers and especially orchids was much finer than on any previous occasion.

Aviaries.

4. The following animals and birds were added to the Zoological collection:—One leopard cat (*Felis bengalensis*) presented by Captain MCGILL, and one by the Hon'ble W. EGERTON; one slow loris (*Nycticebus tardigradus*) presented by Mr. R. O. H. DAWES; one Chinese fox (*Canis* sp.) presented by the Officers of H. M. S. *Phoenix*; unfortunately it died in an epileptic fit brought on by excitement, to which these animals when young are subject; one Russian fox (*Canis vulpes*) presented by the Russian Consul; six white rats (*Mus decumanus* var) presented by Mr. YO CHO POK; one black buck (*Antelope cervicapra*) presented by Captain HARDCASTLE; one *Cervus hippelaphus* from Java presented by J. CARROLL Esq.; one *Fabiru* presented by Mr. YAP WAT; three water hens (*Erythra phœnicura*) presented by Mr. ST. V. B. DOWN; three black swans presented by the Sultan of Johore; one owl (*Huhu orientalis*) purchased; three kangaroos from West Australia presented by Mr. LE SOUEF, but unfortunately they succumbed to the excessive wet of our climate. A common python was presented by Mr. ERSKINE, and two tortoises from Selangor by Mr. GOODENOUGH. A common monkey, a hybrid monkey, a deer, a kijang and a halanger were born as well as a litter of green vipers, *Lachesis Wagleri*.

Plants received.

5. During the year there were received 325 packets and bags of seeds, 300 plants and 1,327 bulbs and tubers. Among which may be specially mentioned a large number of Lily bulbs from Japan, a new Ginger from German East Africa, *Amorphophallus Titanum* (presented by Mr. BUTTIKOFER), and among plants of special economic interest. *Willughbeia edulis* (from Saigon and Calcutta) *Caryocar nuciferum* from Kew. *Dichopsis Krantziana* (Saigon) *Gutta percha* from Saigon, *Mascarenhaisia elastica* from Madagascar, a new rubber, (Botanic Gardens, Berlin) five varieties of Ramie (Mr. BLUNTSCHLI); an unusually large variety of Papaya (Mr. DARBY).

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The contributors were:—

Dr. Rabe.	Mr. St. V. B. Down.
Mr. Meikle.	Messrs. Dammann.
Mr. G. Penney.	Mr. Pereira.
Prof. Cornu.	Mr. Schalz.
Right Reverend Bishop Hose.	Mr. F. Pears.
Mr. T. H. Tressider.	Mr. C. Baxendale.
Mr. E. Buttikofer.	Mr. Robert Little.
Mr. Micholitz.	Mr. Bluntschli.
Mr. Chatterjee.	Mr. Derry.

Mr. Goodenough.

and the Botanic Gardens of Saharunpur, Nagpur, Calcutta, Tokio, Saigon, Jamaica, Trinidad, British Guiana, Brisbane, Adelaide, Sydney, Melbourne, Cape Town, Berlin and Kew.

Messrs. CARTER also supplied as usual the flowering Annuals.

Of ornamental or interesting plants, 156 packets of seeds and 114 plants were sent out to various gardens and private persons in exchange, and a considerable number were also purchased by residents, passengers, and others. The chief demand at present is for palms, of which a large stock has to be kept up to supply the demand. Plants and seeds were sent to the gardens of Kew, Calcutta, Saigon, Brisbane, Buitenzorg, Peradeniya, Old Calabar, West Australia, Edinburgh, Melbourne, also to Messrs. LOHER, CHATTERJEE, DAMMANN and WALTER.

Plants in Flower.

6. The following were among the more interesting of the plants which flowered for the first time in the Gardens, *Bauhinia Vahlia* (India) *Grias cauliflora*, the anchovy pear (West Indies) *Begonia sinuata* (Penang) *Begonia* sp. tuberous-rooted (Lankawi) *Plumiera acuminata* (South America) *Adina rubescens* (Singapore) *Tabernaemontana crassa* (West Africa) *Ceropegia lucida* (Penang) *Sarcanthus rostellatus* n.sp. (Perak) *Calogyne uniflora* (Assam) *Tainia fuscoviridis* (Assam) *Costus pictus* (South America), *C. globosus* (Singapore) *Ludovia crenata* (South America) *Musa violascens* (Selangor). *Tupistra grandis* n.sp. (Perak) *Raphia ruffia* (Madagascar) *Anthurium strictum* (South America) *Aglaonema vittatum* n.sp. (Sumatra) *Amorphophallus Titanum* (Sumatra). *Bowenia spectabilis* (Australia).

Upkeep and Buildings.

7. The borders, beds and shrubberies were cleaned and replanted, many additional ornamental trees and shrubs planted in various parts of the gardens and dying or dangerous trees removed, and a few new small beds and borders were made. The most important building put up was the new Cooly Lines. The old lines were not only in a dangerous state of decay, but so infected with beri-beri that they were no longer fit for habitation and a large new building measuring 120 feet in length and 36 feet in breadth, on brick pillars well raised above the ground was built in another spot, at a cost of 1,206 dollars and the improvement in health of the coolies was immediately noticeable. The watchmen's quarters were also rebuilt. The fern house and the anthurium house were re-roofed.

Artist.

8. Early in the year CHARLES ALWIS from Peradeniya was engaged to make drawings of interesting local plants for the Flora of the Malay Peninsula but did not take up the appointment, and Mr. D. N. CHOUDHURY formerly employed in the Botanic Gardens, Calcutta, was engaged. He arrived on July 22nd and has been employed for the remainder of the year in making drawings.

Vote	...	...	\$ 700.00
Expenditure			
Salary of Artist	...	...	287.09
Materials	...	...	38.60
Balance	...	...	374.31
			<hr/>
			\$700 00

Herbarium.

9. Owing to the absence of the Assistant Superintendent for a considerable part of the year, it was impossible to make any botanical excursions, and comparatively few specimens were added to the herbarium. During my annual visit to Penang, the Dindings and Selangor, I obtained a small collection of plants, Mr. CURTIS sent 136 specimens from Penang, Mr. FOX collected some plants in Penang and also in the Thaiping Hills, including a pretty new *Dendrobium*; Mr. DERRY sent also a number from Perak, Mr. GOODENOUGH sent 240 from Selangor, and Mr. MICHOLITZ presented specimens from Labuan.

The plant-collector was sent to Selangor but obtained very little. A hundred specimens of Australian ferns were received in exchange from the Sydney Botanic Gardens.

Duplicate specimens for naming or exchange were sent to various establishments and botanists, *viz.*, 221 specimens to Kew, 439 to Calcutta, 67 to the British Museum, 1,130 to Dr. GANDOGER in exchange for books, 400 to Sydney Museum, 44 ferns to Dr. CHRIST, 30 to the Pharmaceutical Society and 105 mosses to Mr. MITTEN for naming. A number of fungi were sent to Kew, and named by Mr. MASSEE who found a large proportion of new species among them, which were described in the Kew Bulletin.

Five pounds of the bark of *Roucheria Griffithiana* "Ipoh Akar Putih," supposed to be poisonous and used in the Sakai dart poison were sent to Dr. GRESHOFF for examination.

A few specimens of woods were obtained and added to the collection, and a specimen of the Gutta of *Dichopsis Maingayi* from Jelebu was presented by Mr. GUNN.

Library.

10. The following books were added to the Gardens Library during the year:—

Hiern and Rendle.—Catalogue of Welwitsch's African plants vol. iii presented by the Trustees of the British Museum.

Trimen, Dr.—Handbook of the Flora of Ceylon, vol. iv.

Dyer, Sir W. T. Thiselton—Flora of Tropical Africa, presented by Royal Gardens, Kew.

Lhotsy, I. P.—*Cinchona Calisaya* and *succirubra*, *

Maiden, J. H.—A preliminary study of Prickly Pears, *

" Indigenous vegetable drugs, i. ii., *

" Tracts on New South Wales, *

" A variety of *Panicum decompositum*, *

" Notes from the Botanic Gardens, Sydney, *

" Observations on Eucalypti of New South Wales, *

" The Weeds of New South Wales, *

Christ, Dr.—*Pteridographische Notizen*, *

" *Fougères de Mengtze, Yunnan*, *

" *Monographie de Elaphoglossum*, *

" *Enumeratio de quelques Fougères*, *

Raciborski, M.—*Biologische Mittheilungen aus Java*, *

" *Weitere Mittheilungen*, *

" *Pseudogardneria*, *

" *Pflanzen pathologisches aus Java*, *

" *Einigen Demonstrationen's versuche mit Leptomia*, *

Heine, Dr.—*Biologic relations between ants and plants*, *

Medley-Wood, J.—*Natal plants*.

Berg, Dr. C.—*Comunicaciones del Museu Nacional de Buenos Ayres*.

Riviere, Ch.—*Notes on Ramie*, presented by Mr. SOUTH.

Galbraith, S. J.—*Vanilla culture*, †

Chesnut, R.—*Thirty poisonous plants of North America*, †

Merriam, C. H.—*Lifezones and cropzones of North America*, †

" *North American Fauna*, †

Trelease, W.—*Botanical opportunity*, †

Beal, E. L.—*Cuckoos and shrikes*, †

Bailey, L. H.—*Factors of organic evolution*, †

Plumb, C. S.—*Geographic distribution of Cereals*, †

* Presented by the Author.

† Presented by the Department of Agriculture, U. S. A.

- Carleton, F. A.—Cereal diseases of the United States, *
- Galloway, B. T.—Potato diseases and their treatment, *
- New Spraying Devices, *
- Loew, O.—Cigar leaf tobacco, *
- Murray, John—General conditions of existence and distribution of Marine organisms, †
- Gage, S. H.—Processes of life revealed by the Microscope, †
- Gill, Theo.—Some questions of Nomenclature, †
- Schweinitz, E. A.—War with the Microbes, †
- Huffaker, E. C.—Soaring Flight, †
- Miall, L. C.—Life History studies of Animals, †
- Hamy, E. T.—Royal Menagerie of France, †
- Thayer, A. T.—The law which underlies protective coloration, †
- De Haan, J. V. B.—Mededeeling—Tabak's Aaltje, †
- Bijlert, Dr. A. V.—Oenderzoek van Deli Tabak, †
- Kramers, J. G.—Andere Mededeeling over Koffie, †
- Cameron, J.—Report of a visit to Coorg, †
- Moore, C.—Census of plants of New South Wales, †
- Wildeman, E. de, and Durand, Ih.—Illustrations de la Flore de Congo, †
- Flore Algologique, †
- Annales de Musée de Congo, †
- Gandoger, M.—Flora Europæ, 27 vols., §
- Flore Lyonnaise, §
- Rosæ novæ, §
- Essai Nouvelle classification des Roses, §
- Decades Plantarum Novarum, §
- Tabulæ Rhodologicæ, §
- Sebire, R. P. A.—Plantes utiles de Senegal, ||
- Clouth, Fr.—Gummi Gutta percha and Balata, ||
- Massee, G.—Text book of Plant diseases, ||
- Dyer, Sir W. T. T.—Dipterocarpeæ, ||
- Hegelmaier, F.—Monographische Untersuchung der Lemnaceen, ||
- Collingwood, L. C.—Nutmeg and other cultivation in Singapore, ||
- Cogniaux and Goossens—Dictionnaire Iconographique des Orchidees (*continuation*).

Also the following publications were presented to the Library by the various Gardens and Institutions which publish them. Indian Museum Notes, Tropenpflanzen, Chemist and Druggist Agricultural Ledger, Planting Opinion, Report of the Secretary of Agriculture of the United States, Experimental Station Records, Experimental Farm Reports, Ottawa Transactions of the Botanic Society, Edinburgh, Annual Reports of the Botanic Gardens of West Australia, Missouri, Queensland, Old Calabar, New South Wales, Queensland Acclimatization Society, Jamaica, South Australia, Mysore, Calcutta, Grenada, Trinidad, Hongkong, Forest Reports of Madras, British Guiana, Ceylon, Zanzibar, Victoria Zoological Acclimatization Society, Notizblatt of the Botanic Gardens, Berlin, Bulletin Economique de l'Indo-China, Botanic Museum Haarlem. Year book of the U. S. A. Department of Agriculture. Reports of the Botanic Survey of India, Perak Museum Notes, Calcutta Gardening Circular, Forester of U. S. America, Icones Bogoricensis, Bulletin of Buitenzorg, Journal of Agriculture of Zanzibar and Cape of Good Hope, Journal of the Board of Agriculture, Kew Bulletin, Icones Plantarum, Merck's Digests, Report of Selangor Forest Department, Perak Museum Notes, Report of Selangor Planters Association. Ceylon, Jamaica and Trinidad Bulletins, Annals of the Botanic Gardens, Buitenzorg. Journal of the Linnean Society.

While the following journals were purchased as usual:—Botanical Magazine, Tropical Agriculturist, Gardener's Chronicle.

Economic Gardens.

11. A considerable space of ground on the top of the central hill was cleared and dug over for planting gutta percha, and it was planted in part with gutta percha, a row of Suntai *Bassia* sp. from Sumatra which produces an inferior Gutta and a number of plants of Saigon Gutta, *Dichopsis Krantziana*, almost all are growing well.

It was found advisable to make a cart road through the Garden, as the present roads are too narrow for carts to go safely through, when finished it will also make

* Presented by the Department of Agriculture, U. S. A.
† Presented by the Smithsonian Institute
‡ Presented by the Author.
§ Received in exchange.
|| Purchased.

a pleasant drive for carriages. The proposed route starting from the Dalvey Road entrance passes along the base of the central hill and joins the Cluny Road at the main entrance. The first part of the road has been cleared and levelled, the scrub between the boundary and the arboretum being felled, the ground levelled and turfed. It is hoped to complete the road this year, but the vote will not permit of its being laterited at present. A large number of useless, dead and dying trees were cut down and removed, including two large *Erythras* which were killed by lightning.

Para-rubber.—The demand for this plant shewed no signs of diminution, and the crop of seed supplied by the trees was larger than ever, no less than 157,652 seeds and 4,930 plants being distributed. The larger amount of crop was due in part to the adoption of the plan of gathering the fruit by hand, without waiting for the seed to fall, so that a quantity which was formerly lost by falling upon the roads and into the streams was saved. It was found that the coolies soon learnt what fruits were ripe, and there were no losses from gathering immature fruit. The whole crop amounted to 157,652 seeds and 4,930 plants.

They were distributed as follows:—

Singapore	600 seeds and	30 plants.
Malacca	75,951	900 "
Selangor	70,707	800 "
Perak	7,271	"
Johore	1,850	1,800 "
Borneo	1,273	"
Pahang	"	1,400 "

Seedling plants were less in demand, the planters preferring seed as easier to ship and cheaper; stumps however, *i. e.*, plants of one or two years' old and ten or fifteen feet tall were much in request. Younger plants when planted out are found to be attacked by all manner of pests, deer, mouse-deer, crickets, grasshoppers, wild pigs, snails and even crabs are reported as doing much damage by biting off the tops.

Ramie.

12. Comparatively little was done in Ramie this year, and the cultivation in the Peninsula is not increasing to any extent. Plants of various strains from China, Java, and Sumatra were presented to the Gardens by Mr. RANKINE and Mr. BLUNTSCHLI, over six thousand plants and cuttings were distributed.

Sago.

13. A large number of seeds and plants were sent to Saigon, where it is proposed to introduce the cultivation.

Of other economic plants, Coca, Patchouli, *Coffea stenophylla*, Nutmegs, Gambier-seed, Pineapples, and fruit trees, were distributed. A large number of seeds of timber trees, Tembusu, *Eugenia grandis*, *Pithecolobium bigeminum*, *Albizia Moluccana*, etc., were supplied to the Forest Department, Selangor.

14. Of economic plants new to the Gardens there were received from Saigon, plants of *Dichopsis Krantziana*, an inferior Gutta percha from Cochin-China, *Wilughbeia edulis*, one of the Getah grips from Assam, which produces an edible fruit and an inferior rubber, *Urceola elastica*, from Penang, one of the best local rubbers. *Landolphia* sp. from Trinidad, (sent from Kew). *Mascarenhaisia elastica*, a rubber plant from Madagascar sent from Berlin, *Vanilla pompona* (Mexico) and seeds of the Butternut *Caryocar nuciferum* from Kew; seeds of *Psoralea corylifolia* (a green soiling plant) and good strains of Castor-oil were sent from Calcutta.

Gutta Percha.

15. The diminishing supply of this product has caused some anxiety among the consumers, and the cultivation of the plant has been strongly urged by the Colonial Officer. Steps are now being taken to carry this out on as large a scale as possible. It is now very difficult to procure seed owing to the destruction of all the larger wild trees by the gutta-collectors, so that there are few trees of sufficient size to produce fruit left in accessible parts of the Peninsula, stumps and cuttings are however still procurable from the Peninsula and from Borneo. Mr. DUNLOP procured a large number of cuttings of *Dichopsis* from Borneo which he brought to Singapore. These were dry looking sticks about 8 inches or a foot long of various thicknesses, some being half an inch through, but most were smaller. They had been coated in black mud and packed in bundies in gunnies. These were planted in good soil in the Botanic Gardens, shaded and watered and a number produced shoots and roots, and

have been since planted out in the Garden, and in the Bukit Timah forest reserve. A very large proportion did not grow, and those that did were very irregular in the time of growth, some struck almost at once, others delayed for nearly a year. Enquiries elicited the fact that a considerable proportion had been cut no less than seven months previously, and kept dry all that time. Those that had been cut only two or three months previously grew readily. Among those that came up it was noticed that there were not only *Dichopsis oblongifolia*, but also *D. calophylla* known as Niatoh Waringin in Borneo, a very handsome plant stated to supply a very superior gutta. This species seems to grow better and faster than *D. oblongifolia*. There was also a plant of Getak Sundik, *Payena Leerii*, the white Gutta percha, which grew very rapidly. A number of cuttings of *D. oblongifolia* were also presented to the Gardens by Mr. PEARS of Muar, which seem likely to do well. It seems probable that owing to the difficulty of procuring seed, the system of growing from cuttings will be the most suitable system for cultivation. It is noticed that the small and thin cuttings either do not strike or if they do throw up shoots they soon wither off. The shoots often attain considerable growth before any roots appear on the cuttings, and frequently quite a bushy little plant has only one or two very thin root-lets. This slow development of roots probably accounts for the damping off of apparently strong plants on their being planted out.

Plant diseases.

16. I visited in the spring the districts in Selangor which were affected by the plague of the Coffee caterpillar *Cephonodes Hylas*, and remained at Kuala Lumpur for a few days examining into the life history and habits of the insect, and trying experiments on it. These investigations with those made by Mr. A. L. BUTLER will be described in a Bulletin now in course of printing. A number of injurious insects were sent to the British Museum for identification, and were named by Mr. WATERHOUSE, they included the Banana Weevils, *Sphenophorus sordidus*, Rose sawfly *H. ylesinus* *Victoriæ* and others of which accounts are being printed in the New Bulletin.

A very injurious fungus was found attacking the roots of a fig-tree in one of the shrubberies. It spreads all through the ground and destroyed almost every plant for a considerable distance round the tree. Specimens sent to Kew were discovered to be a species of *Rosellinia*, a genus of most deadly root-fungi. The diseased plants were dug up, and all roots, twigs, etc., affected burnt, the ground was dug over and lime and copper sulphate (Bordeaux mixture) freely applied, which arrested the growth of the fungus and quite exterminated it. Bordeaux mixture was also used on Clove trees suffering from a leaf-fungus, the trees being syringed with the solution, with excellent results.

Vote for Economic Gardens	...	\$2,200.00
<i>Expenditure :—</i>		
Salaries	...	\$1,857.72
Manure	...	59.65
Pots and Tubs	...	69.60
Ataps, lime and bricks	...	25.00
Tools	...	141.89
Balance	...	46.14
		<hr/>
		\$2,200.00

Forestry.

17. I visited Penang and the Dindings in the spring, and inspected the forest reserves in part in both places. In December, while in Malacca, I inspected the Gardens at the Ayer Keroh Reservoir, and went over much of the ground which has been marked out for the planting of Gutta percha and India rubber. The various plants in the Gardens, mostly sent from the Singapore Gardens are growing with remarkable vigour, chiefly noticeable are the Para-rubber, *Ficus elastica* and Ceara-rubber. The soil here is gravelly and dry and seems to suit this latter plant very well. It grew absolutely faster than the Para-rubber, and there were one year old trees 10 or 12 feet tall with a stem three inches through at the base. Its latex seemed rich in rubber, and it may prove an useful cultural plant in dry upland gravelly places where little else will grow. *Ficus elastica* was also very thriving, and this plant is becoming, I am informed, popular with the Chinese. The Hon'ble Resident Councillor showed me an excellent sample of rubber taken by Chinese from three year old trees. The country round the waterworks formerly covered to a large extent with

lalang is now nearly covered by secondary jungle, the difference in one year being very marked. The most useful tree in expelling lalang is the Leban, *Vitex pubescens*, which not only kills it out but also is useful as supplying a good building timber. The Tampinis planted here some years ago have grown into trees of considerable size, but for want of pruning have as usual branched too much to supply good beams at present.

At Bukit Timah about three acres of land at the base of the hill, were cleared of scrub, dug and planted with *Gutta percha* plants. The Bilian trees formerly planted here were freed from the overcrowding jungle, and the Merbau and other trees cleaned, and dug round, Para-rubber, Tembusu and other trees were planted round in suitable places.

The Para-rubber trees at Bukit Mandai were inspected and the grass cleared round them. They have made fair growth but have not yet fruited. A special vote of 455 dollars was granted for the Bukit Timah and Bukit Mandai planting.

Vote	...	...	\$455.00
<i>Expenditure:—</i>			
Salaries of Coolies	...	218.61	
'Rikisha for Mandor	...	35.70	
Cart hire	...	7.50	
Plants	...	25.00	
Balance	...	168.19	
			<hr/>
			\$455.00

Coco-nut Trees Inspection.

18. An additional cooly for cutting down the trees on abandoned and Government ground was employed from April to the end of the year. He destroyed three hundred and eighty-two trees at Teluk Kurau, Gelang Road and Ballestier Road. The old tree-climber having died, he was replaced by another named OSMAN in May. One thousand and eighty-six diseased coco-nut trees, thirty-eight stumps and ten piles of decaying vegetable matter were destroyed during the year. There were no prosecutions under the ordinance.

Vote	...	...	\$450.00
<i>Expenditure:—</i>			
Salaries of Inspector and Coolies	...	299.46	
Transport	...	112.78	
Uniforms, etc.	...	17.45	
Balance	...	20.31	
			<hr/>
			\$450.00

Government House Grounds.

19. The Gardens were kept up in a good condition by the Mandor ROGERS, and the coolies worked well and there were no complaints. The beds in front of the house were bright with Cannas for most of the year. The hedges were repaired all round, but great difficulty was experienced in keeping natives from breaking them down. The plant-houses were re-attapped, and two iron arches were erected to carry plants of *Ipomea Horsfalliae*.

Vote	...	...	\$2,360.00
<i>Expenditure:—</i>			
Salaries	...	2,052.96	
Pots and Tubs	...	82.64	
Planks and Ataps	...	50.33	
Tools	...	149.22	
Balance	...	24.85	
			<hr/>
			\$2,360.00

BOTANIC GARDENS, SINGAPORE.

Statement of Receipts and Expenditure, for the year 1899.

RECEIPTS.		EXPENDITURE.			
	\$ c.	<i>Salaries.</i>	\$ c.	\$ c.	
By Balance in Bank ...	1,254 69	Clerk ...	247 00		
" Government Grant ...	8,500 00	Mandore ...	251 74		
" Sale of Plants, Seeds and Flowers ...	4,605 76	Carpenters, (three) ...	360 70		
" Interest ...	26 55	Masons, (two) ...	150 85		
		Label Printer ...	120 00		
		Plant-collectors, (two) ...	126 79		
		Peon ...	97 00		
		Aviary-keeper ...	92 20		
		Police ...	348 00		
		Coolies ...	3,344 29		
		Rice Allowance ...	652 58		
				5,791 15	
		<i>Bills.</i>			
		Tools and Stores ...	503 81		
		Laterite, Gravel, Sand, etc. ...	336 26		
		Timber, etc. ...	433 99		
		Pots and Tubs ...	371 07		
		Birds' and Animals' Food ...	1,466 47		
		Manure and Cartage ...	249 10		
		Buildings and Repairs ...	1,301 84		
		Freight on Plants ...	124 81		
		Books, Papers, etc. ...	233 66		
		Plants and Seeds ...	125 00		
		Subscription to Telephone ...	97 50		
		Wardian Cases, etc. ...	42 00		
		Petty Expenses ...	200 39		
		Miscellaneous ...	218 53		
				5,704 43	
		Balance ...	...	11,495 58	
				2,891 42	
				\$14,387 00	
	\$14,387 00				

Botanic Gardens, Penang.

Waterfall Garden.

There has been no change in the permanent staff, but Mr. W. FOX was in charge from the 1st May to the 31st October during my absence on leave.

2. Mr. FOX says that owing to exceptionally heavy rains during that time, which caused much damage to roads and paths, and several land-slips, nearly all the available labour was required in repairing and maintaining the roads and grounds in decent order and prevented the carrying out of improvements or extension to any great extent.

3. The most important work of improvement during the year is the reconstruction of the Fern Shed in iron. Most of the material for this was purchased out of the 1898 Vote and the work of erection carried out by the Garden Overseer and coolies. It is a great improvement on the old wooden shed and will be easier and less expensive to maintain in the future.

4. The approach to the granite bridge built in 1898 has been raised and metalled. Three hundred and nine feet of side drains built in rough masonry, and other minor improvements to roads carried out.

5. The large iron plant shed near the entrance has been re-covered with "Chicks" and continues to be one of the most interesting features of the Garden. Many of the local tree ferns and other plants have attained a large size and an appearance such as is seldom seen when grown in pots.

6. As in previous years, Cannas have been an important feature among flowering plants. All the beds were replanted and heavily manured in April and have been in continuous flower right through the wet weather when most other flowers are scarce.

7. A large batch of *Convolvulus* grown in pots were very attractive during the early part of the year owing to their great range of colour. The seeds were obtained from Japan and said to be seeds of double forms, but the nearest approach were a few indifferent semi-doubles of no great merit. The single flowers were however very beautiful.

8. On my way home in May, I took advantage of the boat remaining two days in Colombo to visit the Peradeniya Gardens and made notes of several things which we hope to receive from there later on.

9. On my return from leave in November, I brought out a large collection of economic and ornamental plants, principally from the Royal Gardens, Kew, Messrs. F. SANDER & CO., and Messrs. JAS. VEITCH & SONS; to all of whom the thanks of this department is due for their great liberality. Nearly all these plants, and also two Wards cases of plants handed to my care by the Director, Kew, for the Singapore Gardens, arrived in excellent condition scarcely a plant being dead. Among the valuable plants from Kew are six plants of African rubber (*Kickxia Africana*) all of which are growing. Messrs. SANDER & CO. contributed a fine lot of *Cattleyas*, *Begonia*, &c., and Messrs. VEITCH & SONS, Ferns, Palms, &c.

10. The usual interchange of plants and seeds has been carried on with Botanical and Horticultural Establishments and private individuals to about the same extent as in previous years, and plants sold to the value of \$883.17 which is an increase of \$187.77 on the previous year.

11. The total expenditure of this garden amounted to \$4,482.86, details of which, together with expenditure of other votes, is given in Appendix A annexed.

Governor's Hill Bungalow Garden.

12. During the latter part of the year Mr. O'KEEFE, Overseer in charge, was on leave and his duties were satisfactorily performed by Sergeant WELLS. The usual supply of Vegetables and Flowers were maintained and the grounds kept in fairly good order. During January and February there was a fine show of Annuals, Phlox, and *Dianthus* having done remarkably well. *Dendrobium Fytchianum* planted on the trees flowered very freely and was much admired.

13. As is always the case here a large proportion of the labour was required in repairing damage done by heavy rains. I give below the rainfall registered at this station during the year.

Month.		Rainfall.		Greatest fall in 24 hours.		Month.		Rainfall.		Greatest fall in 24 hours.	
		Inches	P.	Inches.	P.			Inches.	P.	Inches	P.
January	...	8	30	3	10	July	...	11	36	2	16
February	...	1	80	1	10	August	...	27	99	7	55
March	...	4	11	1	28	September	...	26	08	9	30
April	...	4	19	...	74	October	...	15	36	2	29
May	...	22	87	4	11	November	...	17	42	4	34
June	...	9	67	2	75	December	...	5	42	1	18
						Total Rainfall		154	57		

Experimental Nursery.

14. Nothing requiring special mention has been done in this Nursery. Two men only are employed to keep the weeds down and a portion of their time is devoted to keeping in order the grounds of Belle Vue Bungalow.

15. As pointed out in my last year's report there is no further object in spending much on this Nursery as it has been proved that it is not high enough for European fruits, and for the purpose of experiment with rubbers and such other economic products as is likely to be of commercial value, the land is too steep and limited in area.

Preservation of Coco-nut Trees.

16. The Inspector and two men have been employed during alternate months in Penang and Province Wellesley in inspecting plantations, Cow-sheds, stable yards, &c., and in insisting on the destruction or removal of dead trees, manure heaps, &c., in which the Coco-nut Beetle is likely to breed.

17. Three thousand eight hundred and sixty-seven notices were served resulting in the destruction or removal of seven thousand three hundred and sixty-seven dead trees or portion of trees, and seven hundred and forty-two heaps of rubbish. Forty-four persons who failed to comply with the notices within the specified time were summoned and fines inflicted aggregating \$79.

No. of dead Coco-nut Trees destroyed.	No. of Coco-nut Trunks destroyed.	No. of Dung-heaps destroyed.	No. of heaps of Padi-husks destroyed.	No. of Notices issued.	No. of Summonses issued.	Amount of Fines recovered.
						\$ c.
<i>Northern District, Province Wellesley.</i> 873	1,307	151	65	1,920	27	49 50
<i>Central District, Province Wellesley.</i> 482	756	72	34	609	7	12 50
<i>Southern District, Province Wellesley.</i> 114	208	70	26	112	Nil	Nil
<i>Penang.</i> 596	3,031	292	32	1,226	10	17 00
2,065	5,302	585	157	3,867	44	79 00

Agricultural Show.

18. A most successful Agricultural Show was held at Butterworth, Province Wellesley, in June, an account of which was published in the *Government Gazette* of August 25th. Altogether there were nine hundred and eighty exhibits and the total expenditure about \$2,000.

From the Governor's Hill Bungalow Garden was exhibited a collection of European Vegetables (not for competition) which received honourable mention. Samples of Para-rubber from a tree in the Waterfall Garden also attracted attention. Mr. R. DERRY, Superintendent of Government Plantations, Perak, exhibited a splendid collection of tuberous Begonias, Pelargoniums, Fuchsias, &c., grown on Maxwell's Hill at an elevation of nearly 4,000 feet. I am told that from a horticultural point of view this was the most interesting feature of the show. It is also a striking example of what a few degrees of temperature will do for plants. None of these things can be satisfactorily grown in the plains no matter what pains are taken.

Governor's New Quarter, Sepoy Lines.

19. Considerable alteration and improvements have been made in the grounds of the Governor's New Quarter by the removal of the bamboo fences and planting four large clumps of Palms, &c., supplied from the Waterfall Garden. Before planting the ground had to be raised and the purchase of red earth for this purpose absorbed a large proportion of the money available for this work. The effect, when the trees get up, will be satisfactory.

Para-Rubber.

20. In last year's report, I gave the result of tapping the largest Para-rubber

tree growing in the Garden, planted in 1885. Since then two more tappings of the same tree have been made, first in April, and again in November, without so far as can at present be seen any injury to the tree. The result of these tappings, all practically within a year, is close on nine pounds of dry rubber. In addition to this, one pound was taken in 1897 and valued at $3/3$ per lb. There is said to be a considerable difference in the yield of trees of the same size and age growing under similar conditions, so possibly this is an exceptionally good one and it is desirable that several trees should be operated on at the same time in order to arrive at a correct estimate of the average return. Unfortunately we have not the means of doing this here as there are only a few trees in the Garden and most of them planted in poor dry stony soil where they have made very slow growth. On the first occasion tapping was commenced on the 16th November and terminated on the 20th December, and yielded 3 lbs dry rubber. The second commenced on the 8th of April and continued to 14th May, the result being $2\frac{1}{2}$ lbs of dry rubber. Third commenced on the 23rd November and ended on the 23rd December. The first and third tappings took place towards the end of the wet season and the second at the end of what may be considered our dry season. The same number of collections were made on each occasion. A thin shaving was removed from the lower surface of the oblique cuts, made on the first morning, thirteen times on alternate mornings unless Sunday intervened or rain prevented. At 11 A.M. the tins were brought in and the contents poured into a soup plate and by the following morning it had coagulated. After pressing out the water by hand it was weighed. Unfortunately the record of the weights of the April-May tapping has been lost, but as each day's collection was numbered and preserved there is no doubt as to the correctness of the quantity of dry rubber obtained. The following table shows the quantity obtained each day at the first and third tappings and is interesting as showing the small quantity obtained at the beginning and the necessity of renewing the wound on the same surface.

Weight of Wet Rubber obtained at each collection in ounces.														Total Wet.		Total Dry.		
No. of Collection	1	2	3	4	5	6	7	8	9	10	11	12	13	14	lb	oz.	lb	oz.
Nov. and Dec., 1898	$\frac{3}{4}$	$1\frac{3}{4}$	$3\frac{1}{4}$	6	9	$6\frac{1}{2}$	$8\frac{1}{2}$	$6\frac{1}{2}$	$8\frac{1}{2}$	6	$6\frac{1}{2}$	10	$8\frac{1}{2}$	8	5	$1\frac{1}{2}$	3	...
April-May, 1899	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2	8
November-December, 1899	...	$1\frac{1}{4}$	$2\frac{1}{2}$	3	$6\frac{3}{4}$	8	10	$10\frac{1}{4}$	$6\frac{1}{4}$	9	$11\frac{1}{2}$	$11\frac{1}{2}$	11	8	6	$4\frac{3}{4}$	3	4
Total amount of dry rubber from one tree in one year ...																	8	12

Among planters here there appears to be no doubt as to the satisfactory growth of this tree but some have doubts, based mainly on reports from Ceylon, whether the yield will be sufficient to make it a paying crop. From what I saw as the result of tappings at Peradeniya Gardens, Ceylon, last May, and what the Director told me, nothing like the results obtained in Perak, Singapore, and Penang are obtainable there; unless they have not hitherto continued operating long enough on the same cuts. As regards the cost of collection the average time for these experiments was half-an-hour for each collection, or a total of twenty-two hours for eight and three-quarter pounds of rubber. To this must be added the cost of drying, but this is not a serious matter. On the 21st November last, I visited Mr. D. LOGAN'S Estate in Province Wellesley and made notes of the progress of the trees planted there. The first were planted in March, 1898, and had therefore been planted at the time of my visit one year and nine months.

The largest tree measured eighteen feet high with a girth at three feet from the ground of $6\frac{3}{4}$ inches. Many others are almost as tall and thick and the average of a number of measurement gave 15 feet height and $4\frac{1}{2}$ inches girth. A plot planted nine months later, *i. e.*, in December, 1898, has grown relatively better, the average being 12 feet high and 4 inches in girth. The whole plantation looks well but there have been many losses among those planted during 1899 owing to their being submerged before they had become established.

After this tree has become well rooted, flooding the land for a time does not appear to do much harm but when newly planted it is fatal. Some rows that I advised being manured with cattle manure in the early part of the year as an experiment show no appreciable benefit from the treatment.

Gutta Percha.

21. On my return from leave at the beginning of November, I received from the Hon'ble the Resident Councillor some correspondence with reference to "Gutta Taban" (*Dichopsis gutta*). I have not yet had time to examine all the forest reserves so as to be able to give a definite idea of the number of trees in Penang but I am certain that there are many more than is generally supposed.

In one morning, I counted twenty-three trees, some of them sixty feet high, and the smallest forty. The largest measured 51 inches in circumference at 6 feet from the ground and the smallest eleven inches. With the exception of a few young trees, two to four feet high, found near two of the largest trees, there appears to be nothing intermediate in size between those mentioned (which are probably all about the same age) and young seedlings of three or four months' old, which shows that some of the trees fruited during the past year. There are several possible ways of accounting for the absence of trees of intermediate stages, such as the destruction of the seeds or young plants by animals, or as is sometimes the case in this country, the trees only fruiting at long intervals, but I believe the correct explanation lies in the fact that up to 1884 which was the first conception of Forest Conservancy in this Settlement every Gutta tree was cut down in the customary native manner as soon as it was big enough to pay for working and before it was old enough to produce seeds and this season is the first crop of any importance that has been produced for a long time. I am confirmed in this opinion by the fact that we have been watching for fruit of this tree for many years and only on one occasion succeeded in getting a few just sufficient for herbarium specimens. About eight hundred young plants have been collected and planted in pots to be grown on until large enough to be planted out in some suitable place.

Propagation by cuttings again proved a failure. Attempts at tapping one tree in the same manner as Para-rubber proved a failure, a little gutta is obtained when the incisions are first made but not enough to pay for collecting in this manner, and a renewal of the cuts as in Para-rubber yield nothing.

Botanical Tours.

22. In February, I obtained the use of the Government Steam Launch for four days and visited the Langkawi Islands. Many of the small *Didymocarps* and other rock plants were however shrivelled up and difficult to find. Most of the trees on the smaller rocky Islands were quite leafless and presented a striking contrast to the vegetation in Penang at the same season.

Impatiens Mirabilis (Gouty Balsam) which was one of the objects of my journey, I found quite leafless at this season.

It grows on and between sharp pointed dark coloured rocks within a few yards of the sea beach and at a short distance has a striking resemblance to the antlers of a deer. Plants five to six feet high, and with stems more than a foot in diameter at the base were seen, but the branches are so brittle that it is almost impossible to get them down from the rocks without damaging them. I did not attempt to bring away the largest plants, and those we did get were only obtained in good condition by placing several men in a line a few feet apart and passing the plants from hand to hand, then moving on and repeating the process.

To move about on these sharp rocks in an upright position is a matter of great difficulty even with strong boots, and with bare feet almost an impossibility.

Many other interesting plants were collected and it is desirable that a visit should be made to these Islands about the middle of the rains. There are no doubt many small rock plants that are not to be seen in the dry weather and that is the only season at which any collector has so far as I know been there.

The reason for this is that during the South-West Monsoon it is not very safe to go out in a small Launch and there is no other way of doing it except in a sailing boat.

On my return from the Island of Terutau to Kwah, I had the good fortune to meet there His Highness the Rajah Muda of Kedah, who not only assisted me at the time but promised every assistance should it be found possible to get out there this year during the wet weather.

23. In October, Mr. FOX, while acting here, made a short visit to Perak and added many specimens to the herbariums both in Penang and Singapore. He also collected many living plants for cultivation.

C. CURTIS,

Assistant Superintendent of Forests.

17th January, 1900

APPENDIX A.

Revenue and Expenditure of the Botanic Gardens, Penang, 1899.

REVENUE.		EXPENDITURE.	
	\$ c.		\$ c.
Government Grant— Maintenance of Water- fall Garden ...	4,500 00	{ Wages of Gardeners and Coolies	3,054 58
		{ Tools and Materials for Repairs	304 25
		{ Material for renewing Plant-shed	129 43
		{ Do.	390 00
		{ Planks for boxes and labels ...	131 07
		{ Pots and Tubs ...	126 93
		{ Chicks for Plant-sheds ...	89 14
		{ Freight and Cartage ...	24 10
		{ Plants ...	10 50
		{ Periodicals ...	16 25
		{ Material for Herbarium ...	17 55
		{ Manure and Cartage ...	31 95
		{ Paint and Oil ...	18 92
		{ Iron-work for Fernery ...	18 67
		{ Lime ...	8 70
		{ Miscellaneous and Petty Expenses	110 82
		Balance ...	4,482 86
			17 14
		Total ...	4,500 00
Government Grant— Upkeep of Grounds of Governor's Hill Bungalow	1,000 00	{ Wages of Gardeners and Coolies	834 60
		{ Manure ...	82 45
		{ Seeds ...	36 73
		{ Tools and Material ...	43 41
		Balance ...	997 19
			2 81
		Total ...	1,000 00
Government Grant— Maintenance of Experi- mental Nursery ...	200 00	{ Wages ...	174 86
		{ Manure ...	21 60
		Balance ...	196 46
			3 54
		Total ...	200 00
Government Grant— Expenses of carrying out Provisions of Coco-nut Trees Preservation Or- dinance ...	836 00	Inspector's Salary and Travelling Allowance ...	516 00
		Salaries of Notice Server and Climber ...	192 00
		Balance ...	708 00
			128 00
		Total ...	836 00

APPENDIX A—Concluded.

Revenue and Expenditure of the Botanic Gardens, Penang, 1899.

REVENUE.		EXPENDITURE.	
	\$ c.		\$ c.
Government Grant—		Pony Allowance ...	213 00
Travelling and Personal		Personal Allowance and Expenses	
Allowance ...	330 00	of Botanical Tours ...	73 80
		Passage of Assistant Superintend-	
		ent of Gardens, Singapore, and	
		family to Penang ...	39 80
		Travelling Expenses in Province	
		Wellesley ...	3 00
Total amount of Gov-			329 60
ernment Grant }	6,866 00	Balance ...	40
			330 00
Revenue from sale of		Total Expenditure ...	\$6,714 11
Plants ... }	883 17		
Receipts from Swim-			
ming bath }	28 50		

C. CURTIS,

Assistant Superintendent of Botanic Gardens.

Annual Report on the Botanic Gardens, Singapore.

Staff.

1. There were but few changes in the Staff during the year. The plant-collector KASDANI proved very indolent and was discharged, a former peon IDRIS being taken on in his place. The Garden's peon was discovered to be stealing and suppressing letters entrusted to him to post, and was arrested and charged at the Magistrate's Court and sentenced to nine months' imprisonment. The coolies worked well, but the supply of good labour is very short, and the price of labour is very high now. The watchmen were a very poor lot and had to be constantly changed. In fact, the class of labour all round is very inferior to what it formerly was, and it is nearly double the price.

Visitors.

2. The number of visitors was unusually large chiefly on account of the large number of persons passing through to China, and the Philippines. There were also an unusual number of Scientists who visited the Gardens. The Regimental Band played as usual on moonlight nights and was highly appreciated. Beyond the theft of four small palms and a few flowers there were no thefts and no prosecutions.

Aviaries.

No additions were made to the aviary buildings during the year, except a few small additional enclosures for special animals. The following animals and birds were added to the collection:—An Albino Porcupine with a normal young one, (*Hystrix longicauda*) purchased. A Philippine Deer (*Cervus moluccanus*) presented by Madame HINNEKINDT. One Bornean bear presented by Capt. CUMMING (died shortly after). One Kijang (*Cervulus Muntjac*) female, presented by AHMAT BIN HADJI OMAR. One Mias (*Simia Satyrus*) presented by Mr. DITTMAR. One Slowloris and young (*Nycticebus tardigradus*) presented by CUSTAWI. One Indian Mongoose male, presented by YEO CHEOW BOCK. One Cuscus (*Phalangista* sp.) purchased. Two hybrid Monkeys, one Kijang, and one common Deer were born. During the year two Rhinoceros (*R. sumatrensis*), were on deposit in the Gardens by Mr. PUSTAU. One died from injuries received in trapping, but one was thoroughly healthy and was eventually shipped to Vienna. These animals created a great deal of interest in the public who came in crowds to see them. Among the birds a black Adjutant was presented by GARASAMY PILLAI. One Cockateel presented by Mr. W. NANSON. Two Egrets from Sumatra presented by AHMAT. Three young Owls presented by Mr. BODEN KLASS. One Eagle by Mr. T. BIN CHING. Six whistling Teals, by Mr. A. F. BISCHOFF. Four Christmas Island Pigeons (*Carpophaga Whartoni*) presented by Mr. CLAYTON. One Pergam *Carpophaga aenea* presented by Mr. THOMAS. Four Cassowaries, purchased. A short-eared Owl *Asio accipitrinus* caught in Singapore, the first recorded for this region was purchased.

Reptiles.

One *Python reticulatus* presented by Hon. W. EGERTON. One large *Python curtus* captured at Bukit Timah. One large Tortoise (*Testudo emys*) was obtained at Batu Pahat during an expedition there, and another fine specimen was presented by YEOH KOK CHY, from Telok Anson.

The mortality among the animals was no greater than in former years, and, as usual, chiefly occurred in newly imported animals, which often are sent in in a sick condition; others died apparently from old age among which was a jungle pheasant which had been in the Gardens for over 18 years.

Flower Show.

An exhibition of flowers and flowering plants was held in the Town Hall on April 10th. The plants shown in most classes were not up to the average of past years, though some classes, such as ferns and begonias, were very fairly well shown. There was however a deficit on the working expenses.

Upkeep and Buildings.

The chief building alterations were the reconstruction of the back of the large plant-house, the old wooden posts and ataps were removed and the aisles roofed with chicks from Penang, supported on iron pillars. The old *Beaumontia*, which climbed over the roof was lowered when the roof was taken away and supported on an arch made of rough coral, in the interstices of which ferns and other plants have been planted. A tank for water-plants was made at one end of the plant-house and has been very attractive. The old wooden tables which used to carry smaller plants in pots were removed and replaced by permanent brick and cement structures which add much to the ornamental appearance of the house. Four additional long coral and cement tables were made in the Nursery, with brick pillars and iron arches to carry chicks or battens which will form a large addition to the space required for pot-plants.

The beds, borders and shrubberies were renewed as required, and manured and cleaned at intervals. About a hundred yards of road running down from the main hill towards the lake was remetalled.

Plants in flower.

The following were among the more interesting of the plants which flowered for the first time in the Gardens. *Camænsia maxima* (West Africa), *Vatica Wallichiana* (Malay Peninsula), *Ilex nigro-punctata* (Brazil), *Ravenia spectabilis* (Cuba), *Solandra grandiflora* (South America), *Ixora barbata* (India), *Bignonia incarnata* (Guiana), *Gymnostachyum Ceylanicum* (Ceylon), *Bignonia* n. sp. (Penang), *Dammara robusta* (Australia), *Aristolochia saccata* *Clorodendro* n. sp. (Borneo), a most remarkable climber with the terminal leaves on the flowering spray of a beautiful red colour *Cleistanthus parvifolius* (Pahang), *Triomma malaccensis* (Singapore).

Korthalsia *Scaphigera* *Dendrobium refractum* *D. Foxii* n. sp. (Perak), *Cyanastrum cordifolium* (Africa), *Hæmanthus Lindeni* (Africa), *Arisæma Roxburghii* (Penang), *Amomum* n. sp. (New Guinea), *Habenaria Columbae* n. sp. (Siam), *Amorphophallus giganteus* and *A Titanum* flowered again.

Plants received and distributed.

During the year there were received 337 packets and bags of seeds, 600 plants and tubers besides the monthly supplies purchased from Messrs. CARTER & Co. Among the seeds of importance were 8 bags of mahogany and 5 lbs. of *Pterocarpus Macrocarpus* from Dr. PRAIN of Calcutta. Some rare palm seeds from HERR WENDLAND of Hereenhausen and Prof. CORNU of Paris. Of the new plant introductions the most valuable from an economic point of view came from the Royal Gardens Kew; amongst them being a new Coffee, and a new variety of Cocoa, a new African rubber *Landolphia Klainei*, some interesting palms and a new pisang, *Musa Livingstonei*.

The finest introduction of ornamental plants was a fine series of nymphæas from Messrs. HENRY A. DREER of Philadelphia, U. S. A., which have flowered very freely, and made our lily ponds a beautiful sight in the early morning.

The contributors were as follows:—

The Royal Gardens, Kew.	Messrs. Herb & Wulle.
Botanical Gardens, Buitenzorg.	Messrs. Dammann.
" Melbourne.	T. W. Brown, Esquire.
" Trinidad.	J. S. Goodenough, Esquire.
" Berlin.	M. Cornu.
" Queensland.	M. Vernet.
" Ootacamund.	Messrs. Williams Bros.
" Ceylon.	St. V. B. Down, Esquire.
" Calcutta.	E. R. Salisbury, Esquire.
" Old Calabar.	J. Pereira.
" Sydney.	W. D. Barnes, Esquire.
" British Guiana.	H. Wendland, Esquire.
Conservator of Forests, Dehra Dun.	W. Meikle, Esquire.
" Chittagong.	Dr. Braddon.
H. A. Dreer, Philadelphia.	C. Curtis, Esquire.

There were 399 plants and 134 packages of seeds sent out to various gardens and contributors besides those sent to planters and others in the Colony and Native States. Five Wardian Cases of fruit trees and economic plants were sent to His

Excellency the Governor of British New Guinea, and seven cases of various economic plants to the Congo Free State. A Collection of 69 packages of Carpological specimens was sent to Messrs. HERB & WULLE in exchange for living seeds of cultural plants.

Artist.

The Artist CHOUDHURY was employed in making drawings of interesting plants till July when he was attacked by brain disease and became insane. He was sent to the Asylum and eventually returned to Calcutta. CHARLES d'ALWIS was transferred from the Public Works Department where he had been employed as photographer and commenced work here on November 1st,

Vote	...	...	...	\$ 700.00
<hr/>				
<i>Expenditure.</i>				
Salary of Artist	...	...	...	\$ 450.00
Purchase of Colours, Brushes, Pencils, Rubbers, &c.	...	...	...	\$ 33.35
Balance	...	...	...	\$ 216.65
				<hr/>
				\$ 700.00
				<hr/>

Herbarium.

A small number of plants were collected in Malacca and Province Wellesley during my visit in the spring, and an extensive series were obtained during an expedition to Batu Pahat, and also at Panchur on the Johore River. Thirty-three specimens were received from Mr. CURTIS from Penang, and a very interesting collection of 122 specimens was presented by Mr. W. D. BARNES, from Kluang Terbang in Pahang at an altitude of 5,000 feet. Forty-four specimens from the collections of Scortechini were received from Calcutta. Two hundred and seventy-nine Australian and Polynesian ferns and other plants were received in exchange from the Botanic Gardens, Sydney.

Twenty-six specimens of Dichopsis, and Verbenaceæ were received from the Botanic Gardens, Buitenzorg.

The following were distributed to various establishments:—878 specimens to the Royal Gardens, Calcutta, 143 plants and 24 specimens of woods to Kew, 65 specimens and 82 samples of woods to the British Museum, 227 specimens to the Botanic Gardens, Sydney, 12 specimens of sea-weeds to Mr. E. HOLMES for identification, 24 specimens of Dipterocarpeæ to Dr. HEIM of Paris. Twelve pounds of bark of *Roucheria Griffithiana* stated to be poisonous were sent to Dr. GRESHOFF for analysis.

A number of local wood specimens were added to the collection, including a specimen of Chandan presented by Mr. W. D. BARNES and specimens of Perak and other woods obtained by Mr. H. C. HILL, and a specimen of fossil wood presented by Mr. WALSH.

Library.

The following books were added during the year:—

Greshoff Dr.—Indische Vergift rapporten. Presented by Author.

„ Nuttige Indische Planten.

Smith, E. F.—Wilt disease of Cotton, Water-melon and Cowpea. Presented by [Author.

Carleton, M. A.—Cereal rusts of the United States.

Hables, W. H.—A contribution to the Mineralogy of Wisconsin.

Cornstock, G. C.—Studies in Spherical and Practical Astronomy.

Weidman, S.—On Quartz and Keratiphyre and Associated rocks.

Schlundt, H.—On the speed of the liberation of Iodine.

Barnes, C. R.—Analytic key to the Genera and species of North American Mosses.

Vernhout, Dr. J. H.—Onderzoek over Bacteriea by de Fermentation der Tabak.

Maiden, J. H.—A second contribution towards a flora of Mt. Koscinko.

„ Some exotic grasses.

„ Native Food plants.

„ The Noogoora-burr.

„ A new variety of *Dendrobium undulatum*, Useful Australian plants, (eight tracts).

Lotsy, Dr. J. P.—Physiologische Proevengenom met Cinchona.

Schiffner, Dr. V.—Die Hepaticæ von Buitenzorg.

Knapp, S. A.—The present state of Rice-culture in the United States.

- Kamer, G. and Zehnter, L.—Archief voor de Java Suiker-industrie.
 Raciborski, Dr. M.—Parasitischen Algen und Pilze Java's.
 Zimmerman, Dr. A.—De Nematodea der Koggie Wortels.
 Christ, L. and Warburg, O.—Filices Faurieanæ.
 Trimen, Dr.—Handbook of the Flora of Ceylon, part 5.
 Handbook of Jamaica. Presented by Royal Gardens, Kew.
 True, A. C.—Organization Lists of the Agricultural Colleges and experimental
 Stations of the United States.
 Hicks, G. H.—The germination of seed.
 Kramers, J. G.—Andere mededeelingen over Koffie.
 Godefroy le Beuf, A.—Les Caoutchoucaniers Du Para, Ceara, Panama, de
 Pernambouc, de l' Afrique, Le Balata, Le method de culture de Para.
 Catalogue des plantes utiles.
 Vernon Baily.—North American Fauna.
 Palmer, T. S.—The germination of seeds.
 Shea, V. O.—Aspects of mental economy.
 Miller, W. S.—Contributions from the Anatomical Laboratory Wisconsin.
 Maxwell Lefroy, H.—Moth-borer in sugar-cane. Presented by the Commissioner
 for the West Indies.
 Deane, H. and S. H. Maiden—Observations on the Eucalyptus, part V. VI.
 Dyer, Sir W. Thiselton.—Flora of Tropical Africa, Vol. V. Presented by the
 Government.
 Andrews, C. W.—Monograph of Christmas Island. Presented by the Trustees of
 the British Museum.
 King, Sir George.—Materials for a flora of the Malay Peninsula.
 Woods, A. F.—Stigmonose, a disease of Carnations.
 Romburgh, Dr. P. V.—Caoutchouc en Gutta Percha in Nederlandsche Indie.
 Kearney, T. H.—The plant covering of Ocracoke Island.
 Mohr, J.—Overhet Drogen van de Tabak.
 Hart, J. H. and P. Carmody—Seedling canes of Trinidad.
 Bijlert, A. V.—Over Deli-Groud en Deli Tabak.
 Boerlage, J. G.—Flora van Nederlandsche Indie.
 Beale, F. E. L.—Food of the Bobolink.
 Webber, H. J.—The immediate effect of Pollen in maize.
 Schreuk, H. V.—Two diseases of red cedar.
 Galloway, B. T.—Progress of commercial growing of Plants under glass.
 Progress in the treatment of plant diseases.
 Webber, H. J. and E. A. Bessey, —Progress of plant breeding.
 Schmidt, J.—Flora of Koh Chang, part I.
 Heern, G.—Catalogue of Welwitsch's African plants.
 Greshoff, Dr.—Beschrijvingder giftige-planten bij den vischvangst.
 Merrian Hart.—Results of a Biological Reconnaissance of the Yukon River.
 Wood, J. Medley—Natal plants, Vol. 2. Part 2. Vol. 3. Part 1.
 Hitchcock, F.—Trade of the Philippine Islands.
 " Our Foreign Trade in agricultural products, 1890-1898.
 " Trade of Puerto Rico.
 " Section of Foreign Markets.
 Magnussou, C. E.—Anomalous dispersion of cyanin.
 Istvanffi, Dr. G. de—Une visite au Jardin Botanique-de kolosvar.
 Wildeman, E. and Durand.—Illustrations de la Flore du Congo.
 Christ, H.—La question des petites espèces.
 Palmer, T. S.—Legislation for the protection of birds.
 Koorders and Valeton.—Boom sorten op Java.
 And the following serial publications:—
 Journal of the Board of Agriculture, Experimental Station Records (America).
 Annales du Jardin Botanique, Journal of Agriculture for Zanzibar, Planting Opinion,
 Notizblatt (Berlin), Queensland Agricultural Journal, Bulletin Economique de l'Indo-
 Chine, Der Tropenpflanzen, Koloniaal Museum Haarlem, Jamaica Bulletin, Agri-
 cultural Ledger, Indian Museum Notes, Chemist and Druggist.
 Agricultural Journal of the Cape of Good Hope, Icones Bogorienses (fasc. 3)
 Trinidad Bulletin, Mercks Annual Report and Digests, Pharmaceutical Review,

Buitenzorg Bulletin, West Indian Bulletin, Revue des Cultures Coloniales, Acta Horti Petropolitani Transactions of the Botanical Society of Edinburgh and Garden and Forest Reports of South Australia, Queensland, Barbados, Trinidad, Mysore, Ceylon, Hongkong, British Guiana, Natal, Madras (Forest Department), Calcutta, Tenasserim Agrihorticultural Society.

Purchased.—Journal of the Royal Horticultural Society, 14 volumes. Gardener's Chronicle Botanical Magazine. Journal of the Linnean Society. Tropical Agriculturist. Dictionnaire Iconographique des Orchidees for the year.

Bulletins.

A bulletin dealing with Native Rubbers Insect Pests including the outbreak of the bee-hawk moth in Selangor, *Kickxia Africana*, notes on Para Rubber, injurious fungi and other subjects was published in May. A paper on Dammars and Wood-oils, was prepared and printed in the Journal of the Straits Asiatic Society. Another bulletin on the Timbers of the Malay Peninsula was prepared and will be printed in the following year.

Expeditions.

In the early part of the year I accompanied Mr. H. C. HILL in his tour of inspection in the Colony, and in November made a botanical expedition to Batu Pahat in Johore. Arriving there on October 31st, and remaining till November 18th. During this time I explored the hills, Gunong Banang, Pengaram and Soga, and ascended the rivers Sempang Kiri and Sempang Kanan, ascending the latter as far as Tebing Tinggi for two days, and exploring also the rocks at the mouth of the Batu Pahat River at Bata. Although the collector I took with me was ill and almost useless the whole time I obtained a large series of plants from this hitherto unexplored district, including many new and rare plants. The highest hill in this district is Gunong Banang, 1,500 feet, and I had expected to find a flora resembling at least the lower part of Mount Ophir, but there were but few hill forms to be met with. The most striking tree was a very tall *Podocarpus*, evidently the same species as the one on Mount Ophir but attaining a very large size. A new *Bromheadia*, *Sonerila*, and a number of other small plants were obtained here, but the flora was much less rich and striking than that of Gunong Pant, a hill of no greater size on the west of the Peninsula. The general aspect of the flora of this district is that of Singapore with however a number of additional forms, and the remarkable absence of others. This is a great contrast to the flora of Eastern Johore which resembles that of Pahang. In fact the Flora of the Peninsula may be said to be divided into two by a line running down the centre of the Peninsula.

Besides herbarium specimens, a number of living plants, orchids, etc., and a very fine Tortoise *Testudo Emys* captured at Batu Pahat were brought to Singapore.

BOTANIC GARDENS, SINGAPORE.

Statement of Receipts and Expenditure, for the year 1900.

RECEIPTS.		EXPENDITURE.			
	\$ c.	Salaries.	\$ c.	\$ c.	
By Balance in Bank ...	2,891 42	Clerk	284 00		
„ Government Grant	9,150 00	Mandores (three)	484 44		
„ Sale of Plants, Seeds		Carpenters (two)	291 66		
and Flowers ...	2,703 10	Masons, (two)	183 36		
„ Interest ...	49 20	Label Printer	120 00		
		Plant-collector	118 33		
		Peon	103 28		
		Aviary-keeper	96 00		
		Police	331 65		
		Coolies	3,347 09		
		Rice Allowance	662 29		
				6,022 10	
		<i>Bills.</i>			
		Tools and Stores	913 33		
		Laterite, Gravel, Sand,			
		Bricks, etc.	338 27		
		Timber, Planks, Laths, etc.	390 41		
		Pots and Tubs	117 56		
		Birds' and Animals' Food	1,539 33		
		Manure and Cartage	218 87		
		Buildings and Repairs	569 66		
		Freight on Plants, etc.	182 26		
		Books and Papers	302 65		
		Plants and Seeds	387 40		
		Subscription to the Telephone	90 00		
		Wardian Cases	121 50		
		Petty Expenses	268 22		
		Miscellaneous	297 90	5,747 36	
		Balance in Bank ...	...	11,769 46	
				3,024 26	
	\$14,793 72			\$14,793 72	

Economic Gardens.

A considerable portion of ground covered with scrub lying adjacent to the Bukit Timah Road was cleared and planted with Para Rubber stumps and seedlings which have thriven well. The Merabau trees in the remaining portion of the scrub were cleared round and the ground opened up. A band of scrub was cleared along the Eastern boundary of the Garden for planting *Castilloa* as it seemed the most suitable spot for it. A number of cuttings of *Ficus elastica* were planted in various spots, for experiment, many trees were added to the arboretum. Among the Economic plants received during the year were—*Pachylobus edulis* from Calabar, *Coffea Laurentii-robusta*, *Theobroma pentagona*, *Landolphia klainei*, and *L. Owariensis* from Kew; *Kickxia elastica*, of which three lots of seeds were received from different contributors, but unfortunately none germinated. This is the tree which produces the Kickxia Rubber of Africa and not the *K. Africana* which was previously distributed from Europe.

The large fruited bamboo *Melocanna bambusoides* was sent by the Chittagong Forest Department.

Para rubber.—The demand for seed showed no signs of diminishing. During the year 145,600 seeds and 6,400 plants were distributed as follows:—6,000 plants and 46,750 seeds to the Colony, 79,350 seeds to Selangor, 17,500 to Johore and a few to Sumatra, in exchange for Gutta Percha, and to Pahang.

The number of planters in the Colony does not increase and the demand for seed in the early part of the year when the crop was at its greatest was not large. The interest in its cultivation generally, has however, shown no signs of diminution and is only checked by the insufficient supply of seed.

The trees fruited more or less all through the year, the largest amount of seed being obtained in September and October.

The chief enemy complained of by planters was the termite, *Termes Gestroi*, which has done a good deal of damage in different parts of the Peninsula to young trees. It coats the outside of the tree with mud up to a height of some feet, and also burrows up the centre. This termite however is an inhabitant of dense jungle rather than of cleared ground and will probably disappear altogether when the ground has been under cultivation for some time.

Further experiments were made in tapping trees, and in the preparation of the rubber by Creosote. It was found that one or two drops of Creosote dropped into the latex prevented decomposition and no odour was produced during drying. It made no difference in the colouring of the rubber which eventually became as dark as rubber not so treated.

The Creosote however had a tendency to make the rubber sticky, and more than one or two drops produced an objectionable amount of stickiness. Whether creosoting the rubber improves it from a commercial point of view remains to be seen.

In July an average sized tree measuring 60 feet in height, with a circumference at the ground of 5' 5" and a clean stem up to 10' 3" from the ground, approximate age 12 years, was selected for tapping with a view of seeing what could be got out of it irrespective of any conditions, in other words to bleed it to death if necessary. The experiment began on the 5th of July, and was carried on until the 27th September, a period of 84 days on which date the latex ceased to flow. Throughout such a long period as might be supposed all kinds of weather was experienced, from very dry to very wet. On the whole, however, it can be said that the prevailing conditions were comparatively dry, for out of the 84 days on 71 very little or no rain fell at all. The total rainfall registered during the full period being 18·07. The method of tapping was that usually practised, *viz.*:—longitudinal incisions of a V shape fed by similar incisions about a foot apart. The receptacle in which the latex was collected was a small cigarette tin, with a lid on in such a way as to admit of the latex running in whilst keeping out the rain, notwithstanding this, however, a certain quantity of water did get in the tins during wet weather, as will be seen by the great difference in weight between the wet and dry states of the rubber; the total in the wet state being seven and-a-half pounds and in the quite dry three pounds only. The greatest yield in twenty-four hours was 6 ounces on July 12th, and the smallest $\frac{1}{2}$ an ounce on the 28th of the same month. On four days out of the total there was no flow of latex at all, of these four days, three were wet and one dry. The quality of the rubber was necessarily of a scrappy nature, especially when quantities of less than an ounce was taken per day, whereas quantities over an ounce consolidated into nice little cakes. As regards coagulation no difficulty whatever was experienced, a few hours being sufficient to coagulate the latex to the consistency of soft cheese, and as regards the offensive odour due to the decomposition of the proteids it was found that a couple of drops of Creosote was sufficient to entirely get rid of the bad smell. On the whole the experiment may be said to have proved—1st, That three pounds of dry rubber can be obtained from an average tree—whether this quantity can be taken yearly remains to be seen—that it could be taken every other year, one is safe in predicting from our knowledge gained of the time other trees have healed of their wounds. 2nd, That it does not appear to injuriously affect the tree in the slightest.

Insect Pests.

A number of injurious insects were reported on by planters and remedies for them suggested. Among the important ones were *Batocera octomaculata*, a large longicorn beetle, the grubs of which bore up the stems of various species of *Ficus*, and among others the Rambong, being a very large insect it is easily caught and destroyed, but in large Rambong Estates it might prove very destructive. The life history of the Crinum caterpillar which destroys the Crinums cultivated for ornament was worked out, it proved to be the larva of a noctuid moth *Calogramma festiva*.

An obscure disease of the shoots and leaves of *Ficus elastica* was reported from Muar. It was partly due to a leaf fungus, specimens of which were sent to Kew for identification:—

Vote for upkeep of Economic Gardens	...	\$2,200
<i>Expenditure:—</i>		
Salaries of Mandore and Coolies	...	2,002.63
Tools and Stores	...	113.17
Manure	...	30.00
Sand	...	7.50
Purchase of plants	...	26.40
Balance	...	20.30
		<hr/> 2,200.00

Inspection of Coco-nut trees.

During the year, 699 trees and 21 piles of rubbish containing or likely to contain beetles destructive to coco-nut trees, were destroyed, and 266 trees were destroyed on abandoned ground chiefly at Teluk Kurau by a coolie employed for the purpose till July. Notices were served on 156 persons and there were no prosecutions.

There is, I think, no doubt that the number of red beetles has considerably diminished in Singapore. They seem to be comparatively rare now. The destruction of abandoned trees and trees in neglected patches is I think responsible for this.

Vote	...	...	...	\$486.00
<i>Expenditure:—</i>				
Salaries of				
Inspector, climber and cooly	...	...	...	324.00
Transport	...	...	...	141.76
Uniforms	...	...	...	12.75
Balance	...	...	...	7.49
				<hr/> \$486.00

Gutta Percha and Rubber Planting.

The small vote for this purpose allowed of three men being employed to clear the forest on the lower slopes of Bukit Timah, and plant as many trees of Getah Taban as were procurable. The plants planted on the previous year were cleared and replaced where they had died as far as possible, and the trees growing in the forest on the Eastern slope were inspected, the shrubs and jungle trees which were crowding them out were cleared away, and a number of over-crowded young plants were removed from that locality and transferred to the new plantation. The ground on the left side of the road going up to the Bukit Timah Hill proved less suitable for the growth of Getah Taban than was expected, and although a few plants planted on the previous year made a very good growth, one attaining a height of nearly 8 feet 6 inches and several from 3 to 5 feet; the others made a much slower growth, and at one part a large number died. It became clear that the plant requires at least, at first, partial shade and is better grown in secondary growth, sufficiently cleared to allow light to reach them. Hills sloping to water courses covered with thin wood suits the plant better than anything else, provided that they are not planted too close to the water. Suitable ground was found on the right side of the road, and here the fern was cut down and spaces cleared so as to plant as many as could be procured. In the meanwhile steps were taken to secure as many plants as possible and with the aid of a small vote for purchase of seeds and plants, 2,300 seedlings were obtained, and 720 stumps were presented by M. LE COMTE D'ABBANS. These were not sufficiently far advanced in growth to plant out till the end of the year and the weather then being exceedingly dry was not favourable. They will be planted out in 1901. Besides these 1,400 stumps of Getah Sundik (*Payena Leerii*) were purchased and grown on so as to be ready for planting. This gutta is in demand for mixing with Getah Taban for cable purposes, the Taban not being sufficiently plastic alone. A few plants of *Dichopsis calophylla* came on previous occasions mixed with *D. oblongifolia*. This contains a valuable gutta, but less so than *D. oblongifolia*. It is evidently a stronger and more rapidly growing plant than *D. oblongifolia* and stands the sun much better.

At present it has been found impossible to procure seeds of *D. oblongifolia* or *D. Gutta*. Two trees in the Botanic Gardens flowered this year, one rather heavily, it however does not appear to have set a single fruit. At present the only way of procuring plants is to have them dug up from the forests in the form of seedlings or more commonly as young trees about $\frac{1}{2}$ to $\frac{3}{4}$ inch through or less. The tops of these are removed and the stumps with the tap root kept damp till they can be planted. These stumps after a period of 4 to 6 months put out strong shoots, but it is remarkable that the new rootlets do not appear usually till after the shoots have made some growth, and often one can find stumps quite leafy with hardly a visible rootlet. It is found advisable therefore to allow the stumps to remain a long time in the beds or boxes till they have put out strong roots as well as leaves before planting out. The plan of planting the stumps as received *in situ* in the plantation is now being tried, so as to avoid injuring the roots by moving.

The various forms of Marcottage have been tried on *D. oblongifolia* and *D. calophylla*. These are all successful in almost every case, the time required for the roots to be fully emitted so that the marcot can be removed, varies from 3 to 6 months.

For work on a large scale this method of propagation is too slow and expensive. Simple cuttings were also tried but though a few thus treated grew the percentage is too small to be a satisfactory method of propagation. Another method of propagation by laying the young plant horizontally and allowing it to throw up lateral shoots and then cutting the stem into segments each bearing a shoot has been tried with more or less success. This method has however given it is said good results in Sumatra, and plants so propagated have been received thence which are very strong and healthy, but it is noticeable in this case as in the matter of stumps that the proportion of roots produced is very small in proportion to the size of the shoot. The young trees planted in various exposed positions were found to suffer very much from the attacks of a caterpillar which spun the leaf shoots together and destroyed them. It is rather difficult to deal with as it escapes the action of insecticides by concealing itself in the spun-up leaf. Attempts to rear the caterpillar to the moth state failed. It was noticed that not only were young trees freshly planted attacked but even in the jungle when the surrounding vegetation was cleared so as to let in light the pest appeared on the trees in a very short time.

It is regrettable to have to record the destruction of five fine large sized trees in the Bukit Timah Forest by a party of Malays during the year, who destroyed also others in different parts of the Island. Two of the men were captured but with the present value of Gutta Percha, severer penalties and a more adequate staff of Forest Guards will be required to prevent the destruction of the remaining large trees.

The question of the name of the species common in the Malay Peninsula, whether *D. gutta* or *D. oblongifolia* has more than a botanical importance, inasmuch as the values and qualities of the produce of the trees known under these names have been stated to be different. Dr. ROMBURGH who visited the Gardens during the year affirmed that the old trees in the Garden were *D. oblongifolia* and not *D. gutta*. Specimens of the two species as known in Buitenzorg were supplied to the herbarium by Dr. TREUB, but I fail to see any tangible difference. The form of the leaves varies very much in different parts of the same tree and still more markedly with age, and the flowers of the tree identified by Dr. ROMBURGH as *D. oblongifolia* do not appear to differ from those figured as *D. gutta* in Dr. BURCK'S paper on Gutta Perchas. It is still more remarkable that the original *D. gutta*, which was originally obtained in Singapore and has now, according to the Buitenzorg botanists, utterly disappeared, although the *D. oblongifolia* which was discovered very much later is still comparatively abundant, and appears to have replaced it. Botanically speaking the question is of some importance and perhaps economically so, though it must be remembered that in any case at least the bulk of the trade Gutta Percha for upwards of fifty years or more has been derived from *D. oblongifolia*.

The trees of Para Rubber at Bukit Mandai were gone over by the men employed on the vote and all belukar trees which had come up among them and were interfering with their growth were removed.

Vote for timber planting.

The vote for planting valuable timbers in the forests, viz., 300 dollars allowed of three men being employed on this work. The ground was cleared where necessary, in the same district of the Bukit Timah Forest Reserve which was selected for the planting of Gutta Percha, the ground unsuited for that plant being planted with timber

trees. Altogether an area of about 60 acres was opened up and planted and 15 acres planted on the previous year were cleared and the trees weeded. The chief trees planted were Mahogany (large-leaved) 17,600; Merbau 6,800; Eugenias and various plants 982; Rengas, (Melanorrhoea) 300, all raised from seed, and 1,380 Balam removed from the Botanic Gardens were also planted. The Mahogany and Merbau made very satisfactory growth and there were but few failures. The Merbau seed was found to do very well, planted at stake, without the necessity of raising in nursery beds and transferring later to the wood. A large quantity of seed of the small-leaved Mahogany was sent from Calcutta, but failed to germinate. The large-leaved kind is however in every way more suitable for cultivation, being more rapid in growth and altogether a stronger tree. A number of seeds of a *Shorea* found in fruit in the jungle were planted, but made very slow growth, and are not yet ready for transplanting, a few seeds of *Xylia dolabriformis* the Pynkado and seeds of *Pterocarpus macrocarpus* the Padouk were sent from Calcutta and were planted and germinated well. Some thousands of seed of Kranji (*Dialium*) were purchased in the market where the fruit is sold for eating and germinated freely. This very valuable timber is of slow growth at first but increases more rapidly after a few years. The Merbau trees at Bukit Mandai and at the old plantation by the Bukit Timah Forest Station, were opened up, the scrub and other trees growing round them and interfering with their growth were removed, and the few billion trees on Bukit Timah which have survived the encroachment of fern and scrub were also cleared round, and have already shewn signs of increased growth, unfortunately the greater number planted in 1884, succumbed to want of clearing in the following years.

Mr. HILL during his visit to Singapore inspected the planting on Bukit Timah, and made many valuable suggestions which are being carried out as far as possible.

Vote	...	...	\$300
<i>Expenditure:—</i>			
Salary of 3 coolies	...	...	252.14
Transport	...	...	9.39
Cart hire	...	...	7.50
Rent and 'rikisha hire	...	...	21.00
Balance	...	...	9.97
			<hr/>
			\$300.00

Government House and Domain.

The Mandore, ROGERS died in May and as there was some difficulty in getting a suitable man to replace him, the Mandore ANIFF was transferred till a man had been trained for the work, and remained there till the end of the year. The coolies worked satisfactorily and the gardens and park looked well.

Vote...	...	...	\$2,360.00
<i>Expenditure:—</i>			
Salaries of Mandore and Coolies...			\$1,974.89
Tools and Stores	...	...	231.48
Hand Cart...	...	...	29.00
Lawn Mower	...	...	27.00
Pots and Tubs	...	...	87.00
Manure	...	...	7.60
Balance	...	...	3.03
			<hr/>
			\$2,360.00

Botanic Gardens, Penang.

Waterfall Gardens.

For several years there has been no change in the staff of this Garden. MAHOMAD HANIFF, Overseer, and MAHOMAD HUSSAIN, Propagator; the two men on whom the working of this Garden devolves during my absence on other duties both served three

years' apprenticeship here before obtaining their present appointments and are useful men. As I have been absent from Penang about a month and-a-half at different times during the year I wish to record the satisfactory manner in which the work has been done during my absence.

2. Besides other work MAHOMAD HUSSAIN has made a considerable number of drawings of new or imperfectly known plants in which he is sufficiently proficient to make it desirable that his whole time should be devoted to this work.

3. The supply of gardeners and coolies is by no means all that could be wished. Changes are frequent and at times it has been difficult to obtain sufficient labour owing to the demand for railway and other work where the pay is better, and this is the experience of most persons engaged in Agricultural pursuits.

4. Since the German line of Steamers commenced calling at this port, the number of European travellers visiting this Garden has increased, as many as twenty gharry-loads sometimes coming from one of these boats, and there has always been something of interest for them to see.

5. On the whole I think the Orchid House has been brighter this year than usual. From July to the end of the year one of the side stages was kept full of flower with large number of *Calanthe veratrifolia*, *C. vestita*, *C. rosea*, *C. rubens*, *Habenaria*, *Carnea* and *Phalaenopsis violacea*; with which were interspersed in lesser numbers as they came in flower such things as Angrecums, Cattleyas, Vandas, Dendrobiums, *Ærides*, *Erias*, *Miltonia Roezlii*, *Dilochia Cantleyi* and various others.

6. While devoting a good deal of attention to the cultivation and determination of plants of botanical interest from the surrounding Islands and mainland, the more showy, and to some visitors the more interesting, garden forms are not neglected. Caladiums, of which we have a first class collection, are well grown and much admired, and the same may be said of Palms, Ferns, Aroids and other ornamental foliage plants. Flowering plants, especially Annuals, are not easy to grow during the rains, but from November to March we can do a good many things that it is quite impossible to grow satisfactorily during the other months.

7. Contributions of plants or seeds have been received during the year from the Royal Gardens, Kew, the Botanic Gardens, Calcutta, Ceylon, Singapore, Brisbane and Hongkong. The Agri-Horticultural Societies of Calcutta, Rangoon, and Madras; from Messrs. F. SANDER & Co., Messrs. JAS. VEITCH & SONS, Messrs. DAMMAN & Co., Messrs. CHATTERJEE and C. MARIES. Other contributors are Messrs. BAKER, Perak, BUTTIKÖFFER, Sumatra, BURCKARDT, Sumatra, BIRCH, Penang, CUNDALL, Manila, DERRY, Perak, GOLDHAM, Perak, HALLIFAX, Dindings, LOGAN, Penang, MOORE, Rangoon, PECHE, Moulmein, SCHMIDT, Sumatra, STEPHENS, Perak, VERSMANN, Sumatra, YAPP, plants from Gunong Inas.

8. Of recently introduced economic plants, the most promising is *Kickxia Africana*, of which six small plants were brought from Kew in November, 1899. After nursing these in pots for two months they were planted out and the largest is now over four feet high with a stem nearly an inch in diameter. *Landolphia florida*, obtained from Kew at the same time, has made shoots twelve feet long and commenced twining up the trees. *Castilloa elastica* does no good in this Garden. We have tried it in both sun and shade but it refuses to make progress under either condition.

9. Improvements and extension of the Garden, so far as funds permit, have been carried out, but the extent is limited as the Government Grant for Maintenance remains the same as it was nine years ago, while labour and every article that has to be bought has considerably increased in price.

10. One of the old wooden span-roofed plant-sheds in the Nursery, fifty feet long and eighteen feet wide, has been renewed with iron supports and roof, covered with bertam chicks, and the beds on which the plants are set reconstructed with rough soft granite covered with *Selaginella serpens*. Nearly sufficient iron has been accumulated to construct another and larger shed during the current year when the land now owned by the Tramway Company has been acquired.

11. The large iron plant-shed in which the plants are all grown in rock-work has been gone through, overgrown specimens removed to more suitable quarters and the others re-planted and manured. In this shed are some fine tree ferns and shade loving palms. New beds have been made and planted up with miscellaneous flowering shrubs, and a great number of Palms and trees of various kinds planted out in different parts of the grounds.

12. Three old bridges have been reconstructed in stone and iron which is a permanent improvement and completes the bridging of the one and-a-half mile of carriage road within the Garden. There are now three bridges of stone and iron spanning the main stream which bisects the garden, and three on the tributary sources which are practically dry at certain seasons. Five hundred and fifty lineal feet of carriage road, thirteen feet six inches wide, have been entirely remodelled and other parts repaired.

13. No special excursion for collecting botanical specimens has been undertaken by myself this year, but on each occasion I have gone out on forest duty, I have taken the necessary apparatus and a collector and added considerably to the collection of specimens in the herbarium, and to plants in cultivation in the garden. In September, the Overseer, MAHOMAD HANIFF, went out to the Lankawi Islands for a fortnight, but the monsoon was blowing so strong at the time that he found it impossible to get far. I am of opinion that if one could get about there in the middle of the rains, there are many interesting deciduous rock plants to be collected that one never sees in the dry season, but I know from experience that boating at that season is difficult and dangerous. However, he brought back several interesting plants some of which have since flowered and two of the Orchids, a *Bulbophyllum* and *Dendrobium*, have been described by Mr. RIDLEY in manuscript as new species.

14. The expenditure on this Garden during the year amounts to \$4,497.44 as shown in Appendix A, and the Revenue derived from sale of plants and use of Swimming Bath to \$588.20. This expenditure covers the cost of renewal of plant-shed, remodelling of roads and in fact all matters except the construction of bridges which was a budget item and carried out by the Public Works Department. The amount collected as revenue has been paid in weekly to Revenue Account.

Governor's Hill Bungalow Garden.

15. Mr. O'KEEFE returned from leave and resumed duty on the 2nd February and has, in addition to his own duties, been acting as Signal Sergeant since the end of May. He reports having been handicapped as regards coolly labour during the last three months in the year, being for some time three and four men short out of a staff of seven, which he attributes to higher pay being obtainable elsewhere.

16. The rainfall was less than in the previous year by about 30 inches, the wettest month being September with 33 inches, and the driest, December with 12.7 inches only.

17. With an adequate supply of manure and water a great many kinds of European Vegetables and flowers can be grown on this hill from November to March, but the present cost of carrying up manure is prohibitive, and when the rainfall falls to a point so low as in December last the rain water tanks on which we are dependant for gardening purposes become exhausted and it then requires all the available labour to carry from the nearest spring enough water to keep things alive. When the hill railway is made, it is hoped that the first of these troubles will be overcome, and I hope that the time will then not be far distant when water will also be made more easily available.

18. No new work has been undertaken, the sum authorised for upkeep being barely sufficient to keep the grounds in order, to grow enough ornamental plants for house decoration when the Bungalow is occupied, and maintain a regular small supply of vegetables. When the railway is made the hill will be largely visited by travellers passing through as well as by residents in the Island, and in that case more money should be spent in making the hill attractive.

Experimental Nursery.

19. The experimental Nursery on Government Hill has been practically abandoned for two years and steps are now being taken to re-afforest the site with useful trees.

Coco-nut Tree Preservation.

20. Mr. BALHETCHET, Inspector of Coco-nut trees, and two men have been employed six months in the year in Penang and six in Province Wellesley, in inspecting plantations, &c., and in serving notices on persons having on their premises dead trees or other matter likely to prove breeding places for beetles. The number of dead trees reported is less than in previous years and I believe this is

owing to diminution in the pest. Altogether 1,931 notices were served and twenty-nine persons prosecuted as shown below:—

Name of District.	No. of dead Coco-nut trees destroyed.	No. of pieces of Coco-nut Trunks destroyed.	No. of heaps of Cattle Manure removed.	No. of heaps of Paddy-husks destroyed.	No. of Notices issued.	No. of Summonses issued.	Amount of Fines recovered.
							\$ c.
Province Wellesley. Northern District,	554	2,147	104	66	824	14	28 50
Province Wellesley. Central District,	194	436	69	49	306	5	14 50
Province Wellesley. Southern District,	97	183	49	44	94	Nil	Nil
Penang Island.	634	2,074	181	25	707	10	35 00
Total.	1,479	5,047	403	184	1,931	29	78 00

Forests.

21. In February I visited the Dindings to inspect some proposed additions to the Forest Reserves in that District on which I reported on my return and of which I attach a copy (Appendix B).

Visits were also made at the request of District Officer to Tassek Glugor and Bukit Panchor Reserves, Province Wellesley.

22. In accordance with instructions from His Honour the Acting Governor, I went to Malacca in May with five hundred plants of "Gutta Taban" (*Dichopsis Gutta* or *D. oblongifolia*) and selected two sites on which to plant them. These trees were planted out 20' x 20' in partial shade, the idea being to gradually cut away the surrounding "bluker" as the plants acquire strength. While these enquiries were made and samples collected of some of the local climbing rubbers, which together with leaf specimens were sent to Kew, and a report on these has already been published in the *Government Gazette*. The Forest tree Nursery at Ayer Kroh was also inspected and at the request of the Acting Resident Councillor a few simple instructions in writing drawn up for the guidance of the Overseer in charge.

23. From June the 18th to July 2nd, I was detailed to accompany Mr. H. C. HILL of the Indian Forest Department during his tour of inspection of the Forests of the Colony in Penang, Province Wellesley and the Dindings. Mr. HILL has since reported on these Forests and the manner in which they should in future be administered.

24. In September, I obtained permission to visit Perak for three days to make some enquiries and observations in connection with Gutta Percha, especially the hill forms. On my return I furnished a short report on this trip, a copy of which is attached (Appendix C).

Para Rubber.

25. In my last two Annual Reports I have furnished information as regards the method adopted and results obtained from tapping a single Para Rubber tree (*Hevea brasiliensis*) growing in the Waterfall Garden, and the matter is of so great importance to the Agricultural Community of the Colony and Native States that no apology is necessary for again referring to the subject and repeating to a certain extent what has already been recorded in these reports. The tapping of this one tree has now been continued over a period of two years and the result is such as to confirm the opinion that in this cultivation lies a source of wealth of the greatest importance. This particular tree is now fifteen years old and has yielded in two years twelve and a half pounds of dry marketable rubber without any apparent injurious result to the health of the tree. It is growing on a dry, gravelly bank, not at all the sort of place I should select from choice, and is fifty-five feet high. At three feet from the ground it is sixty-six

inches in circumference and forks at three feet six forming two straight stems measuring at five feet from the ground, 42 and 32 inches in girth. The branches are not greatly spreading in proportion to its height and for trees of this size 20' x 20' apart gives ample room. This would give 108 trees to the acre and supposing them all to be equally as good as this one the result would be 675 lbs. of rubber per annum which at 3s 10d per lb. the price realised for three hundred weight sold in the London market by Mr. DERRY, Superintendent of Government Plantations, Perak, in April last, works out to over £129 per acre. It is not probable that all the trees on an estate would be equally good, in fact experience proves that there is a considerable difference, but Mr. DERRY informs me that in tapping once about a hundred trees in Perak, the average was three and-a-half pounds per tree, and much more could have been taken but it was feared that further tapping might interfere with the seed crop. This comes fairly near the result of our one tree which shows an average of three and one-eighth of a pound for each of the four tappings. In addition to the experience gained in tapping this one tree over a period of two years, two other trees in a group of twenty planted 12' x 12' have been tapped once, the result being 2lb. 9 oz. of dry rubber from the two. These are comparatively small trees about forty feet high and measuring 23 and 25 inches in girth at five feet from the ground. They are the same age as the large one but have grown slowly as might be expected in the sort of place they are planted. I think that this result from trees of this size will appear perfectly satisfactory to planters some of whom I know base their calculations on one pound per tree per year after the seventh or eighth year, and in good soil I believe that trees equal in size to these two will be grown in that time. The cost of land, clearing, and planting, is well known to those interested in the matter and the question of more importance to them at present is the quantity of rubber to be expected and the cost and method of collecting it. I have already shown the result as regards quantity, and as regards cost the time occupied in collecting this 12½ lbs. occupied one man about 28 hours, but the cost of tapping small trees will be proportionally greater. The only other labour involved is smoke drying which if the rubber is rolled out into thin sheets is a simple and inexpensive operation, but should be done as soon as possible after coagulation. A good deal has from time to time been written about the particular kind of nut that is used in Brazil for this purpose but in a recent Consular Report by Mr. Vice-Consul TEMPLE on the state of Amazonas, Brazil, he says that it is a mistake to suppose that any considerable portion of the rubber exported is prepared in this manner and he further states that wood chips which give less trouble to procure are preferred which is what might reasonably be expected seeing that the thing has to be done quickly. I find Coco-nut husks answer the purpose admirably. The latex coagulates as a rule without any trouble but if it contains a large proportion of rain-water there are various chemical re-agents that will cause coagulation. Acetic Acid and corrosive sublimate are recommended, but I have only tried Alum and Spirits of Wine. The latter is instantaneous in its action and if it does not injuriously affect the rubber, and I do not think it does, it may open a market to the sugar planters for their spirit. As regards the method of tapping I have found no better than that described in my last year's report that is that after having made a certain number of V. shaped or herring bone incisions to continue working on the same cuts by removing with a sharp chisel a thin shaving from the lower surface on alternate days. Very little milk is obtained at the first and second operations, but after about the third time it begins to run freely as will be seen by the following record of each day's collection:—

Date of tapping.	Weight of-Wet Rubber obtained at each operation in ounces.														Total weight of wet rubber.		Weight when dry.	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	lbs.	oz.	lbs.	oz.
Nov.-Dec., 1898	3¼	1¾	3½	6	9	6½	8½	6½	8½	6	6½	10	8½	8	5	9¾	3	0
April-May, 1899	Daily record mislaid																2	8
Nov.-Dec., 1899	1	1¼	2½	3	6¾	8	10	10¼	6¼	9	11½	11½	11	8	6	4	3	4
Oct.-Nov., 1900	0	½	3	4½	6	9½	11	9½	12¾	14	14	12	15	12	7	11¾	3	12
Total ...	11¾	3½	8¾	13½	21¾	24	29½	26¼	27½	29	32	33½	34½	28	19	9½	12	8

It will be seen by the above that this tree yielded freely after the third operation and continued to do so up to the end of the tapping and that there was no reason to discontinue the tapping on account of falling off in the quantity of latex, the only reason for doing so being that the cuts were by this time from three-quarters to one inch wide, and although they heal rapidly it was not thought wise to make them wider. New bark has completely grown over the cuts of the first three tapplings. It would appear that October to December are better months for tapping than April and May, but too much importance should not be attached to an experiment made on a single tree either as regards the yield or best months for tapping. I simply record the facts for what they are worth, but as regards yield it should be considered in conjunction with the result obtained in Perak with a hundred trees, the oldest seventeen years old, and this should I think induce capitalists and the Government to consider whether this tree has as yet received the attention it deserves. In the Consular Report already referred to, it is stated that hundreds of miles have to be traversed to reach the rubber districts in Brazil, and although there are probably fifty million acres of forests at present being worked for rubber it is estimated that for Districts where it is fairly plentiful, the average is only one Hevea tree to every two acres, and the estimated yield one to one and-a-half kilos per annum. In a few roughly calculated tests made here I found half a pint (10 fluid ounces) of latex gave three ounces of dry rubber, and coagulated rubber weighed wet lost about 50 % of its weight in drying.

Gutta Percha.

26. In 1899 it was decided by Government to form plantations of Gutta Percha in Malacca, and in May last I was instructed by His Honour the Acting Governor to take down 500 young trees and plant them in Bukit Bruang Reserve. These are the half of a batch of seedlings raised in Penang. Since then Mr. H. C. HILL in his report on the forests of the Colony has advised that plantations on a large scale should be made both in Penang and Malacca, and by way of a beginning the remaining 500 will be planted in Penang at the proper season. Consequent on this recommendation a good deal of attention has been devoted to this subject during the past few months. None of the trees in Penang have fruited this year nor have we been able to obtain seeds elsewhere. Mr. DERRY, Superintendent of Government Plantations, Perak, wrote me in November that a tree growing in the Resident's grounds at Kuala Kangsar was in fruit, but on a subsequent visit, a month later, he found that squirrels had eaten them all with the exception of two fruits which he sent me for herbarium specimens. These are the only fruits I have seen or heard of this season. All the *Dichopsis* are slow growers and transplant badly, great care will therefore be necessary in preparing plants and laying out plantations. Young plants in the Nursery under most favourable conditions have grown about a foot in height in a year. The tree referred to as fruiting at Kuala Kangsar is said to be eighteen years old and is twenty-five feet high, with a girth of twenty-four inches at three feet from the ground. As it is uncertain when we may be able to obtain seeds in sufficient numbers to plant on a large scale we have been trying recently in various ways to propagate from cuttings. It is too soon yet to say what percentage will grow from cuttings but the prospect of raising a large stock by this means is not encouraging. Some species of *Dichopsis* may grow from cuttings fairly well (though seedlings, of all if obtainable should have the preference) but *D. gutta* or *D. oblongifolia*, whichever the Penang plant may be, and there is some doubt about it, is a most difficult subject. To obtain cuttings and information as to the quantity of gutta to be obtained, &c., we cut down one tree in the Highland Reserve and collected the gutta in the native manner, the result being one and-a-half pounds of first class gutta percha. This tree was 55 feet high with a moderately clean straight stem 39 inches in circumference at five feet from the ground, and at least forty years old. I do not consider this method or the result satisfactory and some other and better way of extracting the gutta will have to be devised. Tapping in the same way as rubber trees is not applicable to this tree and the solution of the problem will probably be some system of cutting the plantations at a comparatively early age, when they will coppice, and treating bark and leaves at a central factory; unless the leaves alone are found to be of sufficient value and produced in sufficient numbers to render plantations remunerative. *Dichopsis gutta* occurs only at low elevations and it is desirable to introduce for planting the upper portions of Penang Hills the species that occur on Perak Hills up to 3,000 feet. This is known locally as "Gutta Taban Putih" and is I believe *D. pustulata*, I have recently had an opportunity of observing this tree on the Taiping

range and found it abundant at 2,000 to 2,500 feet, whereas the Penang tree seldom or never occurs above 1,000 feet.

C. CURTIS,

Assistant Superintendent of Forests.

Penang, 15th January, 1901.

APPENDIX A.

Revenue and Expenditure of the Botanic Gardens Department, Penang, 1900.

REVENUE.		EXPENDITURE.	
	\$ c.		\$ c.
Government Grant— Maintenance of Water- fall Garden ...	4,500 00	{ Wages 3,174 61 Plants and Seeds 87 27 Pots and Tubs 153 25 Manure and Cartage 31 00 Material for Herbarium 103 70 Books and Periodicals 28 00 Planks for cases and labels 147 25 Tools 113 10 Material for repairs, &c. 343 14 Iron for renewing sheds 85 64 Road metal 107 00 Miscellaneous Petty Expenses 123 48	
		Balance	4,497 44
		Total	2 56
			4,500 00
Government Grant— Upkeep of Grounds of Governor's Hill Bungalow	1,000 00	{ Wages 795 54 Seeds 33 67 Tools 61 84 Pots 22 00 Manure 33 09 Material for Repairs, &c. 51 70	
		Balance	997 84
		Total	2 16
			1,000 00
Government Grant— Maintenance of Experi- mental Nursery ...	200 00	{ Wages 155 30 Manure 40 00	
		Balance	195 30
		Total	4 70
			200 00
Government Grant— Expenses of carrying out Provisions of Coco-nut Trees Preservation Or- dinance	736 00	{ Salaries and Wages 588 00 Travelling Allowances 121 73	
		Balance	709 73
		Total	26 27
			736 00

APPENDIX A—Concluded.

Revenue and Expenditure of the Botanic Gardens, Department, Penang, 1900.

REVENUE.		EXPENDITURE.	
	\$ c.		\$ c.
Government Grant— Travelling and Personal Allowances ...	462 00	{ Pony Allowance ...	225 00
		{ Expenses of trip to Dindings ...	52 75
		{ Expenses of sending Overseer to Lankawi ...	43 54
		{ Expenses of journey to Perak ...	41 76
		{ Expenses while on duty with Mr. H. C. Hill ...	60 75
		{ Miscellaneous ...	3 02
		{ Field and Personal Allowances ...	19 96
Total Government Grants	6,898 00		446 78
Revenue from Plant sales	550 80	Balance ...	15 22
Revenue from Swim- ming Bath }	37 40	Total ...	462 00
Total Collected ...	588 20	Total Expenditure ...	6,847 09

C. CURTIS.

Assistant Superintendent of Forests.

Appendix B.

BOTANIC GARDENS,

Penang 28th, February 1901.

SIR,—In accordance with your instructions, I went to the Dindings on the 15th instant, and inspected the two blocks of Forest it is proposed to add to the Reserves. I also took the opportunity of seeing as much as I could in the time of the already demarcated areas which are practically those I had the honour of suggesting in 1888, and in which no cutting of any importance has been authorized since that time.

2. From the papers you sent me to see I gather that there is an impression that Mr. CANTLEY at some time visited this District and made certain suggestions, but I think this is a mistake. I have no recollection of his having been there subsequent to my joining the service in 1884, and I am pretty sure that he had not previously done so.

3. The present Reserves consist of six blocks, *viz* :—Pangkore Island, Lumut Hills, Tanjong Hantu, Bukit Segari, Gunong Tunggal, and Tanjong Burong. The latter is all mangrove and is reserved specially for fire wood.

4. The two portions that it is now proposed to add are several miles apart, one being in the extreme North of the District, and the other in the extreme South. The District Officer proposes that these should be known as Ulu Bruas, and Tulloh Morah Reserves.

5. Ulu Bruas Reserve is a triangular block of forest land, mainly hilly, but including some low wet jungle, which has been recently worked by timber cutters. The boundaries on two sides are well defined by the territorial boundary line which divides Perak and the Dindings, and the third by a cart-road for a distance of about two-and-a-half miles. A good deal of land has been taken up along the edge of this road for cultivation so that in places the road will not be the actual boundary but a line running more or less parallel with it above the line of cultivation. It is difficult to estimate the area with anything like correctness but it is safe to say that the area is not less than 1,500 acres. This Reserve contains the only Gutta Percha (Gutta Taban) I saw in the District. I actually saw only half-a-dozen trees but I have no doubt there are many more. The largest measured had a girth of 5' 6" at five feet from the ground.

6. Tulloh Morah is an oblong block of well wooded hills, the boundaries of which will follow the base of the range leaving out the flat land suitable for cultivation along the coast line. With the little I was able to see of this, I should not like to make a guess as to the area.

7. As regards your instructions that I should suggest new Reserves, or additions to existing ones, there is some difficulty. There has been no survey and consequently it is impossible to say what proportion of the District is already reserved. One thing is certain and that is that the rough estimate as given in the District Officer's Report for 1898 is a very long way below the mark. Pangkore Island for instance which with the exception of village sites is practically all Forest Reserves, is put down at 1,250 acres. The total area of Pangkore Island which is about 4 miles long cannot be less than 5,000 acres, probably more, and the village sites and cultivated portions do not I should say represent one-fifth of the whole, so that the Reserve must be more like 4,000 acres.

8. There is also another matter to be considered in suggesting any considerable addition and that is the system it is intended to pursue in the future as regards these Reserved Areas. The original idea of prohibiting wood-cutting within the areas known as Forest Reserves was for the purpose of allowing time for them to recover by natural means the effects of severe and indiscriminate cutting in the past, and as soon as that had been accomplished to again open them for working, one or more at a time, in rotation, but without satisfactory maps and an intimate knowledge of the area and contents of each Reserve it is impossible to formulate a working plan or to say when the time will have arrived to put this intention into effect.

9. The whole of the Dindings is practically forest. It appears from the District Officer's Report that the Revenue from Forest produce in 1888 was over \$15,000 and represented 70% of the Revenue of the whole District. The population is not supposed to be increasing and so far as I can see no appreciable increase in cultivation has taken place during the past ten or twelve years. Under these circumstances it is important that the Forest should be managed so as to derive as much Revenue as is consistent with their being maintained in a state of efficiency, which is to say that the quantity cut each year must not on the whole exceed the annual normal increase.

10. If I may venture to offer a suggestion it is this, seeing that the greater portion of the Dindings is forest and that neither population nor agriculture shows any appreciable increase the whole of the Crown Forests, both reserved and unreserved should be considered from a business point of view and supervised by one Forest Staff, to do this the Forest Guards would have to be increased in number and stationed in different parts of the District, preferably in the immediate vicinity of the principal Reserves. Each guard should be kept informed of all licences issued for his part of the District and it should be his duty to see that the produce removed corresponds with the licence both as regards kind and quantity. It would also be his duty to arrest any person cutting or removing without a licence jungle produce from any Crown Forest whether reserved or not. This would in my opinion be simpler for the Officer in charge, and more economical and effectual than keeping one staff for reserved and another for unreserved forest, and that without in any way rendering the protection of the Reserves less effective than at present. On the contrary, my experience in Penang has been that nine times out of ten it is professional wood-cutters who take out Passes that get into the Reserves and it is most important for the Forest Guards to know who have licences and where they are working.

11. The principal distinction I would draw between reserved and unreserved Forests in this District is that no portion of the former should at any time be granted for agricultural purposes, while the latter is available for that purpose should a demand for land arise. For the present, and probably for some years yet no cutting should be allowed within the Reserves but the time will come when a considerable Revenue should be derived from these Reserves.

12. In one of the papers you sent me to see I noticed that His Honour the Officer Administering the Government considers that one-fifth of the District should be Reserves, and I think that with the two new portions now to be added, the total area will not fall far short of that; but in the absence of any survey it must be more or less guess work.

I have, &c.,

C. CURTIS,

Assistant Superintendent of Forests.

Appendix C.

BOTANIC GARDENS,
Penang, 2nd November, 1900.

SIR,—In accordance with your verbal permission to proceed to Perak for three or four days to obtain more definite information about the range of Gutta Percha trees, &c, on Taiping Hills, and to collect Orchids and other plants of interest for cultivation in the Public Garden here, I left for Taiping at 10 P.M. on the 25th October, and returned at 7 P.M. on the 30th.

2. On arrival in Taiping I proceeded first to the Museum where Mr. L. WRAY, the Curator, kindly allowed me to look through his herbarium specimens of *Sapotaceæ*, in which order are included our most important Gutta Percha producing trees, and gave me much valuable information. He also showed me samples of Gutta from various species, most of which have been collected and prepared by himself, and as the herbarium specimens were collected at the same time and from the same tree these samples are of more than ordinary interest and value.

3. On leaving the Museum I walked up to Maxwell's Hill where Mr. DERRY, Superintendent of Government Plantations, gave me all the information and assistance in his power.

4. During my stay in Perak I saw only two species of *Dichopsis* (Taban) neither of which appear to be *Dichopsis Gutta*, and until flowering and fruiting specimens are obtainable their specific names must remain more or less doubtful. I showed Mr. WRAY leaf specimens on my return from the hill and he thought they corresponded with what the Malays call Taban Chaier and Taban Putih, and which have been determined for him at Kew as *Dichopsis polyantha* and *D. pustulata*. In the absence of flowers or fruit the difference in appearance is not great. At a little distance they look all alike, but those in Perak and Penang, and it is only on examining them closely that one sees there is a difference.

5. The question of the correct botanical name, although most desirable to know is not of so great importance as the question of the quality of the Gutta and the situation in which each particular species is found growing naturally, so that in any planting scheme we may plant the right species and in the right place.

6. On the Taiping Hill, Taban Putih (*D. pustulata*?) extends up to 3,000 feet and is most abundant at 2,000-2,500 feet. I collected a small sample of gutta and it is so far as I can judge of good quality. Mr. WRAY who knows the tree well informs me that it is always considered very good gutta, but not so good as *Dichopsis Gutta* (Taban merah).

7. *Dichopsis gutta* occurs only at low elevations. Much of the available and uncultivated land in Penang that it is desirable to re-afforest, such, as areas within the Reserves and abandoned spice gardens, are at an elevation of from 1,000-2,000 feet and it therefore seems probable that this Perak mountain form *D. pustulata*? will prove more suitable for planting in places in Penang than *D. gutta*.

8. *Dichopsis polyantha*? (Taban Chaier) grows at a much lower elevation than *D. pustulata*? (T. Putih) and is found quite down to the foot of the hill, but as *Dichopsis Gutta* also grows at low elevations and is the more valuable of the two, this will probably be of less importance as a tree for planting unless it should prove that it is the quicker grower or yields a greater quantity of gutta which might compensate for the difference in price. On these and many other points more definite information than is at present available is wanted.

9. Of Orchids, Palms, and other plants for cultivation in the garden, I collected great numbers.

I have, &c.,

C. CURTIS,
Assistant Superintendent of Forests.

Annual Report on the Botanic Gardens, Singapore, for the year 1901.

The Weather.

The year 1901 was very dry since only 78·36 of rain fell in the Gardens. March had the smallest fall 3·93, and June the greatest 9·67. The effect on the vegetation was not very marked, although it is usual for a dry year to be a heavy seed bearing year.

Staff.

The Director went on long leave on March the 17th, on which date I took over charge of the Department. There were several changes in the staff owing to the dismissal of ZAIN ABDUL RASIP, the Chief Mandor of the Economic Garden, for carrying on an illicit sale of Para Rubber seeds. This man had for twelve years borne an excellent character, and had also acquired a considerable knowledge of Economic plants and their uses, and the loss of his services to the Department, at a time when it was undermanned, was felt acutely. His place was filled by MOHAMED HANIF, the Mandor from the Upper Gardens, who in turn was replaced by an entirely new, and of course untrained, man from outside. This fact emphasizes the long felt need of apprentices who could fill the places of trained men who leave the service. In connection with the subordinate staff, I am glad to record the sanction by Government of a Scheme for the improvement of their positions, which will result, I hope, in making them as a body contented, and promote the interests of themselves and the Department.

2. The coolies have on the whole worked fairly well, but, as reported last year, the class of labour is not what it used to be; the fact is that the coolies, as soon as they have picked up a smattering of Malay and the rudiments of their work, leave the Gardens for private employment or to labour on Public Works, with the result that the work of the Gardens has to be carried on with quite untrained men. There has been an unusual number of Beri-beri cases amongst them, no less than 29 cases having occurred, generally of a mild character. Three cases were however fatal. In May the number of cases were so numerous, and in one or two cases so serious, that I reported the matter to the Principal Civil Medical Officer who had the Coolie Lines disinfected, and gave general instructions as to treatment.

Visitors.

3. The number of Visitors was about the same as in the previous year, when the number was abnormal owing to the many Mail passengers who visited the Gardens. Several eminent men of science, chiefly Germans and Americans, also visited the Gardens, in several cases staying for some months studying questions of Economic Botany.

4. The Regimental Bands played in the Gardens from time to time, attracting enormous crowds of people, especially on the occasion when the massed bands of the 3rd, 13th, and 16th Regiments of Madras Infantry gave a performance in November.

5. It will be a question in the near future whether the Gardens, or at least that portion round the Band-Stand, are not too small to accommodate such large numbers of people.

Aviaries.

6. The aviaries and animal enclosures have for some time required overhauling; the latter are, I regret to say, practically beyond repair. In the early part of the year the Public Works Department prepared a series of plans of enclosures for the better accommodation of the animals. The buildings thus designed would have placed the Zoological Department in a very efficient state, but the scheme was thrown out by the Legislative Council, and Government gave orders for the disposal of all the larger animals.

7. The following additions were made to the collection during the year:—Two Wa-Was (*Hylobates lar*.) presented by Miss Edith Abrams, one Javanese squirrel

(*Sciurus bicolor*.) presented by Mr. F. W. Christian, three Pythons (*Python reticulatus*) presented by Messrs. Romenij, Branagan, and F. Teng Quee respectively, one flying fox with young, presented by Mr. Lim Koon Yang; one Binturong (*Arctictis binturong*) presented by D. H. Wise, Esq., one Christmas Island Pigeon (*Carpophaga Whartoni*) presented by M. Hellier, Esq., one young red Civet cat and one long tailed monkey, presented by R. Shelford, Esq., Sarawak, two storks presented by Madame Gorski, and two young monkeys and three parrots from the Andamans. One young Berok (*Macacus nemestrinus*) was born in the Gardens. A female Rhinoceros procured by the Austrian Consul was deposited in the Gardens; it is intended for the Zoological Gardens at Vienna and will be shipped there in the coming spring. A female specimen of the rare "Sapi-Utan" (*Anoa depressicornis*) was obtained from Celebes by the Museum authorities.

8. The following animals died during the year. One (*Python curtus*), one Eagle, three Phalangers, two Kijangs, one wild cat, three Christmas Island Pigeons, one deer, and one black swan.

Upkeep and Buildings.

9. The chief work under this head has been the erection of a new plant house near the potting shed. It consists of seven long tables of coral 48 feet long. It has a ridge and furrow roof, covered with Bertam chicks obtained in Penang, and supported by steel rafters on brick pillars; it is a most substantial, structure and will last for years. It has been filled with a miscellaneous assortment of plants, chief of which are a named collection of our various palms, some of the rare ferns, and some of the most recent introductions from Kew. All the plants have thriven well in it. The roof of the small nepenthes house has been entirely renewed, as also a very large part of the Aroid and Begonia house. The work of keeping up of the beds, borders and shrubberies has perhaps taken up a greater amount of time than usual, as a special effort was made to render the gardens more bright and attractive with flowering plants.

10. The drives and paths have been repaired where necessary. Of the former, the drive from the main entrance to the deer enclosure was entirely remetalled during the year.

11. The bamboo hedge surrounding the western part of the gardens and that from the office to the main entrance, are not in a very creditable state, owing partly to their being under trees, and the soil being poor, but also to the constant breaking through by syces, native soldiers, etc. I should be glad to see the hedge replaced by a low wall surmounted by an iron railing similar to that in front of the Lunatic Asylum.

Plants and Seeds. (Exchanges)

12. Exclusive of the large consignments of plants and seeds (chiefly guttas and Rubbers) and the monthly supply of seeds from Messrs. Carter & Co., we have received during the year one hundred and sixty plants and one hundred and eight bags or packages of seeds. The following is a list of contributors:—

The Royal Gardens, Kew. The Botanic Gardens, Buitenzorg, Calcutta, British Guiana, Saigon, Saharanpur, Madagascar. Messrs. Rauch, Von Pustau, Arden, and Schlechter. The Government Horticultural Gardens, Nagpur. The Tokio Plant and Seed Co. The Agri-Horticultural Society of India. Messrs. Herb & Wulle, Naples.

13. Seven hundred and sixty-nine plants and eight hundred and four packages of seeds were sent to forty-two Institutions and individuals.

14. Amongst the most useful plants introduced during the year were the true West African Rubber (*Funtumia elastica*), about 100 plants of which were raised from seed supplied by Mr. S. ARDEN, and some thousands of Gutta Sundik (*Payena Leerii*) supplied from Buitenzorg. From Kew came several species of Landolphia (the African Rubber plant) including two new species, *Garcinia Kola*, from old Calabar, and *Mimusops Schimperii* (the *Persea* of ancient writers), from Madagascar. From the same establishment came a collection of miscellaneous plants of striking interest chiefly selected by the Director Mr. H. N. RIDLEY. The Rt. Rev. Bishop HOSE kindly presented a set of 25 varieties of hybrid *Rhododendrons* which he obtained at Kew.

Plants in Flower.

15. Most of the plants mentioned in former Reports have flowered during the year and the following for the first time. *Kigelia pinnata* (T. Africa) *Exostemma cariboeum* (W. Indies) *Brunfelsia nitida* (T. America) *Bulbophyllum grandiflorum* (New Guinea.)

Library.

16. The following books and periodicals were added during the year.
- Hunger Dr. F. W. T. Een Bacterie-Ziekte Der Tomaat.
 „ Ziekten en Beschadigingen van het blad by Deli-Tabak.
- Lloyd C. G.—Mycological notes.
- Wood Medley, J.—Natal Plants.
- Kramers, Dr.—Mededeelingen over Koffie.
- Maiden, J. H.—Tracts on the useful Australian Plants.
- Zimmermann, Prof. Dr. A.—Over het enten van Koffie.
- Dyer-Thiselton, Sir W. T.—Flora of Tropical Africa.
- Tryon Henry, Tracts on Entomology and Pathology of Queensland Plants.
- Koningsberg, Dr. J. C.—De Vogels van Java en Hunne Oeconomische Beteekenis.
- Cook, O. F.—The Origin and Distribution of the Cocoa Palm, The Chayote (A Tropical vegetable.)
- King Sir Geo.—Materials for a Flora of the Malay Peninsula Nos. 11 and 12.
- Cooke, Theodore, Flora of the Presidency of Bombay.
- Masters Dr. Maxwell T.—Hybrid Conifers.
- Smith, C. B.—A German Common School with a Garden.
- Rusby, Dr. H. H.—A Comparison of the English and German works on the Genera of Plants.
- Ward, Dr. L. F.—Description of the species of Cycadioidea.
- Kooders, S. H. and Valetton Dr. Th.—Boomsoorten op Java.
- Schrenk, Von H.—Some Diseases of New England Conifers.
- Dorsett, P. H.—Spot Disease of the Violet.
- Pierce, N. B.—Peach Leaf Curl, Its Nature and Treatment.
- Bentham, George.—Flora Hongkongensis (Purchased.)
- Wilcox, Dr. E. M.—Glimpses of Tropical Agriculture.
- Schmidt, Johs.—Flora of Koh Chang.
- Gifford, John.—Silvicultural Prospects of the Island of Cuba.
- Hitchcock, H.—Distribution of the Agricultural Exports of the U. S. 1894-98.
 „ Our Trade with Japan, China and Hongkong, 1889-99.
 „ Sources of the Agricultural Imports of the U. S. 1894-98.
 „ Foreign Markets for American Agricultural Products.
 „ Our Foreign Trade in Agricultural Products 1891-1900.
- Coulter, J. M. and Rose J. N.—Monograph of the North American Umbelliferae.
- Palmer, T. S. and Olds H. W.—Laws Regulating the Transportation and Sale of Game.
- Engler, A.—Pflanzenreich 6 parts. (Purchased)
- Christ, Dr. H.—Ferns of Shen-Si and Costa Rica.
- De Bie, H. C. B.—De Landbouw Der Inlandsche Bevolking op Java.
- Smith, E. F.—Wakker's Hyacinth Germ.
- Gildemeister and Hoffmann.—The Volatile Oils. (Purchased)
- Gordemoy, Dr. J. de.—Gommes Resines D'origine Exotique et vegetaux qui le Produisent.
- Rydberg Axel Per.—Flora of Montana.
 „ New Species from westers United States.
 „ Delphinium Carolinianum and Related species.
 „ Studies on the Rocky Mountain.
- Dougal, Mac T.—Symbiosis and Saprophytism.
- Nash, V. George.—The Dichotomous Panicums (some new species.)
- Small, J. K.—Notes and Descriptions of North American Plants.
- Blodgett, F. H.—Vegetative Reproduction and Multiplication in Erythronium.
- Williams, R. S.—Two New species of Grimmia from Montana.
- Britton Elizabeth, G.—Life History of Schizaea Pusilla.
- James Veitch and Sons.—Manual of Coniferae (Purchased)
- Hallier, Dr. H.—Indonesische Acanthaceen.
- Dabney, C. W. Jr. Ph. D.—The Cotton Plant.
- Brannt W. T.—India Rubber, Gutta-Percha and Balata (Purchased)
- Clark, C. B.—Commelynaceae.
- Henriques, Dr. R.—Kautschuk.
- Warburg, Dr. O.—Kautschukpflanzen.
- Loew Oscar.—A New Enzym of General Occurrence.
- Hissink, Dr. D. J.—Toelichting Behoorende bij de Grondsoortenkaart.

Weinland, Dr. C. A. F.—*Reliquiae Weinlandianae*.

Preyer, Dr. Alex.—*Über Kakaofermentation*.

Chesnut, V. K. and Wilcox, E. V.—*The Stock-Poisoning Plants of Montana*.

Nanninga, Dr. A. W.—*Veranderingen Welke Deze Stoffen*.

Lefroy Maxwell.—*General Treatment of Insect Pests*

Urban, Prof. Dr. Ing.—*Vorgeschichte des Neuen Könige Botanischen Gartens*, Berlin.

Prudhomme, M. *L'Agriculture sur la Côte est de Madagascar*.

17. Exchanges :—

Bulletins of.—Kew, Jamaica, Trinidad, The West Indies, Ceylon, Buitenzorg, Indo China, Land Record and Agriculture, N.W.P. and Oudh, Madagascar, Koloniaal Museum te Haarlem, New York, L'Herbier Boissier, Wisconsin (U. S. A.)

Journals.—Journal of the Board of Agriculture, Experimental Station Records (America) Annales du Jardin Botanique, Annals of Royal Botanic Gardens Calcutta, Journal of Agriculture for Zanzibar, Planting Opinion Madras, Notizblatt Berlin, Queensland Agricultural, Dept: of Agriculture Western Australia, The Chemist and Druggist, Acti Horti Petropolitani, The Annual Report and Proceedings of the Agricultural Society of Madras, Agricultural Journal of the Cape of Good Hope, Tropenpflanzer (Berlin) Revue des Culture Coloniales (Paris) Journal D' Agriculture Tropical (Paris). Bulletin of the Dept: Journal of Land Record and Agriculture Madras, The Agricultural Ledgers of India, Bulletin Du Jardin Colonial (Paris) North American Fauna, Indian Museum Notes, Pharmaceutical Review (America) Bulletin of the Ohio Agricultural and Experiment Station (U. S. A.)

18. Purchased :—

Indian Gardening and Planting, Gardeners Chronicle, Journal of the Linnean Society, The Botanical Magazine, The Tropical Agriculturist, Dictionnaire Iconographique des Orchidees.

19. Annual Reports :—The Forest Dept: of South Australia, Land and Agricultural Dept: Madras, Dept: of Agriculture Queensland, Merck's Annual Report and Digest, Botanic Gardens :—Natal, Ceylon, Trinidad, Hongkong, British Honduras, Calcutta, Buitenzorg, New South Wales, Travancore, Barbados, Mysore, British Guiana, Gold Coast, Forest Dept: Madras, Zoological Garden, Ghizeh (Cairo), Queensland Acclimatization Society, Agricultural and Mechanical College, Still-water, Oklahoma (U. S. A.) Smithsonian Institution, The Year Book of Dept: of Agriculture, Washington, U.S.A.

Herbarium and Office.

20. Two hundred and sixty-nine herbarium specimens of Malayan Plants were received from Sir GEORGE KING. Seventy-one species from Dr. PRAIN, Calcutta, and 32 species of plants collected by Mr. CURTIS in Indragiri were received and mounted. One hundred and four species of plants and forty-four wood specimens were sent to the Royal Gardens, Kew; three hundred species of plants and one bundle of Palm leaf specimens were sent to the Kolonial Wirtschaftliches Komitee, Berlin.

A collection of Malayan fruits was sent to the Director, Botanic Gardens, New York.

One packet of Gutta specimens was taken by Dr. SHERMAN of the Forest Bureau, Manila. The herbarium specimens of the following Natural Orders were sent to Kew for critical comparison by Mr. H. N. RIDLEY, the Director; *Viz* :—

Palmae.

Aroideae.

Agricultural Bulletin.

21. For some time past a want has been felt by the Planters and others of having some kind of a periodical which would serve as a medium for the record and exchange of their experiences and also contain articles on agricultural and allied subjects appertaining to their interests. This want has been met by the publication of the existing Bulletin in a somewhat different form, and by its issue regularly once a month.

Some three numbers were issued up to the close of the year, and although it is somewhat early to criticise it in its infancy, I may be allowed to say that I can see very clearly that the Editor will have either to go about the Peninsula himself, and see what is going on, or else he will have to have some one with sufficient knowledge to do this for him, for it is obviously impossible for the Editor to write about subjects which require examination on the spot, when he is kept constantly in Singapore.

BOTANIC GARDENS, SINGAPORE.

Statement of Receipts and Expenditure, for the year 1904.

RECEIPTS.			EXPENDITURE.		
		\$ c.	Salaries.		\$ c.
By Balance in Bank	...	3,024 26	Salaries		5,880.40
„ Government Grant	..	9,150 00	Bills		6,298.96
„ Sale of Plants, Seeds and			Balance in Bank		2,796.51
Flowers	...	2,763 c9			
„ Interest	...	38 52			
		\$14,975 87			14,975.87

Inspection of Coco-nut Trees.

22. The good effect accruing from constant inspection of coco-nut estates, tanneries and saw mills, is shewn by the fact that a Palm beetle is now very rarely seen, while very few years ago the beetles and their larvæ could be seen by the thousand. During the year notices were served on 253 persons calling on them to destroy old coco-nut stumps, piles of rubbish, etc., and in every case were readily complied with, so that there was not a single prosecution. In all there were destroyed 835 old trees, 121 stumps and 32 piles of rubbish.

Vote	...	...	\$486.00
Expenditure	...	...	\$441.12

Economic Gardens.

23. The ground opened up in 1900 for planting the Central American Rubber (*Castilloa elastica*) was planted early in the year. The growth of the plants has been somewhat irregular, owing probably to some parts being wetter than others; unlike Para Rubber, these plants do not seem to like low damp ground, as those on the drier parts have made the best growth.

24. Para Rubber.—Our trees are still the principal stock plants for the supply of seed, the demand for which was about the same as last year. I anticipate however in the near future a much smaller demand, as many of the oldest trees on Mr. BAILEY'S Estate have begun to fruit. It is satisfactory to record that the Chinese squatters are turning their attention to this cultivation. One hundred and fifty-two thousand seeds, and nine thousand nine hundred and seventy-five plants were distributed as shewn in the subjoined table, which gives the quantity distributed during the past six years:—

	1896.	1897.	1898.	1899.	1900.	1901.
Colony	2,810	2,885	1,800	77,481	52,750	74,025
Perak	Nil.	Nil.	Nil.	7,271	Nil.	Nil.
Selangor	Nil.	20,625	76,700	71,507	79,350	66,950
Pahang	Nil.	3,650	3,550	1,400	..	...
Negri Sembilan	Nil.	...	600	...	...	...
Johore	Nil.	600	21,300	3,650	17,500	11,200
Borneo etc	Nil.	4,150	5,500	1,273	2,400	...
	2,810	31,910	109,450	162,582	152,000	152,175

25. The usual stock of young Economic plants was maintained by propagation from seed and cuttings. Blanks were filled up in the arboretum, and in the section plots. With the exception of one demand for 1,200 plants for Cochin China not a single enquiry was made for Ramie.

Vote for Up-keep of Economic Gardens ...	\$2,200.00
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Expenditure.

Salaries of Mandore and Coolies ...	\$1,911.36
Tools ...	204.40
Timber, bricks, lime etc. ...	82.33
Balance ...	1.91
	<hr/>
	\$2,200.00

Gutta-Percha.

26. More attention has been given to this subject than to any other during the year, and, for the first time in the history of the Colony, seeds of the true *Dichopsis gutta* were gathered, although for upwards of 15 years efforts have been made to obtain them both by ourselves and by the late Sultan of Johore. To Singapore belongs the honour of getting the first seeds from a tree in the Gardens which is the direct descendant of the original trees at Bukit Timah which gave the first Gutta-Percha brought to the notice of Science, and on which the genus (*Dichopsis*) was founded. The Penang trees also furnished several thousand seeds, at nearly the same time. Interesting as this success is, we should have made comparatively little progress had we been dependent on seeds alone. I am glad to say, however, that some forty-one thousand saplings have been obtained, and either planted out directly in their permanent positions, or put in nursery beds for future planting. It must, of course, be expected that a considerable number of these will succumb, but putting the failures at 50 per cent., which I believe will prove an over-estimate, I think we may be satisfied that a distinct advance has been made. Of the 41,660, 16,000 were sent to Penang; a little over 10,000 to Malacca; and the balance 16,007 have been kept for stocking Bukit Timah. I am glad to record that Mr. BURN-MURDOCH, the Chief Forest Officer, who inspected the work at Bukit Timah, expressed his approval of what had been done. As regards the exact determination of the different species much has been done, although it is admittedly a difficult genus to determine. The Director in last year's report discussed the probability that *Dichopsis gutta* and *D. oblongifolium* are one species, the leaf variation being more or less identical in both types. There is however no doubt on this point, that *D. oblongifolium* is the species that has yielded the chief supply of gutta Taban for many years, and although there is a great amount of leaf variation in that species the practised eye can easily recognize it from other species such as *D. borneensis*, *D. pustulata*, *D. Treubii*, and others. The critical studies of Messrs. SCHLECHTER and SHERMAN, who spent some months studying this genus both here and in Java and Borneo, have been of much assistance to us. Their conclusions, which are in accordance with ours, are, that the two best sorts to cultivate are *D. oblongifolium* and *D. borneensis*, and of the two the former is preferable as it grows more readily, and is indigenous here.

Planting in Forest Reserves.

27. The Mandor in charge at Bukit Timah suffered severely from fever, as also did his wife and family, so that they were obliged to leave the new quarters erected in May. The quarters in question are placed on an apparently healthy site close to the road leading to the top of the Hill. I attribute the fever to the disturbance of the soil during the erection of the building, and believe that the place will gradually become healthier. The coolies who live in lines immediately behind the Mandor's quarters also suffered from fever, but not to the same extent as the Mandor. The only work done with regard to the trees planted in previous years was clearing the ground round them, so that the coolies were chiefly employed in preparing ground for and planting out gutta percha saplings.

Vote.

Planting in Forest Reserves ...	\$ 300 00
Expenses of Planting Gutta-Percha and Para Rubber (according to the Printed Estimates) ...	300 00
Further extended on two occasions ...	4,000 00
	<hr/>
	\$ 4,600 00

Expenditure.

Expended on Procuring Gutta-Percha Plants	...	\$ 2,307 40
Coolies Wages	...	679 57
House Rent for Mandor and Cartage on Plants	...	17 00
Tools	...	26 20
Balance	...	1,569 83
		<hr/>
		\$4,600 00

Government House Grounds and Domain.

28. A new Mandor, TAJURDIN, was appointed on the first of June, after receiving several months training in the Botanic Gardens. He relieved MOHAMED HANIF who returned to his own post as Mandor of the Botanic Gardens. The new Mandor has worked well and the coolies satisfactorily, and the grounds have been kept in good order. The plant sheds have been repaired where necessary and the staging renewed.

Vote \$2,360.00

Expenditure.

Salary of Mandor and Coolies	...	\$2,030.61
Tools and Stores	...	194.65
Repairs to Plant Shed	...	123.70
Balance	...	11.04
		<hr/>
		\$2,360.00

Visit of Their Royal Highnesses The Duke and Duchess of Cornwall and York.

In April Singapore was honoured by a visit of Their Royal Highnesses The Duke and Duchess of York, who arrived on the morning of 21st of April and left on the evening of the 23rd. During their stay the weather was intensely hot, and the many plants used in the decorations suffered a great deal, notwithstanding our efforts to keep them watered. In all some thousands of plants were used and some tons of greenery, chiefly (Ribu-Ribu) "*Lygodium scandens*," and (Rumput-halus) "*Lycopodium cernuum*." H. R. H. The Duchess was graciously pleased to accept for the Royal Yacht a small collection of 36 plants.

W. FOX,

Acting Director of Gardens, Singapore.

Botanic Gardens, Penang.

The only change in the staff of this Department was the appointment of Sergeant WELLS to take charge of the grounds of the Governor's Hill Bungalow in succession to Mr. O. KEEFFE, who was appointed Light-Keeper at Muka Head. Sergeant WELLS assumed charge on his return from leave in May.

Waterfall Garden.

2. The maintenance of the Waterfall Botanic Garden in an efficient and attractive condition occupies the greater portion of the time of the officer in charge in this Settlement, but although the Forests are now, and have been for some years, under the supervision of the Collector of Land Revenue and District Officers, a good deal of the work in connection therewith devolves on the Assistant Superintendent of Gardens also. This has been specially the case during the past year in connection with starting plantations of gutta percha trees in Penang and Malacca, and necessitated my absence from Penang for a period of about six weeks, besides the time occupied in the Island in connection with the same subject.

3. So far as funds admit efficiency has been maintained, and some improvement effected, but the purchasing power of the dollar, both as regards labour and material has so greatly diminished since the time when the annual amount of the Government Grant was fixed at \$4,500, that efforts in the latter direction are limited, and it became absolutely necessary to ask for an increase in 1902, which I am pleased to find has been granted.

4. There being no Museum or other object of special interest in the town, the one place in Penang to which passing visitors resort is the Waterfall Garden. The majority remain here only for a few hours and have not time to go up the hill, which is about the only other point of interest, and it is therefore desirable that this garden should be made attractive as well as useful.

5. The most noticeable addition during the year is a new iron plant shed close to the entrance gate. The material for this has been accumulated bit by bit during the past three or four years, and now put together without the aid of skilled labour or any additional grant of money.

With the exception of new "Chicks" for the roof, about every two years, this shed will not involve any expense in repairs for many years. It is filled with a choice selection of ornamental foliage and flowering plants, mostly large specimens. There is a water tank in the centre for the cultivation of small aquatic plants.

6. The large iron plant shed has been re-covered with chicks as has also the Orchid House, and a portion of the Fernery. A new hand-rail has been fixed to one of the bridges at the top of the garden, the approach to this bridge improved, and sundry repairs to roads, &c. effected.

7. Some new beds have been formed, many of the old ones replanted, and numerous new trees and shrubs added to the collection. Twenty *Kickxia elastica* and one hundred *Palaquium gutta* plants have been planted in and near the Garden in order that visitors may be able to see these plants without making a long journey to the more extensive plantation at Batu Feringgi, which is some miles distant.

8. The show of flowering plants, especially Annuals and Orchids, has been kept going fairly well during the greater part of the year, and the two leading features of the Orchids have been *Habenaria carnea* and *Calanthes*, of which great numbers are grown. At one time there were upwards of two hundred plants of *Calanthe vestita* in flower, and *Calanthe veratrifolia* is seldom out of flower. *Calanthe rubens* from Langkawi comes in later and is now in flower. Although not so showy as *vestita* it is a charming little species. *Saccolabiums* and *Aerides*, planted on the rain trees on either side of the entrance drive, flowered profusely in May owing to these trees having cast their leaves during the long spell of drought, conditions not always attainable here. Gardenias too were a sheet of white during the month of May.

9. Drawings of many new and interesting plants which flowered in the Garden were made during the year, and a bundle of over a hundred, done in previous years, was sent to the Royal Gardens Kew for inspection. Many of these were copied before being returned.

10. Considerable additions of Penang plants have been made to the herbarium, and much more might have been done had I not been absent in Malacca and Johore, on duty in connection with gutta percha, during a portion of the best flowering season for forest trees that we have had for years. There is however some compensation in the collections made in these two places, and during a trip to Indragiri in Sumatra during the early part of the year.

11. Many strangers interested in Botany or other branches of Natural History have called during the year. Two of these, Mr. SCHLECHTER on behalf of the German Government, and Dr. SHERMAN on account of the American, were specially intent on studying both the natural and cultivated vegetable products of this region with a view to introducing any new plant of commercial value, the one to German New Guinea, and the other to the Phillipines; more especially gutta percha producing trees.

12. Plants and seeds have been exchanged to about the same extent and with practically the same Public Gardens, Nurserymen, and private individuals as last year, and plants sold locally to the value of \$585.50, being a slight increase on 1900.

13. More room for herbarium specimens, and a more extensive library are two things much needed in connection with this Garden.

Government Hill Bungalow Gardens.

14. Beyond keeping the grounds in a neat and presentable condition, and maintaining a small but regular supply of vegetables all the year round, nothing is attempted in this Garden. Sufficient pot plants are grown to decorate the corridor and rooms when the Bungalow is occupied, and this is about all that can be done under existing circumstances. Water and manure, the two essentials to high class gardening, are neither of them available in the same manner as in the Waterfall Garden. During the long drought of last year there was barely enough water for domestic purposes, and that had to be carried such a long distance that it would require a small army of coolies to keep a large collection of pot plants going. A cart load of manure costing sixty cents at the foot of the hill costs more than ten times that amount at the Garden. The climate however is, apart from the heavy rainfall during certain months, such that, with an adequate supply of water and manure, many plants that simply live down below luxuriate here. When the hill railway is constructed and pumping machinery for supplying the whole of the Bungalows is complete this can be made the most attractive spot in the whole Colony.

Experimental Nursery.

15. It was decided in 1900 that this Nursery should be abandoned, it having been proved that the altitude is not sufficient for the cultivation of European fruits, and the sum of \$300 was inserted in the Estimates for reafforesting the site. A good number of plants and seeds of the better class native timber trees, and some introduced ones have been planted, but I have not deemed it necessary to spend all this money, as, with a little assistance, this spot, surrounded as it is with large seed bearing trees, is bound to recover itself in a natural manner.

Coco-nuts.

16. The cultivation of Coco-nuts is one of the most important and profitable industries in this part of the world, and one in which perhaps a greater number of individuals are interested than in any other. A few Europeans in this Settlement own large plantations, and in the Native Malay States some have planted on a considerable scale, but on the whole it must be looked on mainly as a native proprietor's crop, and in their interest it is important that the destructive beetles be kept in check. When I first came to Penang \$10-12 was about the price per 1,000 nuts and this was then considered a paying price. In recent years the price has ranged from \$25-30 with a ready market for any quantity. A large proportion of the Penang and Province Wellesley crop is shipped to Rangoon, where the product is used as food in the form of curries, sweetmeats, etc. Both in England and Germany Coco-nut butter is being manufactured on an extensive scale, but the low temperature at which it becomes liquid militates against its introduction here.

The Inspector of Coco-nut trees has been employed seven months in Province Wellesley and five months in Penang in inspecting plantations, Cow sheds, Stables and other places containing material forming suitable breeding places for the Coco-nut Beetle. The number of Notices served, trees destroyed and prosecutions under the Ordinance are shewn below :—

Name of District.	No. of dead Coco-nut trees destroyed.	No. of pieces of Coco-nut Trunks destroyed.	No. of heaps of Cattle Manure removed.	No. of heaps of Paddy-husks destroyed.	No. of Notices issued.	No. of Summons issued.	Amount of Fines recovered.	Remarks.
Province Wellesley, Northern District	560	1,864	71	26	408	12	\$ 22 00	9 cases not yet come on for hearing.
Province Wellesley, Central District	164	740	61	7	181	Nil		
Province Wellesley, Southern District,	77	201	42	28	77	Nil		
Penang Island.	411	2,444	283	23	511	19	51 00	
Total.	1,212	5,249	457	84	1,177	31	73 00	

Weather.

17. During the latter part of 1900, and the first three months of 1901, Penang experienced a period of unprecedented drought. During that time little garden work could be done beyond watering, and in spite of every care in this matter quite large trees and shrubs suffered severely. So prolonged was the drought that there was great danger of a water famine in the town, and auxiliary sources of supply had to be hurriedly extemporised in order to avert a calamity. At the time it was proposed by the Municipal Engineer to acquire the Waterfall Valley for the purpose of forming a reservoir in order to obviate the possibility of a similar occurrence. This would of course completely destroy the present Garden on which so much time and money has been spent, and would be a great misfortune, but should it become absolutely necessary in the future to carry out this scheme a new site in the direction of Ayer Etam near the starting point of the proposed Hill Railway would be the most suitable place for the formation of a new Garden.

Agricultural Show.

18. On the 10th and 11th of July an Agricultural Show was held in the Dato Kramat Gardens. As regards the site selected and the attendance on both days it proved a decided success, but the improvement in the quality of exhibits in any Division did not in my opinion show the advance that one naturally would expect in a progressive Settlement. The Horticultural Division was decidedly weaker than on the previous occasion when a similar exhibition took place on the Race Course. That the season had been an unfavourable one there is no denying, a long period of drought being followed by torrential rain, but still the result should have been better. The exhibits of Produce, under which heading were included all vegetable products except Fruits, Flowers, and Vegetables, although containing some new and promising exhibits in the form of Guttas and Rubbers, tending to show the new direction agriculture has taken since the last exhibition, was on the whole not what might be expected. Probably too long a time had elapsed since a Show of this kind was held here, and more interest would be taken in producing high class samples if it were certain that similar exhibitions would be held biennially or triennially. An annual Show on the same scale is more I think than the voluntary financial resources of the Settlement would stand. During the progress of the Show, advantage was taken of the presence of a Para Rubber tree growing in the Show ground to give a demonstration of the method of tapping and coagulating in the presence of several planters interested in the cultivation of this tree.

Gutta Percha.

19. As already mentioned in Paragraph 2, much attention has been paid to the question of gutta percha, especially as regards the means of obtaining a large supply of seeds or plants of the best type, and the best manner of forming plantations, of which a commencement was made under my supervision in Malacca in 1900, and has this year been commenced in Penang. Since then a new Chief Forest Officer from Burmah has been appointed to the Malay States and the Colony, and it is gratifying to learn from a private letter received from him that he approved of the work that has already been done. In January last, I made a trip to Indragiri (Sumatra) in the Dutch Residency of Rio, in order to see the method of planting and propagating gutta percha trees as practised by a gentleman residing there, and if possible to arrange for a supply of seeds or plants. On my return a report was furnished for the information of His Honour the Officer Administering the Government, who took a keen interest in the subject, a copy of which I annex (Appendix B.) Some time later I was deputed, in accordance with an arrangement made with His Highness The Sultan of Johore that a responsible Officer should be sent to see that no material damage was done to his forests, to proceed to Muar to collect and transport to Malacca young gutta percha trees from that region. Every possible assistance was given me by the Johore authorities, who sent me a Steam Launch when I was ready to return, so that in a few days 1,750 plants were landed in Malacca in excellent condition. Mr. HUDSON, who has been appointed Superintendent of Forests and Plantations, Malacca, had by this time arrived and took charge of the planting. In Penang we have been fortunate in getting a crop of seeds from some trees growing in the Waterfall Valley from which over 3,000 plants have been raised. In order to prevent these seeds being eaten by squirrels and monkeys it was necessary to fell all the adjoining trees from which they could gain access to them and to fix an arrangement of bamboo spikes round the boles of the trees themselves. Bats, however, which are equally fond of the sweet pulp in which these seeds are embedded, were not so easy to circumvent and carried off great numbers. Netting some of the best branches in the manner in which bush fruits are protected in England was resorted to, but the effectual protection of large forest trees by this means is next to impossible. These trees flowered during February and March, and ripened their seeds in June and July. Two of them, growing side by side, I have known for years, and until they fruited never for a moment suspected that they were different species, having been accustomed to consider them both *Palaquium gutta*. There is however a difference in the fruit, one being much rounder and of a deeper colour than the other. Good specimens of both flowers and fruits, together with drawings, were sent to Kew and Buitenzorg, and I am not sure that the matter is even now quite satisfactorily cleared up. The Kew authorities consider one to be the true *Palaquium gutta*, and the other an unnamed species which it is proposed to name *Palaquium Curtisii*. Dr. TREUB, however, hesitates as to the exact specific name and points out the great difficulty there is in this genus of determining what is to be called species and how far variation may go and his remarks on this are quite in accordance with my own field observations. He was also kind enough to have an analysis made of samples of gutta from both these trees, the result of which is more

important than the exact determination of the species, and that is that both yield a gutta of first rate quality. The samples were sent marked A. and B. and the result as determined at the Laboratory of Agricultural Chemistry, Buitenzorg, is as follows:—

A.			B.
Water 9.3	...	...	9.6
Resin 11.8	...	...	11.9
Gutta 77.2	...	...	78.7
Dirt 1.2	...	...	traces

Relation between resin and gutta 1 to 6.6.

In undertaking plantations of such slow growing trees as *Palaquium*, it is important that only the very best kinds should be planted, as it will require at least forty years to grow a tree large enough to yield one and-a-half to two pounds of gutta percha according to the present method of extraction, but I feel sure that some better system will be discovered by which much more will be obtained than is done at present. Last year I recorded the yield obtained from a tree, 55 feet high and 39 inches in circumference at five feet from the ground, as one and-a-half pounds. This year there has been an opportunity of testing a tree 52 feet high and 42 inches in circumference that was blown down in the Forest Reserve, and the result is one and one-third pounds of clean gutta. So little is known of the actual yields of gutta percha trees that this is of some interest. Several thousand young saplings, showing considerable leaf variation, have been received from the Acting Director, but what proportion of these will survive for eventual planting it is too soon to say. Most of these are in nursery beds where they will remain until the spring of 1903.

Para Rubber.

20. Para Rubber is a subject in which a great number of Europeans, and some natives, are interested. It bids fair to become the great agricultural industry of the Malay Native States, and in this Settlement, in Province Wellesley, three Europeans are planting on a considerable scale. The rate of growth is eminently satisfactory in almost every place this tree has been planted, and as none of the large plantations are yet of an age to commence tapping, the quality and continuance of the yield that may be expected is of more interest to planters than the question of soil and cultivation, and I have therefore made another tapping of the tree, now sixteen years old, growing in the Waterfall Garden, to which reference has been made in previous Annual Reports. This tree has now been tapped five times on the dates and with the result given below.

	lb.	oz.
November-December, 1898, Yield of dry Rubber	...	3 0
April-May, 1899, Yield of dry Rubber	...	2 8
November-December, 1899, Yield of dry Rubber	...	3 4
October-November, 1900, Yield of dry Rubber	...	3 12
August-September, 1901, Yield of dry Rubber	...	2 2½
Total of five tappings	...	14 10½

So far as can be seen no injury whatever has been done to this tree; it looks healthy and produced this season a good crop of seeds. The last tapping was done during a period of very wet weather, the rainfall being 24.52 inches, or a little over an inch a day during the twenty-three days the tapping was carried on. Whether this affected the yield of latex or whether the tree requires a longer period of rest can only be ascertained by a further experiment under different weather conditions, and this will be done before long. At any rate the quantity of rubber is less than that obtained at either of the previous tappings. I have not the slightest doubt however that during the next four years, by the end of which time the tree will be twenty years old 5 lbs. 5½ ozs. more rubber can easily be extracted (probably very much more) this bringing up the yield to twenty pounds or an average of 1 lb. per year for every year of its life. Assuming an estate with 100 trees to the acre as good as this one, and the value of rubber at 3/- per lb. only, below which it is scarcely likely to fall, and which is about 25% below the present price of fine para, we have as a return in twenty years 2,000 lbs. of rubber of the value of £300 or an average of £15 per acre per annum from the time the trees were planted. After deducting all expenses this should leave a handsome profit without any consideration as to subsequent profits. Samples of the rubber from this last tapping, which was coagulated

by the addition of a few drops of acetic acid, and not smoked, was submitted for valuation to three quite independent experts, two in England and one in America, and they all agree in valuing it at from four pence to six pence per lb. less than previous samples from the same tree which coagulated naturally and had been smoked. All remark that the rubber is good but that there appears to be something wrong in the curing. I was induced to try this method after seeing some nice looking samples prepared in this way and exhibited at the Penang Agricultural Show, but it does not appear to be a method to be adopted. It is possible that too frequent tapping may cause deterioration in the latex and whether this be so or not will be proved in the next tapping. The valuers however all remark that the fault appears to be in the curing.

-Gutta Jelutong.

21. A sample of Gutta Jelutong received from the Senior District Officer, Province Wellesley, was sent to the Director, Royal Gardens, Kew, who submitted it to the well known brokers, Messrs. HECHT, LEVIS & KHAN who state that it is known in the London Market as "Pontianak," and estimated the value in October at £19-20 per ton. The tree from which this is obtained (*Dyera costulata*) is fairly common throughout the Peninsula and in the Islands of the Malayan Archipelago.

Botanical Expeditions—Langkawi.

22. In addition to the two expeditions to Indragiri in Sumatra, and to Muar in Johore territory, especially in connection with the collection of gutta percha plants or seeds, a short trip was made to the Langkawi Islands in November for the purpose of collecting botanical specimens. On this occasion I was absent from Penang five days, the greater portion of two of them being occupied in going and returning. During this short trip many interesting and, I believe, some new plants were collected. I went up to a small Island called Pulau Hujung Duri which is about fifteen miles further North than I had been on any previous occasion. This Island does not exactly belong to the Langkawi cluster but rather to a small group closer to the main land off the Malay State of Satul, from the North end of it the small village of Wala Bara on the mainland is distinctly visible. At this point the hills come quite close down to the sea, and our Langkawi pilot, who knows the place well, says they are inhabited by Sam-Sam. We anchored the Launch in a beautiful little bay with four fathoms of water and circumnavigated Pulau Hujung Duri in one of the boats. The Western side, which is exposed to the full blast of the South-West Monsoon, is very rugged, and the vegetation less varied and luxuriant than on the Eastern side. The striking features on the West side are giant Euphorbias and a species of Pandanus in great numbers. The hard woody portion of the former is in great repute as a medicine for bowel complaints under the name of Tras Sudu. While at Kuah I made some inquiries about guttas as I was desirous of satisfying myself as to what kind of tree produces the article that is exported from these Islands under the name of "gutta minjato." Having now seen leaf specimens I have little doubt that it is a species of Bassia. It is a low grade gutta of no great market value. Gutta taban, that is to say Palaquium species, which are the only trees yielding true gutta percha, do not extend so far north as these Islands. I have made careful inquiries on this point on this and previous visits, and have now no doubt that Penang is almost the Northern limit of these trees. The two largest Islands of this group, Langkawi and Trutau, contain some excellent timber of which the greater portion comes to Penang. I saw on the beach at Kuah some fine straight logs over sixty feet long and fourteen inches square which had been cut for the new tin smelting works in Province Wellesley. The working of timber was also commenced some time ago at Pulau Adang, a large Island to the West of Langkawi, and which so far as I know has not yet been visited by any botanist, but the men and buffaloes have been brought away and the work stopped on account of fever.

Perak.

23. The Christmas holidays were spent on the Perak hill, and by permission of the Hon. Resident Councillor, I took with me a man from the Garden to assist in collecting plants for cultivation in the Waterfall Garden, and for the purpose of exchange. Few of these mountain plants grow well for any length of time when brought down to the hotter and drier region of sea level, but many of them live long enough to produce flowers from which drawings can be made.

The past year appears to have been a great flowering one as regards forest trees in Perak as well as in Penang, as can be seen from the myriads of young seedling plants of all kinds everywhere. We brought back a large collection of Orchids, Aroids, Ferns, Gingers, Gesneriaceæ, Melastomaceæ and other small growing plants suitable for pot culture. Rhododendrons, of which I collected three species, have, I am told, been a wonderful show, but the season was over at the time of my visit as was also the case with the majority of trees.

C. CURTIS,

Assistant Superintendent of Gardens, Penang.

APPENDIX A.

Revenue and Expenditure of the Botanic Gardens Department, Penang, 1901.

REVENUE.		EXPENDITURE.	
	\$ c.		\$ c.
Government Grant— Maintenance of Water- fall Garden ...	4,500 00	{ Wages of Gardeners and Coolies ... 3,394 14 Purchase of Plants and Seeds ... 101 46 „ Pots and Tubs ... 129 50 „ Manure and Cartage ... 55 00 „ Material for Herbarium ... 29 80 „ Books and Periodicals ... 32 22 „ Planks for boxes, &c. ... 94 07 „ Material for repairs ... 294 50 „ Material for new plant shed ... 164 16 „ Tools ... 86 94 Miscellaneous Petty Expenses ... 113 03	4,494 82 5 18
		Total ...	4,500 00
Government Grant— Upkeep of Grounds of Governor's Hill Bungalow	1,000 00	{ Wages of Gardeners and Coolies ... 801 58 Purchase of Seeds ... 67 13 „ Manure ... 48 25 „ Pots and Tubs ... 26 80 „ Tools and Materials ... 52 55	996 31 3 69
		Total ...	1,000 00
Government Grant— Reafforesting Site of Ex- perimental Nursery ...	300 00	{ Wages of Coolies ... 167 23 Balance ... 132 77	300 00
Government Grant— Expenses of carrying out Provisions of Coco-nut Trees Preservation Or- dinance ...	730 00	{ Salaries and Wages ... 708 00 Balance ... 28 00	736 00
Government Grant— Travelling and Personal Allowance ...	411 00	{ Pony Allowance ... 216 00 Expenses in connection with journey to Indragiri ... 168 60 Expenses of trip to Langkawi ... 36 54 Field Allowances ... 13 50	434 64 6 36
		Total ...	441 00
Grant Total Government Grant ...	6,941 00	Grand Total Expenditure ...	6,801 00

Revenue from Plant Sales \$ 585 50
 „ Swimming Bath 18 00

Total Collected \$ 603 50

APPENDIX B.

BOTANIC GARDENS,

Penang, 13th February, 1902.

SIR,—In a separate letter I have furnished for the information of His Honour the Officer Administering the Government a brief general report on my journey to Indragiri on the coast of Sumatra, and in this I purpose to deal exclusively with the gutta percha question which was the main object of my visit.

2. There is not the slightest doubt that all kinds of gutta percha trees are being rapidly exterminated in this part of Sumatra and it is a difficult matter to find a tree over six inches in diameter. I made inquiries at all places touched at going up the river, and at the farthest point I reached, which is about one hundred and fifty miles up the Indragiri river, I spent three days in examining the forest and in making further inquiries, but in no single instance could I see or hear of a tree large enough to produce seeds, so that I think we may dismiss the idea of obtaining seeds from this region. Mr. BURCHARD, the gentleman whose estate I stayed at, is interested in this subject and has planted some thousands of trees of *Palaquium*. He has been living over four years in the same place and is aware of the value of seeds, but during the whole of that time has not been able to obtain one.

3. Four kinds of gutta percha trees are found growing in this district and some of each kind are planted on the estate which I went to visit. They are all known as "Balam" *i.e.* Balam Merah, (*Palaquium oblongifolium*) which is the same thing as Taban Merah of the Peninsula and Ekor of Penang, Balam Putih (*Palaquium* sp.) and Balam Sundek (*Payena Lecrui*). I obtained leaf specimens of all these trees and saw the manner in which they have been planted. "Balam Merah" produces the most valuable gutta percha and is the one that it is desirable to plant in this Colony as in addition to its higher market value gutta percha is obtainable from the leaves as well as from the stem, and I think it doubtful whether this is the case with the others.

4. The planting has not been done in a systematic manner, but trees set out at varying distances apart between Coffee and Gambier. In some places they are thirty feet apart and in others only twelve. Owing to want of capital the greater portion of the estate has been practically abandoned and the jungle has grown up and ruined the Gambier, but where the heads of the gutta trees have been kept clear the effect has probably been beneficial to them rather than otherwise. A great number of trees appear to have died when first planted, owing largely no doubt to the inexperience of the coolies, but mainly from the fact that the stumps were brought direct from the dense damp jungle and planted in the open without any previous preparation.

5. During the first two years all the species of *Palaquium* grow slowly, but after that appear to get away faster. The height of two years planted trees I found to be six to eight feet with stems $\frac{3}{4}$ "-1" in diameter at the base. Those four and-a-half years planted are ten to thirteen feet high and six to nine inches in circumference at three feet from the ground. The soil in which they are growing is excellent, much better than anything we have in Penang or Malacca.

6. In the absence of seeds the difficulty of obtaining a sufficient number of suitable plants to form plantation on a large scale in Malacca and Penang is a serious and somewhat expensive matter, but to wait for a seed crop may mean waiting for years. In the first place *Palaquium oblongifolium* trees do not flower annually. When they do flower it sometimes happens that animals take the crop. In support of this statement I may say that none of the trees in Penang flowered last year, nor am I aware of their having flowered more than once during all the years I have been here, which was in 1899, when we obtained a thousand young seedling plants. Mr. RIDLEY informs me that one tree in the Botanic Gardens, Singapore, flowered freely but set no fruit. Mr. DERRY wrote some time ago that a tree in the Residency grounds at Kwala Kangsar was in fruit, and two months later that squirrels had taken all except two which he sent me while still unripe. Under these circumstances it does not seem advisable to sit down and wait for seeds, and the only course open appears to be to purchase seedling plants as young as possible from the jungle, or plants propagated from cuttings.

7. The main object of my journey to Indragiri was to see how this tree is propagated from cuttings, for all attempts made here have proved a failure. I know now how the thing is done, and it is as I suspected, but as the system depends on a large supply of small plants to work on we cannot apply it to any considerable extent.

in Pepang. I am in hopes however that a fair proportion of cuttings from large trees treated in the same manner will succeed and experiments will be commenced as soon as the season is suitable.

8. The so called young plants used for propagation (which I prefer to call stumps to distinguish them from truly young seedlings or cuttings) are found plentiful in places near where I was staying. They are in reality old suppressed seedlings from the size of a lead pencil to that of a man's little finger, with a long tap root two to three feet long, as thick as a man's thumb, and perhaps twenty or more years old. They are pulled up and cut back to within about six inches of the point that was level with the ground, and then planted horizontally on a sloping bank in damp shady jungle until they make new erect shoots at right angles to the stem with two or three fully developed leaves, when they are cut off with about two inches of the old wood attached, and planted in boxes until they root. The process is a slow one, and plants large enough to put out in plantations cannot be produced in less than eighteen months. When once rooted they grow well and make good plants. We received a box of these cuttings last October when only a few of them had roots, and in January they had rooted and were potted off singly in five inch pots. Next to seedlings collected in a very young state these are the best plants I have seen.

9. In the Singapore Gardens I saw a number of young seedling plants that had been brought from Borneo, and if plants of this stamp are obtainable they should be purchased in large numbers for Malacca and Penang and forwarded in the boxes as they arrive to Nurseries as near as possible to the places in which they are to be eventually planted. I also saw in the same place a number of boxes of stumps of which I have no very high opinion, unless they are utilised for propagation in the manner I have already described in paragraph 8. I doubt whether these old stumps, from which one half the tap root has been cut in order to get them into boxes, will ever make satisfactory growth.

C. CURTIS,

Assistant Superintendent of Forests.

Annual Report on the Botanic Gardens, Singapore, for the year 1902.

Staff.

The Director returned from leave on March 18th, 1902, and the Assistant left on long leave on March 23rd. For some months there was no Assistant in the Gardens, and as the available portion of the salary of the Assistant, is insufficient considerable difficulty was experienced in inducing anyone to take the post. It has long been impossible for a single European, however energetic, to get through the work of the Department and, as may be expected, almost every branch of the work had fallen into arrears. Mr. A. D. MACHADO accepted the post of Assistant on July 1st, and it then became possible to get the Department into something like its proper condition.

The scheme of salaries for the mandors referred to in the last report did not give satisfaction to the employés. It amounted to a commencing salary of 20 dollars per month rising 5 dollars in every fifth year to 40 dollars, the maximum previous service at or over 20 dollars counting. Two of the three Garden mandors and one at Government House sent in a petition to be raised to the maximum at once; this was refused, and they all resigned. One of them, MOHAMED HANIF, had been employed for seven years consecutively as mandor, and for three years previously with a break between, so that he had had ten years training. His salary was 25 dollars.

The mandor SAHIB, who had resigned with the others, applied to be taken on again and this was permitted. VICTOR PASSANAH replaced HANIF in charge of the Economic Gardens, and a lad EZEKIEL was taken on in place of a mandor CHINTA who was dismissed. CASTAWI, a Javanese who has been employed in the Gardens since boyhood, was put in charge of the flower beds, etc.

This constant change of mandors, and the consequent work of training utterly ignorant men, adds not a little to the work of the Department.

The coolies, with the exception of one or two of the older men, were a very poor lot, very indolent and thievish, and one of them out of spite attempted to burn down the mandor's quarters, a design happily frustrated.

The supply of both Javanese and Klings was by no means adequate, and it seems at present impossible to procure more.

The peon SALLEH was arrested on a charge of fraud and sent to gaol for three months, being the second successive peon who was thus imprisoned. Considerable difficulty was experienced in getting a successor, as the work is hard, and long, and the fact that the peon has to act also as bill-collector and has many opportunities of fraud makes it essential to get a trustworthy man. It would be advisable to require the peon to find security.

There was very little sickness among the coolies except that dengue fever ran through the whole staff, and there was one case of beri-beri which ended fatally very suddenly.

Weather.

The weather was unusually dry and hot for many months, and this entailed a great deal of watering. All the wells being dry, water had to be fetched from the lake by bullock cart, employing a good many men and costing a good deal of money in cart hire.

In spite of all these difficulties and drawbacks to which must be added the very large increase in cost of all materials used in the Gardens, the Gardens were kept bright and improved in many ways and before the end of the year were got into good condition again.

Visitors.

The number of ordinary visitors was as great as usual, and there was an increase in the number of Scientific and Gardening Men who came to study plants and

methods of cultivation and preparation of vegetable products. Among the latter were M. DUPONT sent by the Seychelles Government to study tropical products, with a view to introducing them into the Seychelles. Mr. MERRILL, Government Botanist for the U. S. A. Government at Manila; M. BOIS of the Paris Museum; Mr. USTERI of Zurich, Mr. NITOBE, Chief of the Agricultural Bureau, Formosa; Prof. COMES, School of Agriculture, Portici; Dr. P. DE TAVERA, Member of Philippines Commission; H. FOUKOUBA, Director of the Imperial Garden, Shinjicou, Japan; Prof. T. TANAKA, Central Experiment Station, Tokyo; Dr. VOLZ (Sweden) and Sir E. SATOW.

The Regimental bands played as usual on moonlight nights and on afternoons, and were highly appreciated.

Upkeep of Buildings &c

No new buildings were constructed but repairs and alterations were made to the cooly lines, the large plant-house and the smaller buildings. Some of the drains by the roads were reconstructed and more will have to be done. At the request of some members of the public the paths on the bandstand were covered with a layer of white sand for the benefit of the children who play there which gave much satisfaction to them and their parents, though by no means beneficial to the grass.

All garden seats have been repaired during the year and fresh seats purchased.

Aviaries.

In accordance with the Government instructions all the larger animals were disposed of, some being sold. The deer were sent to Cocos Island to resupply the stock formerly there. Only a few of the smaller animals and birds are now kept, chiefly those which have been here many years. No attempt will be made to add any more; indeed a number of animals offered by various persons were declined.

The old wire netting on two sides of the monkey's cage was replaced by iron bars at a cost of \$260.

One bamboo rat (*Rhizomys*) was presented by the Hon. R. N. Bland, Malacca.

One pelican (*Pelecanus* sp.) captured in Singapore was purchased.

One Hornbill (*Berenicornis Comatus*) was presented by a passenger.

One squirrel (*Sciurus Prevosti*) presented by Mr. A. D. Machado.

Two silver pheasants (*Euplocamus Nycthemerus*) presented by Mr. Falshaw.

One sparrow-hawk presented by Mr. Kesting.

The fine peacock was found dead one morning, having apparently been killed by a wound under the eye given by a pheasant in the next cage.

Plants and seeds received.

There were 332 packets of seeds, and 1,528 plants received as presents or in exchange from various Institutions and private persons. The contributors were Royal Gardens, Kew; Botanic Gardens, Sierra Leone, Uganda, Calcutta, Ootacamund, Penang, Jamaica, Melbourne, Nagpur, Trinidad, Cape Town, Sydney, Bermuda, Berlin, Dar Es Salam. The Agri-horticultural Societies of Calcutta and Madras, U. S. A. Department of Agriculture, Messrs. J. C. Harvey (Mexico), M. Prudhomme (Madagascar), Dr. Schlechter (New Guinea), Messrs. Boehmer (Japan), Mr. E. S. A. Cohen (Java), Mr. Micholitz (East Indian Orchids), Mr. J. C. Pereira (Orchids), R. Little, Mrs. O'Sullivan, Mr. S. P. Chatterjee (Calcutta), Mr. Gunn, Mr. St. V. B. Down, Mr. Jenkins (Bangkok), Messrs. Herb and Wulle, Mr. Choa Kim Keat, Mr. F. Pears (Muai), Mr. R. Derry (Perak Orchids).

Plants and seeds sent out.

There were sent out from the Gardens to various institutions and private persons 775 packets of seeds and 2,181 Plants, besides which there were sold to various purchasers 829 Ornamental plants, 4,763 Economic plants, 125,110 Para rubber seeds and 100 packets of various seeds.

Seeds and plants in exchange were sent to the Gardens of Kew, Buitenzorg, Calcutta, Saigon, Bermuda, Madagascar, Uganda, U. S. Forest Bureau, Manila, Brisbane, Seychelles, Rockhampton, Ahuri, Trivandrum, British New Guinea (14 cases of plants), Sydney, Ceylon, British Guiana, Calcutta, Trinidad, Penang, Melbourne, Hongkong, Bangalore, Mauritius, Jamaica, Adelaide, Rangoon, Zanzibar, Travancore, Old Calabar, Baroda, Barbados, Malta, Kuala Lumpur, Agri-horticultural Society of Calcutta and Madras, British Legation, Bangkok, British North Borneo Government, Paris Museum, Forest Department and Gardens, Malacca and Negri Sembilan, Experimental Gardens, Batu Tiga, Administrator of Fiji, Kapalgoo Mission, Port Darwin,

Dr. Schlechter, Messrs. Vanden Gucht, Beaufort, (Chinde E. Africa), Hemings (Fiji), Harvey (Mexico), Chatterjee, Pereira, F. Pears, and others.

The number of plants and seeds received and sent out this year far exceeds that on any previous year in the records of the Gardens. The increase in the demand for plants from these Gardens is due not only to the development of the British tropical colonies, especially Africa, New Guinea, Seychelles and the Malay States, but also to the fact that these gardens are now considered to rank among the most important of the equatorial tropical stations of the world, so that all questions and requirements of tropical cultivated plants are referred to this department from the various foreign Colonies as well as from those of Britain. This not only entails a very large stock of cultural plants being kept, but increases the correspondence enormously, so that this Department has probably by far the largest correspondence of any in the service.

Plants in Flower.

The following plants flowered in the Gardens, for the first time, *Millettia Albiflora*, (tree) from Pahang, *M. atropurpurea*, *Napoleona imperialis* (shrub) West Africa, *Bassia* sp. Getah Soontai, Sumatra, *Kickxia africana* (tree) Africa, *Mascarenhaisia elastica* (Rubber tree) Madagascar, *Webera asiatica* (shrub) Ceylon, *Allamanda violacea* (shrub) Brazil, *Passiflora Watsoniana* (climber), *Posoqueria longiflora*, and *P. latifolia* (shrubs) South America, *Pavetta madagascariensis* (shrub) Madagascar *Abutilon* sp. Madagascar, *Landolphia hendelotii* (Rubber vine) Africa, *Ichnocarpus frutescens* (climbing shrub) Penang, *Dipterix odorata* Tonquin Bean, *Homalium grandiflorum* (Tree) Singapore, *Coffea* sp. Abbeokuta coffee, *C. Laurentii robusta* Congo Coffee. *Aristolochia Duchartrei*, (climber) South America.

Saccolabium fissum (Orchid) Lankawi, *S. secundiflorum* Sinkep, *Cælogyne kingii* Perak, *Renanthera coccinea*, *R. Imschootiana* Indo-china, *Vanda limbata* Celebes, *Calanthe microglossa* n. sp. Sumatra, *Sabal glaucescens* (Palm) Trinidad, *Iguanura* sp. "Teruno" Dindings, *Zamia pumila* America, *Carludovica humilis* S. America. *Calamus Lindenii* Philippines.

Cola acuminata and *Allamanda Williamsi* fruited for the first time.

Library.

The following books and periodicals were added to the Library:—

Niederlin, G.—The State of Nicaragua; presented by the Author.

Agricultural and live stock Statistics, presented by the Government of S. Australia.

A public Institution devoted to the Extension of American Commerce	} Issued and presented by the Philadelphia Commercial Museum.
The Worlds Commerce	
Conversion tables of Weight & Measures	

Merck, E.—Recent clinical reports on Iodopin; presented by the Author.

Morrison, W. K.—Bee keeping in the West Indies.

Alford-Nicholls, Dr. H. A.—The harmfulness of Bush fires; presented by Imperial Department of West Indies.

Seedling and other canes in the Leeward Islands; presented by Imperial Department of West Indies.

Pieters, A. J. and Charles, V. K.—The seed coats of certain species of Brassica; presented by U. S. A. Government.

Howard, L. O.—The Economic Status of Insects, presented by U. S. A. Government.

Wildeman, Ede.—Observations sur les Apocynacees á latex; presented by the Author.

Hackel, E.—Neue Graser; presented by the Author.

Wright, H.—Observations on *Dracæna reflexa*; presented by the Author.

Heim, Dr.—Recherches des Dipterocarpees; presented by the Author.

Angler, A.—Monographien Afrikanische Pflanzen und Gattungen Vol. III. IV. V.; presented by the Author.

Dyer, Sir W. T.—The flora of tropical Africa; presented by the Author.

Sack, J.—Einiger Pflanzenstoffe; presented by the Author.

Cook, Theo.—Flora of the presidency of Bombay; presented by the Author.

Benson, C.—Sugar Cane of Madras; presented by U. S. A. Government.

Report on the United States Philippine Commission; presented by U. S. A. Govt.

Berichte Land und Forstwirtschaft in Deutsch Africa.

Appel, O.—Paul Knuth, presented by the Author.

- Knuth, P.—Bloemen biologische mededeeling aus den tropen ; presented by the Author.
- Preyer, Axel.—Einiges über Sudasiatische Agricultur ; presented by the Author.
- Preyer, Axel.—Über kakao-fermentation ; presented by the Author.
- Urban, J.—Vorgeschichte des Neuen kgl. Botanisch Gartens zu Dahlem-steglitz ; presented by the Author.
- Christ, H.—Elaphoglossum Bangii ; presented by the Author.
- „ Spicilegium pteridologicum Austro-Braziliense.
- „ Aspidium munchii.
- „ Filices setciouenses.
- „ Die Farn flora der Osttiche Riviera.
- Raciborski—Farne von Tagal.
- Agricultural Imports and Exports 1897 ; presented by U. S. A. Government.
- Our Foreign Trade 1892-1901.
- Lloyd.—Mycological notes.
- Arden, S.—Report on Para Rubber, Selangor.
- King, Sir George.—Materials for the Flora of the Malay Peninsula (continuation).
- Report of Agricultural Experiment Station ; presented by U. S. A. Government of the University of Wisconsin.
- Moore, R. A.—Oatsmut in Wisconsin.
- Mohr—over het Oopten van Delie Tabak.
- Kramer, Dr. J. G.—Ground Analyses.
- Koningsberger, J. C.—De Zoogdieren van Java.
- Proceedings of the Central Indigenous Drugs Committee of India—Vol. 1 ; presented by Government of India.
- Niederlein, G.—Ressources vegetales des Colonies Francaises ; presented by the Author.
- Ferguson, M. C.—Germination of the spores of Agaricus Campestris.
- Green, A. O.—Tasmanian Timbers ; presented by the Author.
- Medley Wood, J.—Natal plants, Vol. 3 ; presented by the Author.
- Wildeman,—Illustrations de la Flore du Congo ; presented by the Author.
- Kearney, Th.—Report on Botanical Survey of the Dismal Swamp region ; presented by U. S. A. Government.
- Coulter and Rose—Monograph of the North American Umbelliferæ ; presented by U. S. A. Government.
- Lyon, W. S.—A primer on the Cultivation of Sugar-cane ; presented by Philippine Bureau of Agriculture.
- Engler—Der Pflanzenreich (Purchased)
- Hannam, W. J.—Textile Fibres of Commerce „
- Blume, C.—Bijdragen tot de Flora van Nederlandsche India: Tabellen „
- en Platen v. d. Jav. Orchideen „
- De Sturler, W.—Catalogue des especes de Bois de l'Archipel des Indes Orientales „
- Hagen, Dr. B.—Die Pflanzen und Thierwelte von Deli „
- Scheffer, R. H. C. C.—Observationes Phytographicae III. „
- „ Sur quelques Plant Nouvelles „
- Choisy, J. D.—Plantæ Javanicæ „
- Miquel, F. A. G.—Analecta Botanica „
- Warburg—Monsunia Vol. 1. „
- Rodrigues, J. Barbosa—As Heveas „
- Botanical Magazine, Journal of the Linnean Society, Indian Gardening and Planting Gardeners Chronicle. Tropical Agriculturist, Dictionnaire Iconographique des Orchidees.

The following journals and reports were also presented :—Journal of the Board of Agriculture, The Indian Forester, Journal of the Imperial Institute, The Chemist and Druggist, Botanical Survey of India, Journal of the Department of Agriculture of W. Australia, Queensland Agricultural Journal, Agricultural Journal of the Cape of Good Hope, Jamaica Bulletin, Saigon Bulletin, Kew Bulletin, Trinidad, West Indies, Ceylon, Annals of the Buitenzorg Gardens, Land record North West Provinces, Bulletin of the Koloniaal Museum te Haarlem, Journal d'Agriculture Tropicale, Revue des Culture Coloniales. Tropenflanzer, The Pharmaceutical Review, Bulletin du Jardin Colonial, Agricultural News (Barbados), Agricultural Ledger (India), Bulletin of the University of Wisconsin, Planting opinion of India, Bulletin Economique, Acti Horti Petropolitani, Experimental Station Record (U. S. A.), Bulletin de la Chambre d'Agriculture, Annales du

Musee du Congo. Madagascar Bulletin, The Shamba (Zanzibar), Agri-Horticultural Society, Madras, and the annual reports of the Gardens of Natal, Ceylon, Trinidad, Hongkong, British Honduras, Zanzibar, Zurich, Calcutta, Buitenzorg, New South Wales, Travancore, Barbados, Antigua, Mysore, British Guiana, Gold Coast. Forest, Department, Madras, Uganda, Queensland Acclimatization Society, Smithsonian Institute, Washington.

The Flora.

During my stay in England, I examined and compared the Aroids, and Calamæ of the Singapore Herbarium with those of Kew Gardens and published an account of new species of Aroids from the Peninsula in the Journal of Botany. The volume of the Flora including the Monocotyledons having been entrusted to me, I have finished the *Hydrocharideæ* and *Orchideæ* and the manuscript has been typewritten, the remainder of the orders with the exception of the Glumales have been written out and are nearly ready for the typewriter. I hope to finish the work in a few months. I have also undertaken to do the order *Gesneraceæ*.

The Artist has continued to make drawings of the more interesting plants.

Bulletin.

The Bulletin was published regularly each month, and to judge by the demand for it may be considered very successful. The first volume of the new series was completed at the end of the year. It included 616 pages of letter press and 8 Plates.

Three hundred and thirty copies were distributed to various establishments and private persons each month, beside separately purchased copies. It was not expected at first that there would be so great a demand for it, so that of some numbers no copies remain in stock.

Herbarium.

Comparatively few specimens were added to the herbarium this year, as owing to stress of work it was not possible to visit the forests. I went to Penang however in December, and got three days' collecting in the Perak Hills; though the time was short I obtained several new and little known plants including three Pandani, several Rattans in flower, and a remarkable Balanophoraceous plant, probably generically new, and such rare and little known plants as *Chrysoglossum villosum*, and *Zingiber Kingii*.

Herbarium specimens were also received during the year from Mr. Curtis (Penang and Malacca), Mr. R. Shelford (Sarawak), Dr. Prain, specimens from Scortechini and Kunstler's collections, together with some copies of drawings of rare species. Mr. E. Merrill (plants of Labuan), Mr. Penny, specimens of wood, leaves and fruit of the catinga from Pahang. Mr. Craddock, Pahang plants, Mr. Micholitz, *Balanophora* n. sp. Tenimber islands, and specimens of rare plants were sent by Messrs. Derry, Arden, Burn-Murdoch and Machado.

Duplicate specimens from the Herbarium were sent to Kew (146), Sydney Botanic Gardens (479), Calcutta (212), British Museum (120) and some palm and pandanus specimens to Dr. Beccari. A collection of specimens of Economic plants was prepared for Prince Roland Buonaparte.

Economic Gardens.

In this part of the Garden, a large piece of ground, lying between the new road and the Arboretum on the east side, was cleared, stumped and partly turfed. This much improves the appearance of this portion of the Garden. The boundary on this side was also cleared, and a hedge planted. A number of new nursery beds were formed, and the stock of Economic plants for distribution having got very low was renewed as much as possible, but owing to the drought and change of mandors, it was difficult to get a large enough supply for the demands.

Para rubber.—The demand for seeds and plants of this fell off materially as many of the trees planted in the Native States and Malacca are fruiting now, and the planters are now supplying themselves. The number of seeds sold or otherwise distributed was 126,210, young plants.

Owing to the drought the crop was very late and smaller than usual; experiments were made in tapping but were not completed as owing to the drought, the latex escaped very slowly and in small quantities.

Experiments were made in manuring young plants in pots, with various kinds of manures, including lime, cowdung, burnt earth, poudrette etc. The evidence, was in

favour of burnt earth and cowdung; lime and poudrette seemed not to benefit the plants at all.

Brucea Sumatrana.—This new dysentery drug was introduced to Singapore from Pahang in 1892, by myself, and its use in cases of dysentery described in the bulletin of this year. There was a fairly good demand for it from varied parts of the world especially India, and a piece of ground was planted up with it. The shrub fruited in 6 months after planting, and grew very readily. A bag of ten pounds weight of seed was sent to Messrs. BURROUGHS AND WELLCOME, for experiment.

Among the plants of economic value received during the year were two species of *Anona* from Mexico with edible fruit, *Eugenia owariensis* "Nsali" with eatable fruit, the Nyasa Land Coffee, and the "Masanda",—an *Artocarpus* with edible seeds, and some *Amomums* from Uganda, the Rotan Segar, *Calamus* sp. from Muar, the best rattan in the Peninsula; Seeds of *Bambusa spinosa*, *Dendrocalamus strictus* and 16 bags of *Swietenia Macrophylla* from Calcutta, *Copernicia cerifera* Wax Palm, from Guiana, Javanese vegetable seeds from Mr. COHEN, American vegetable seed from U. S. A. Department of Agriculture.

The chief demand for economic plants besides Para rubber, was for Fruit trees, and Vanilla. Large collections of various economic plants were supplied to British New Guinea, the Seychelles Gardens and the experimental station of Selangor.

Upkeep of Economic Gardens Vote ...	...	\$1,888.00
Expenditure ...	...	\$1,879.50
Balance ...	...	\$ 8.50

Inspection of Coconut Trees.

During the year notices to cut down infected trees were served on 238 persons and 1,039 dead trees and 35 piles of rubbish were destroyed. There were no prosecutions. The number of red beetles especially has greatly diminished in Singapore, so that it was some time before I could get a couple for a correspondent in Madagascar who wished to see it.

Vote ...	...	\$210.00
Transport ...	...	169.60
Uniform ...	...	17.50
Balance ...	...	22.90
		\$210.00

Upkeep of Government House Grounds and Domain.

The mandor Tajuridin resigned early in the year and was replaced by Kappa, who has worked very well. The coolies worked satisfactorily, a new bit of ground was opened as a vegetable garden, and produced a quantity of vegetables, and the grounds were kept in good condition.

Vote ...	...	\$2,024.00
Expenditure ...	...	1,955.57
Balance ...	...	\$ 68.43

Planting in Forest Reserves.

There was still a good deal of fever among the men engaged at Bukit Timah forest, and eventually the Mandor Castawi was removed from there and transferred to the Botanic Gardens. The six men worked well and 14,000 trees, chiefly Gutta Percha, were planted. The young trees were cleaned up and the paths opened where they had got covered. As a portion of the reserve was alienated by Government for cooly lines for the quarry, all the trees on it that could be moved were transferred. The hot weather interfered a good deal with the planting but the Gutta plants seemed to suffer very little from it. Some of the wild Gutta percha trees fruited in the forest, as they did in the Gardens, and a quantity of seed was obtained which

was planted. The greatest difficulty was to prevent their being carried off even ere ripe by bats. These are most troublesome animals, the worst being those of the genus *Cynopterus*, they occur in enormous numbers, and being small are impossible to shoot.

This plantation was transferred at the end of the year to the Forest Département.

Vote	...	...	...	\$600. 00
Expenditure	...	...	...	592. 13
			Balance	\$ 7. 87

HENRY N. RIDLEY,
Director.

Statement of Receipts and Expenditure for the year 1902.

RECEIPTS.			EXPENDITURE.		
		\$ c.			\$ c.
By Balance in Bank	...	2,797 51	Salaries		5,759.67
„ Government Grant	...	8,000 00	Bills		8,338.03
„ Sale of Plants, and Seeds	...	3,460 53	Balance		194.07
„ Interest	...	33 73			
		\$14,291 77			14,291.77

Botanic Gardens, Penang.

The year was an unusually dry one for Penang, the total rainfall on Government Hill, which is always greater than in the plains, being only 115.51 in., whereas the average for a number of years is about 150 inches.

Waterfall Garden.

For several weeks during the early part of the year a Surveyor was employed by the Municipal Commissioners in taking levels in this Garden, and a number of coolies in sinking a shaft outside the Garden limits to ascertain the nature of the foundation, their idea being to apply to Government for permission to convert the Waterfall Valley, the present site of the Garden on which much labour and money has been expended, into a reservoir. No definite decision has as yet been come to, but the chalk line and level pegs put down by the Surveyor to show the height to which the water will

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rise, supposing this scheme is carried out, shows that there will be nothing left worth preserving as a Government garden, and that an entirely new site will have to be selected if Penang is to have a garden of any interest. Under this circumstance of uncertainty no extension has been made during the year, nor have certain much needed improvements of permanent nature, such as increased Office and herbarium accommodation and Quarters for employes within a reasonable distance of their work, been put before Government as was intended in preparing the Estimates for 1903; as it would be wasting money if the garden is to be abolished within a year or two. It is most important that this question should be settled as soon as possible so that works of improvement may be carried on with a certainty that the labour and money is not being spent in vain.

2. This garden, as is often remarked both by resident and visitors, is the one show place in Penang, and in addition to this much work of a more utilitarian nature is done here in connection with Forestry, Economic Botany, &c. A large proportion of the trees are now too large to be removed and every year the difficulty and also the expense of removing is enhanced, so that I cannot too strongly urge the necessity of a decision being arrived at as soon as possible as to whether this is the only possible site for an adequate water supply; and if so that steps should be at once taken to provide for another suitable site for a garden.

3. The main attraction to the majority of visitors are the plant sheds, especially the Orchid shed, which generally contain a number of interesting plants in flower. In this respect there has been no falling off during the past year, and there is at the present time (January 8th) a bank of *Calanthes* and other Orchids in flower that is most attractive. The attention of plant lovers has been called to this easily grown and attractive genus in an article to be published in the *Agricultural Bulletin*, with hints as to their culture, so that there is no necessity to dilate on the subject here further than to say that since the beginning of September there has been a continuous show of those plants in flower which will continue for at least another month or six weeks. *Habenaria carnea* is another Orchid that served to keep the house gay during the months of July and August, there being at one time about 100 plants in flower, and the individual flowers last from a month to six weeks. Some of the *Cattleyas*, *Oncidiums*, and other S. American Orchids do fairly well and are greatly admired, but for the greater number of species of these genera the temperature is too high to grow them to perfection.

4. Beds, borders, and shrubberies were maintained in a satisfactory manner, and many plants and trees were more than usually floriferous when the rain came after the prolonged drought. The *Lagerstroemia* and *Cassia* trees were exceedingly showy as were also many flowering shrubs. *Cannas* are grown in large numbers and some three dozen new varieties were received from Messrs. Dammann & Co., Naples. This is one of the best flowering plants to grow for the wet season, but to obtain the best results they require to be transplanted frequently, and manured heavily. Many Palms and other trees were planted out in different parts of the grounds and more would have been done in this line but for the uncertainty as to what is to happen to this garden as already mentioned. Nearly the whole of the collection of pot plants were gone through and repotted during the months of April and May.

5. Numbers of new plants were contributed to the collection already in cultivation by the Officers in charge of Botanic Gardens, Nurseries, and other establishments, with which we are in correspondence; and a good many by residents in the Malay States, Sumatra and Penang. A trip to Selangor in the month of May, in connection with forestry, afforded an opportunity of adding many plants that are quite new, and others not previously recorded from the Peninsula. Among the former is a most beautiful *Didymocarpus* with snow white flowers, found growing at an altitude of about 3,000 feet; and among the latter, *Cypripedium Lowii*, which had hitherto been recorded only from Borneo, where it was first discovered by Sir Hugh Low, and in Sumatra. The mountain range on which these and many other interesting plants were collected divides the Native States of Selangor and Pahang, and is a region that from a botanical point of view will repay further exploration.

6. The principal contributors of plants and seeds are the Directors of the Royal Botanic Gardens Kew, and Calcutta; Botanic Gardens Buitenzorg, Glasnevin, Gold Coast, and Singapore. Among others may be mentioned Messrs. F. Sander & Co., Messrs. Dammann & Co., S. P. Chatterjee, C. Maries, Hon. J. K. Birch, J. de Voogt, D. Aeria, Khoo Joo Keat, Khaw Joo Tok, A. B. Stephens, A. Lens, J. Irving, L. Hawkins, D. Blaze, C. Goldham, A. Runge, Dr. Wright, Mrs. Rivis, P. Laurie, C. H. Sprenger and Mr. Stiedel.

7. The recipients were about equal in number to contributors and to a great extent the same individuals, but there are others, of which the Curator of the Botanic Station Seychelles, and H. H. the Rajah Muda of Kedah received the largest collections. Plants of *Kickxia* (*Funtumia*) *elastica* raised from seeds obtained direct from West Africa by the Superintendent of Government Plantations Selangor were divided between the Superintendents of Government Plantations Perak and Selangor, a few given to private planters, and some planted in Penang in the Forest Reserve at Batu Feringgi.

8. Plants to the value of \$741 were sold, the greater proportion being ornamental plants in pots, but included some 3,000 rubber plants of sorts. The greatest demand in the way of decorative plants is for Palms, the taste for which has greatly extended during recent years. The increase in revenue over the previous year's collection amounts to \$167.

9. Drawings of many new and interesting plants that have flowered in the garden have been added during the year, and it is hoped that more work of this kind will be done in the future as the Artist's time has hitherto been largely taken up with typewriting and other clerical work for which a man is provided in Estimates 1903.

10. Numerous additions have been made to the herbarium, which although confined exclusively to Malayan plants, has outgrown the accommodation provided. New Cabinets have been purchased but a larger and more suitable building is much needed.

Governor's Hill Bungalow Gardens.

11. This garden suffered much during the early part of the year from want of water. The rain-water tanks were all dry and the pump out of order. All the men employed could only carry enough water to keep the pot plants alive, and in many cases failed to do even that. Until there is some more satisfactory arrangement for supplying water it will not be possible to do much more in the way of growing choice plants here than is done at present.

Coco-nut Tree Preservation.

12. The Inspector of Coco-nut trees complains that in too many cases persons summoned for infringing the Ordinance are let off with a caution, or fined in so small amounts as to be non-deterrent. In view of the increasing importance of Coco-nut cultivation, and the necessity for keeping the beetle in check, for which it has recently been found necessary to take steps in the Federated Malay States on the same lines as in the Colony, I think too lenient treatment is a mistake.

The number of Notices &c., issued are shown below.

Name of District.	No. of dead Coco-nut trees destroyed.	No. of pieces of Coco-nut Trunks destroyed.	No. of heaps of Cattle Manure removed.	No. of heaps of Paddy-husks destroyed.	No. of Notices issued.	No. of Summonses issued.	Amount of Fines recovered.	Remarks.
Province Wellesley, Northern District	480	2,770	168	89	383	7	\$ c. 15 50	
Province Wellesley, Central District	149	1,089	103	54	185	10	33 00	
Province Wellesley, Southern District	49	231	35	22	85	Nil	Nil	
Penang Island.	380	3,716	389	70	596	27	53 00	
Total.	1,058	7,806	695	235	1,249	44	101 50	

Economic Products.

13. Information regarding economic products, with which it has been customary

to deal at some length in successive annual reports, appears now in the regular monthly issue of the Agricultural Bulletin so that it is unnecessary to do more than refer briefly to the more important points in this branch of the work.

Para Rubber.

14. Para Rubber still holds the field and bids fair to recoup Agriculturists some of the money that has been lost in other cultivations. The largest tree in the Waterfall Garden, of which mention has been made from year to year in annual reports, has been tapped for the seventh time, the yield of dry rubber being 2 lbs. 13 $\frac{1}{4}$ ozs: which makes a total of 18 lbs. 7 ozs. from this tree in seven years, or an average of 2 lbs. 10 oz. per year; and I see no reason why this average should not be maintained or even exceeded without injuring the tree. According to a note in the Agricultural Bulletin, two of the oldest Para rubber trees in Perak that had not previously been tapped gave 50 lbs. of dry rubber at one tapping. Mr. STANLEY ARDEN, Superintendent of Experimental Plantation Selangor, has just published his report on the tapping of trees in various manners and at different ages, and I believe the conclusions arrived at coincide in all material points with my own experiments, which though dealing with only a few trees have been spread over a much longer period. The extension of plantations is pushed on, especially in the Native States, and it is proposed to commence tapping this year on two Estates that I know of, but I fear that the return from very young trees will be disappointing after deducting cost of collecting.

Ramie.

15. A short note on Ramie in the Agricultural Bulletin somewhat revived the interest in this fine fibre producing plant, and has resulted in eliciting some information that may be of practical value.

A correspondent in Scotland who is thoroughly conversant with the methods of cleaning and preparing this fibre, and to whom a parcel of ribbons was sent for treatment, suggests that the kind we sent, and which I believe to be the same that has been planted on the two or three estates in which the cultivation on ramie has been attempted on any considerable scale, is a very inferior variety which he terms black ramie. It is a very strong and quick growing form and on this account it has no doubt been selected in preference to others, but if our correspondent's views are correct this is its sole recommendation. We have in cultivation in the nursery here a smaller and shorter variety with hollow stems which will, I have little doubt, give more than double the weight of fibre from an equal weight of stems as compared with the large growing kind. The nature of the stem too, I think, simplifies the decortivating process, for instead of stripping the bark from the wood, which is never a complete process, there being always a certain amount of fibre adhering to the wood, that cannot be removed with the bark, by simply beating the stems while in a green state and washing in water, every particle of fibre is obtained. From this variety two pounds weight of green stems without leaves gave 4 oz. of roughly cleaned fibre which has been sent home to ascertain what further loss occurs in completing the process of preparing the finished article, and the approximate value if shipped as per sample.

Gutta Percha.

16. Gutta Percha trees growing in the Waterfall valley, from which a good crop of seeds was obtained in 1901, produced not a single fruit this year though one tree flowered freely. Imported saplings both from Borneo and Sumatra are decided failures, and until seeds are obtainable the cost of forming large plantations is too great to justify the undertaking. This however is a matter to be dealt with more fully in a report on the Forest department which I have been asked by the Chief Forest Officer to write, and I merely refer to the subject here as the preparations of Gutta Percha plants for planting in the Forest reserves has hitherto been done in the Botanic Gardens.

Imperial Institute.

17. Early in the year samples of different kinds of "Gutta Percha" including "Taban Puteh" from Perak were forwarded to the Scientific Department of the Imperial Institute with the request that these might be examined and their commercial value reported on.

Later, a case of *Blumea balsamifera*, and seeds of *Hevea brasiliensis*, was sent.

Receipt of these packages has been acknowledged and an investigation of the contents promised as soon as an opportunity occurs. The Hevea seeds were sent at the request of the Superintendent of Government Plantations, Selangor, who anticipates that in the near future the supply will be enormous and that it is therefore desirable to ascertain whether they can be utilized in the production of oil, or for any other purpose.

Forests.

18. Up to the end of the year the Forests were directly under the District Officers and Collector of Land Revenue, the Superintendent of Gardens and Forests acting as adviser especially in the matter of planting operations, and additions or alterations in the area of reserved Forests. From the 1st January, 1903, a somewhat different system comes into operation whereby more direct control is taken by the Superintendent of Gardens and Forests.

Expenditure:

19. The total amount of Government Grants under the heading of Botanic Gardens amount to \$6,906, of which \$6,769.64 were expended, particulars of which are given in Appendix A annexed.

C. CURTIS,

Superintendent of Gardens and Forests.

APPENDIX A.

Revenue and Expenditure of the Botanic Gardens Department, Penang, 1902.

REVENUE.		EXPENDITURE.	
	\$ c.		\$ c.
Government Grant—		{ Wages	3,173 75
Maintenance of Water-fall Garden ...	4,960 00	Stores, Tools and Material ...	653 33
		Material for Herbarium ...	166 90
		Books and Periodicals ...	19 90
		Pots and Tubs ...	65 51
		Manure and Cartage ...	81 80
		Road Metal ...	69 00
		Freights ...	48 89
		Typewriter ...	211 75
		Office Furniture ...	20 00
		Cabinets for Herbarium ...	77 00
		Chicks for Plant Sheds ...	33 43
		Iron for renewing Plant Shed ...	190 16
		Miscellaneous & Petty Expenses	144 56
		Balance	4,955 98
			4 02
		Total	4,960 00
Government Grant—		{ Wages	943 59
Upkeep of Grounds of Governor's Hill Bungalow	1,180 00	Seeds, Plants and Tools ...	123 29
		Manure ...	64 89
		Pots and Plant Tubs ...	45 49
		Balance	1,177 26
			2 74
		Total	1,180 00
Government Grant—		{ Wages	101 78
Reafforesting Site of Experimental Nursery ...	200 00	Balance	98 22
		Total	200 00
Government Grant—		{ Pony Allowance	216 00
Travelling and Personal Allowance ...	416 00	Passages, Personal and Field Allowance ...	199 22
		Balance	415 22
			78
		Total	416 00
Expenses of carrying out Provisions of Coco-nut Tree Preservation Ordinance ...	150 00	{ Allowance to Inspector of Coco-nut trees	120 00
		Destruction of dead Coconut trees... ..	4 00
		Balance	124 00
			26 00
Total Government Grant	6,906 00	Total	150 00
Revenue from Plant Sales	\$ 741 90		
„ Swimming Bath	32 20		
Total Collected	\$ 774 10		

Annual Report of the Botanic Gardens, Singapore, for the year 1903.

Staff.

Mr. A. D. MACHADO, Acting Assistant during the absence of Mr. FOX, having accepted a position on an estate in Perak, resigned his post at the end of July. His services were so highly appreciated by the Government that he received a gratuity of \$500 from the Government. He was succeeded by Mr. C. B. KLOSS who remained till the end of the year, when Mr. DERRY was expected to return from England, which he did early in January. The salary provided for an Acting Assistant Superintendent is too small for an European to live on, about \$125 a month, so that it is by no means easy to get any one at all to act during the absence of either of the Superintendents, so that the Department was very fortunate in procuring the services of the above-mentioned gentlemen.

The Mandor VICTOR PASSANAH, who was employed last year, was dismissed, and his place was not filled up.

The collapse of the labour supply throughout the East was felt very severely in the Gardens. All the better class of the ordinary coolies left, and it was discovered late in the year that certain licensed cooly-brokers had been crimping the men and shipping them to Bangkok and Borneo. The men usually ran away immediately after receiving their pay and were not heard of again. This was discovered by one of the men who had been kidnapped against his will escaping from the house in which he had been locked up. In this way a very large number of men had disappeared. In fact, during the year, no less than 176 men ran away or were discharged for worthlessness out of a staff of 71 men, and this does not include a large number who came for a single day. The attention of the Chinese Protector in charge of the Emigration Department was called to the matter, the licence of one of the worst of the cooly-brokers revoked, and the running away of the men immediately stopped. The result of this wholesale exportation of labour was that the only coolies procurable were lads of 15 or 16 or old worn-out or diseased men rejected by the cooly-brokers, and for a good portion of the year the supply of these was inadequate. These coolies were not only lazy, but knew no Malay nor could most of them handle any tools. It was useless to discharge them as no others could be procured. At the end of the year matters got a little better, but many of those employed were of very little value.

The watchmen, although their wages were raised considerably, were almost equally troublesome, and several lots were dismissed during the year.

There was very little sickness throughout the year and none of any importance.

Visitors.

The number of ordinary visitors was as large as ever, but the residents do not make as much use of the Gardens as would be expected, except on occasions on which the regimental band plays. Performances took place not only on moonlight nights but also on Sunday afternoons on two occasions, and were highly appreciated especially the Sunday performances to which large crowds came.

The number of scientific visitors and those studying agriculture increases largely each year, as the Gardens are becoming more widely known throughout the world. Among this class of visitors may be mentioned:—Colonel LUMSDEN, Mr. DUNN (Hong-kong Gardens), Dr. HALLIER, M. BONNECHAUX, Mr. C. D. COBHAM, (H. M. Commissioner of Larnaca), Professor HOCHREUTINER, Dr. NILS SWEDELIUS, Baron DE SOSTEN, Professor C. S. SARGENT, and Mr. A. R. SARGENT, Dr. TREUB, Mr. W. R. TROMP DE HAAS, Dr. HEINRICHER, Professor PREUSS, M. JACQUET.

The tapping and other experiments with Para rubber attracted many planters and others interested in rubber planting, and there were often six or seven persons a day present while the rubber was being collected and prepared.

Thefts.

There were no thefts of any importance during the year, except those of a quantity of garden materials, evidently stolen for use in private gardens. A notice was published in the papers warning residents to be careful as to what their gardeners obtained, and the thefts which had been going on for some time immediately ceased.

Gardens Committee.

The meetings of the Committee for the management of the Gardens, after being long in abeyance, were recommenced at the request of a member of the Legislative Council. The members for the year were Dr. ELLIS, Hon'ble W. J. NAPIER, W. EVANS and Mr. JAGO who was during the year replaced by Mr. SHIELFORD. Ten meetings were called, of which six were attended by the Committee.

Aviaries.

In accordance with Government instructions most of the remaining animals were sold; a few of the birds, some monkeys and a few other animals which had been a long time in the Gardens being kept. An unusually large number of animals were offered as presents to the Gardens, including a fine tiger offered by the Sultan of Johore, but almost all had to be refused. The abolition of the Menagerie caused many expressions of regret among the visitors with whom it was the most popular part of the Gardens. The funds however made it impossible to keep it up even if the dispersal of it had not been ordered.

It may be hoped that at some future time the Government might found a suitable Zoological Garden, in Singapore, which with a low charge for admission would easily be made to pay for its upkeep as is done in many colonies where the expenses of procuring the animals and keeping them are very much greater than they would be here.

The only animals accepted during the year were:—

A binturong (*Arctictis binturong*) presented by Mr. C. A. Kroessen, (Celebes.)

A common Berok Monkey (*Macacus nemestrinus*).

A pair of Crowned Pigeons (*Goura Victoria*) presented.

An Ibis (*Ibis melanocephalus*) presented by Captain C. E. Remmers.

A young pelican, presented by Tee Gay.

A Monitor Lizard (*Varanus salvator*) caught in Singapore Town, presented by Mr. C. A. Ribeiro.

A tortoise-shell turtle (*Chelone imbricata*) presented by Mr. Klinteberg.

The two fine black storks from Pahang were accidentally killed by a swarm of bees which appear to have stung both birds in the throat.

Upkeep of Buildings, etc.

The most important building work was the erection of a new herbarium and museum building by the Public Works Department. This is an ornamental building 100 feet in length and 28 feet wide, divided into two rooms, one for the herbarium 69 feet in length, and the other 31 feet long for a museum of economic specimens and laboratory. A verandah five feet wide runs round the whole building.

The cost of the whole structure was \$5,926.

A building of this nature has long been required, as the office building was far too small to contain the library and herbarium, both of which have increased so extensively during the last few years, and it was impossible to make a proper collection of our economic products still less to exhibit them, as there was not a corner in which they could be stowed. The transfer of the herbarium from the office buildings will permit of the extension of the overcrowded library shelves, and the proper arrangements of papers and correspondence so as to be easily accessible.

On the site of the old deer-sheds, a small rustic summer house of tembusu posts, walls of split bamboo, and lalang roof was erected with seats inside and a verandah running round it. This has proved very useful as a shelter in rainy weather for people caught in storms at that end of the gardens.

The Cooly-lines, Clerk's quarters and potting shed were re-atapped and four small detached houses were made for married coolies; some of the woodwork of the plant-houses was renewed, but a good deal which required attention could not be done for lack of funds; some of the roads were patched, and one or two of the main drains re-made.

In spite of the labour difficulties and scanty funds, the Gardens were kept in a fairly good and bright condition and were highly admired by many visitors who expressed themselves as quite unprepared for such picturesque gardens.

Plants in Flower.

Among the more interesting plants which flowered in the Botanic Gardens for the first time were:—*Acanthus Monianus*, *Ocimum viride*, the Mosquito plant, *Dracæna phrynioides* and the Uganda *Coreopsis* from Africa. *Diospyros argentea*, *Calamus scipionum*, the Malacca cane, *Parabæa capitata*, *Dendrocolla*, two new species collected by Mr. Machado. *Coscinum fenestratum*, *Raphidophora Korthalsi*, *Mapania triquetra* n.sp. from the Malay Peninsula.

Schismatoglottis multiflora, n.sp. *Curculigo racemosa*, n.sp. *Homalomena fasciata* n.sp. *Haplochorema uniflorum* and *Dracæna au cubæfolia* n.sp. from Borneo. *Alpinia calcarata*, Ceylon, *Dendrobium taurinum* var *Album*, New Guinea. A new *Strobilanthes* from India, presented by Mr. Micholitz. The Wistaria pea, *Dolichos* sp. from Japan.

Zephyranthes citrina, *Chamædorea Martiana*, *Astrocaryum tecumoides*, *Hibiscus lunariifolius*, *Calliandra Caracasana*, *Aphelandra pumila*, *Dichorisanthra thyrsiflora*, from South America. A hybrid *Crinum* from Italy also flowered, and *Eugenia braziliensis*, fruited for the first time. This latter is an excellent little sweet black fruit, well worth cultivation.

Plants and seeds received.

The number of plants received during the year by presentation or in exchange was 510 together with 442 packets of seeds.

The donors were Mr. J. C. Harvey (Mexico), Dr. Busse (German East Africa), Mr. Erichsen (Sweden), J. Waterstradt (Borneo), Mr. Micholitz (Burmah and Malay Islands), Bishop Hose (Borneo), Mr. Von Uslar (Borneo Orchids), Mr. St. V. B. Down (Southern Siam plants), Mr. Dupont (seeds of *Lodoicea seychellarum*), Mr. Lyons (Manila), Dr. Abbott (Sumatra), Mr. G. L. Lucas (Jamaica pineapples), Mr. Pritchard (Cotton seed), Messrs. Choa Kim Keat, Chatterjee, Dunman, Wulle Sutton, Harmsen and Boehmer (various ornamental plants), Mr. Machado (Perak plants) and the Conservator of Forests, Darjiling, Southern Californian acclimatization Society, the Botanic Gardens of Kew, Gold Coast, Lagos, Uganda, Barbados, Mysore, Madagascar, Lagos, Calcutta, Sierra Leone, Selangor, British Guiana, Mauritius, Baroda, Sydney, and Dehra Dun.

During a short excursion on leave to Sarawak, I obtained a number of new and interesting Borneo plants.

Plants and seeds sent out.

During the year, exclusive of plants sold, there were sent out 233 plants and 234 packets of seeds.

Among the recipients were, Mr. Choa Kim Keat, Mr. Pereira, Mr. Harvey, Messrs. Dunman, Dr. Busse, Mr. Frizell, Mr. Meissner, Mr. Craddock, Mr. Down, Mr. Bland, M. Boehmer, and Bishop Hose.

The District Officers of Tampin, Kuantan, Kuala Kubu, Temerloh, Kuala Lipis, Raub, District Surgeons of Pekan, Kwala Lipis, Malacca, Province Wellesley, Negri Sembilan, Kwala Lumpur, Teluk Anson, Parit Buntar, Batu Gajah, Taiping, and Conservator of Forests.

The Botanic Gardens of Kew, Uganda, Seychelles, Gold Coast, Madagascar, Zanzibar, British Central Africa, British Guiana, British Honduras, Jamaica, Mauritius, Sierra Leone, Old Calabar, Southern Nigeria, Trinidad, Baroda, Penang, Selangor, Southern California, Acclimatization Society.

The Flora.

The portion of the Flora dealing with the Monocotyledons was finished and the greater part is type written and ready for publication. The *Gesneraceæ* were also finished during the year. The collection of *Utriculariæ* was loaned to Dr. PRAIN at Calcutta who is undertaking the *Leutibulariæ* for the flora, and he on his part sent the collection of *Gesneraceæ* of the Calcutta herbarium to be studied for the Flora. The herbarium specimens of *Impatiens* were sent on loan to Sir JOSEPH HOOKER at Kew who is writing an account of those of the Indo-Malayan region.

The Artist continued to make drawings of plants for the flora and to finish the unfinished drawings. He however is resigning his post in January. The loss of his services is regrettable in the cause of botanical science, as these drawings are of the

greatest value in a country where specimens of many plants are almost impossible to preserve satisfactorily, and it is the more unfortunate inasmuch as the Malay Artist at Penang, trained carefully in botanical drawing, has also left for a post of an inferior class of work, but higher pay.

The Agricultural Bulletin.

The Bulletin was published regularly each month. It contained 419 pages and nine plates. The Government of the Straits Settlements and the Federated Malay States contributed as before \$600 to its cost. The demand for it increased to nearly double what it was last year, 600 copies being distributed, each month, Nos. 1, 8, 9 and 10 of the first volume being all sold out are being reprinted to supply the demand for them. The old series was also much in request and several numbers have had also to be reprinted.

The Herbarium.

During the year I had little opportunity of getting any collecting expeditions as it was not possible to leave the Gardens while the temporary Assistants were new to the work. But in July I visited Sarawak on leave and taking a plant-collector obtained a large series of herbarium specimens as well as living plants, many of which were new to Science. Herbarium specimens were received in exchange or by presentation from—

Hose, Miss.—Bornean Grasses.

Shelford, Mr. R.—Bornean plants.

Prain, Dr.—Malay Peninsula plants collected by Wray, Scortechini and Kunstler.

Micholitz, Mr.—Borneo plants.

Merrill, Mr.—Philippine plants.

Burn-Murdoch, Mr.—Peninsula plants.

Machado, Mr.—Perak plants.

Barton, Capt. F. R.—New Guinea plants.

Moorhouse, Mr.—Specimens of rattans from Negri Sembilan.

Engler, Dr.—New Guinea plants.

Napier, Mr.—Negri Sembilan plants.

Duplicate specimens were sent to Kew, Calcutta, Berlin and Sydney Gardens and to Mr. Merrill in the Philippines and Dr. Beccari.

Eight new Cabinets for herbarium specimens were made.

The Herbarium is now without doubt the finest for Malay Peninsula plants in the world, and contains many types and cotypes of plants from the Peninsula, Borneo, Sumatra and Siam. Although it is chiefly confined to the local plants it also contains valuable series from the islands of the Malay Archipelago and Australia, and a few from Europe, America and India. Named Garden plants are often added for reference, in identifying cultivated plants.

Library.

The Library has so much increased that the small accommodation it had proved far too small, so that the new building destined for the herbarium was much required, so that the rooms in which the herbarium is packed will be in future available for the extension of the library. Although the money which could be annually offered for the purchase of books has been very limited, the collection is an excellent working one, and several professional botanists have come to study the catalogue, and professed themselves well pleased with the library. A very large number of books and papers are received in exchange for the Gardens Reports and especially the Agricultural Bulletin.

The following books were presented by their respective authors or Governments:—
Nanninga, Dr. A. W. J.—Invloed van den Boden op de Samenstelling van Het Theeblad.

Koningsberger, Dr. J. C.—Ziekten van Ryst Tabak en andere Culturgewassen.

Hunger, Dr. F. W. J.—De Mosaick Ziekte bij Deli.

Hissink, Dr. G. J.—Tabaks Cultuur.

Koorders and Valetton—Boomsorten op Java, part 7-9

De Bie, H. C. H.—De Landbouw der inlandsche Bevolking.

Der Botanischer Garten und die Botanische Museum der Universitat Zurich.

Penzig, O. and Saccardo, P. A.—Diagnoses Fungorum Novorum in Insula Javae, presented by the Authors.

Maiden, J. H.—Eucalyptus tereticornis and E. rostratus.

Notes on some unrecorded plants collected by W. V. Fitzgerald.

Critical revision of the Genus Eucalyptus.

- Maiden, J. H. — Is *Eucalyptus* variable.
On *Eucalyptus polyanthemus*.
- Fairchild, D. G.—Spanish Almonds and their introduction into America
Berseem, the great forage crop of the Nile valley.
Three new plant introduction from Japan. Japanese Bamboos.
Letters on Agriculture, West Indies, Spain and the Orient.
- Wiley, H. W.—Official Method for analysis of Tanning materials.
- Satow, Sir Ernest.—The cultivation of Bamboos in Japan.
- J. Macoun—Catalogue of Canadian Plants; Part VII, presented by Government of Canada.
- E. de Wildeman.—Annales du musée de Congo, presented by the Author.
- Thiselton Dyer.—Flora of Tropical Africa, vol. iv, Part ii, vol. viii, p. 2.
- Medley-Wood.—Natal Plants ii. 3, iv. i. presented by Natal Government.
- Prudhomme, E.—Le Quinquina.
- Targioni Tozzetti.—Le Collezione di Georgio E. Rumpf., presented by the Author.
- Haffner, Dr. E.—Rapport sur le champ d'essai de Ong-Jeno.
- Maxwell, Lefroy. Scale Insects of the lesser Antilles.
- Stebbing, E. P.—Rice Sapper.
Bengal Rice Hispa.
Sugar cane borer.
Rhinceros or Date Palm Beetle.
North west or migratory Locust.
Cut worm.
- Presented by the Trustees of India Museum.
- Cook, Theo.—Flora of the presidency of Bombay.
- Dultin, T. G.—Flora of the Upper Gangetic plain, vol. i., part i.
- Vines, S.—Proteolytic Enzymes in Plants.
- Christ, H.—Filices *Chinae centralis*.
Sur quelques Fongères.
Le *Pteris longifolia*.
Fongères de Madagascar.
Spicilegium Pteridologicum Austrobraziliense.
Zur Flora des Obern Lago Maggiore.
Filices Novae.
Filices Bodmierianae.
Frublings flora der Tremezzina.
Filices Setciouenses.
Filicesin Shensi collectae, all presented by Author.
- Zimmermann, A.—Johannisbrot (*Ceratonia Siliqua*).
Bermuda grass (*Cynodon Dactylon*).
- Hallier, H.—Uber Kautschukpflanzen, presented by Author.
- Watt George and Mann H.—Pests and Blights of the Tea plant, presented by the Indian Government.
- Aliotta, Dr. A.—Rivista critica del Genere *Gossypium*, presented by the Author.
- Wiley, H. W.—Manufacture of Table Syrups from Sugar Cane.
- Gardner—Annual Report of Porto Rico Experiment Stations.
- Collins, G. N.—Mango in Porto Rico.
- Collins and O. F. Cook—Economic plants of Porto Rico.
- Barrett, O. W.—The Changa or mole cricket in Porto Rico.
- Kearney, Th. H.—Report on a botanical survey of the dismal swamp.
- Rose, J. N.—Studies of Mexican and Central American plants.
- Maxon, W. R.—Study of certain Mexican species of *Polypodium*.
- Preble, E. A.—North American fauna.
- Coulter and J. M. Rose.—Monograph of the North American Umbelliferae.
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Receipt and Expenditure.

	\$	c.
By balance in Bank	964.01	
Government Grant	8,407.00	
By Sale of Plants and Seeds	2,562.96	
Interest	24.18	

Total ... \$11,958.15

Expenditure.

	\$	c.
Wages of Coolies, &c. ...	4,627.	26
Bills ...	6,716.	47
Balance ...	614.	42
Total ...	\$11,958.	15

Economic Gardens.

A considerable tract of land lying along the Cluny Road was felled and stumped to plant Para rubber on it. This land lies between two blocks of Para rubber and had many years ago been planted up with Merbau, Inga Saman, Calophyllum inophyllum, Cedrela Toona, and Mesua ferrea, with a few other trees. The whole had grown into a dense scrub of secondary growth, all of which was cleared out leaving the more valuable trees. The Calophyllum is useless for foresting in this way, and had made little growth, nor were the Inga Saman much better. Owing to the difficulty of getting labour this work was not quite finished by the end of the year.

On the hill behind the policemen's quarters the trees were thinned and Castilloa planted through the wood, and outside along its edge, to compare the growth of this plant with and without shade.

A piece of secondary jungle along the Cluny Road between the cooly lines and the entrance to the lower gardens was thinned and planted through with Gutia percha, *Dichopsis oblongifolia* and also *D. obovata*.

The road from the Dalvey entrance to the main entrance through the garden was widened, strong drain pipes put in the culverts and kept in good condition as a riding road, and has been very popular. Beds were made and planted with Cotton, and a number of new vegetables were cultivated together with several species of *Ocimum* including the mosquito plant, *Ocimum viride*. Experiments made with these especially the last mentioned proved their complete uselessness in driving away Mosquitoes. Ramie beds were renewed and the stock replanted, and a new bed of Patchouli under partial shade was made.

The experiments in manuring Para rubber were continued, the plants being planted out in beds manured with different kinds of manure. The experiments confirmed those made on pot plants in the previous year—those manured with cow-dung making the greatest growth and those with burnt earth and leaves came next, while lime appeared to injure the plant. A number of plants of Para Rubber were manured also with different kinds of phosphate manures, but no very apparent result has yet appeared.

A number of Para Rubber trees well grown were mulched with cut grass, as an experiment but the results of this will not be shown for some time.

The most important experiments were those made by tapping the adult Para rubber trees. Experiments were made as to the best method of cutting the tree with the least injury, in the flow of latex as taken from different heights on the tree, at different times and under different weathers, also as to preparing the rubber from the latex. A quantity of rubber prepared in the Gardens, 143 lbs was sold to various buyers at home who spoke highly of it, and gave an average price of 4 shillings a pound for biscuit and 3 shillings for scrap. Samples of well prepared rubber were given to various planters and others interested in the business and some specimens were sent to the Imperial Institute and to Kew. Latex was supplied to the Government Analyst for examination and analysis.

Experiments were also made in the acidity or alkalinity of all laticiferous trees in the Gardens, by which it was shown that Para rubber latex was unique in possessing a distinctly alkaline latex.

The account of these experiments was published in the Agricultural Bulletin. During the progress of the experiments in tapping a large number of residents, planters, and others came to see the work carried out. During the year 94,235 seeds and 12,454 plants of Para rubber were supplied to planters.

The crop of seed was very irregular this year, probably due to the irregularity of the weather for the past two years. Many of the trees fruited very late, and some apparently not at all.

Probably for similar reasons the fruit crop, especially Durians and Mangosteens, was very short this year.

The chief demands besides Para rubber were for fruit-trees, Vanilla, chocolate, shade trees and pepper plants. There was a large demand from New Guinea, the Seychelles, and the Native States. Pepper was wanted chiefly for Madras where a disease had destroyed a large quantity of the Estates. Mr. G. B. CERRUTI conceived the idea of teaching the Sakais to make Panama hats and a small number of plants was supplied him with instructions as to their use, and a number of plants were planted out to observe their growth.

Vegetable seeds were in demand for Cocos and Christmas Islands and elsewhere.

The stock of economic plants was re-arranged, and a good number propagated to supply demands.

Among the important economic plants added to the Gardens were *Eugenia pitanggo*, a fruit tree from Mexico sent by Mr. HARVEY; a large variety of Guava, from Trinidad Botanic Gardens; a number of Mangos from Madagascar, and some grafted kinds from CHATTERJEE (Calcutta). Cardamum seed from Ceylon; Cotton seed from Egypt, presented by Mr. PRITCHARD (Penang). *Ocimum viride* from Sierra Leone Gardens; eight kinds of pineapple suckers from Mr. LUCAS (Jamaica) and one kind, the Spineless Guatemala pine from Mr. HARVEY of Mexico, and plants of a very large Ceylon variety from Mr. CAREY.

Seed of the fodder grass *Paspalum dilatatum* was obtained from Australia, but did not germinate.

Vote	...	...	...	\$2,808.00
Expenditure	...	...	...	2,797.26
				<hr/>
Balance	...			\$ 10.74
				<hr/>

Government House Grounds.

There was less trouble among the Coolies in the Government House domain than in the Botanic Gardens, and the full number worked all the year. The overseer RAPPA worked well.

Vote	...	...	...	\$2,266.00
Expenditure	...	...	...	2,242.23
				<hr/>
Balance	...			\$ 23.77
				<hr/>

Inspection of Coconut Trees.

During the year the inspector visited all the plantations of Coconut trees in Singapore and served notices on 222 persons to destroy 925 dead trees, and remove or destroy 57 piles of rubbish. All complied with their notices and there were no prosecutions.

Although a few beetles occur in Singapore still, the amount of damage done is really very small.

Vote	...	...	...	\$210.00
				<hr/>
Transport	...	...	...	181.58
Uniform	...	...	...	8.00
Balance	...	...	...	20.42
				<hr/>
				\$210.00
				<hr/>

HENRY N. RIDLEY.

Director of Gardens.

Botanic Gardens, Penang.

The year 1903 will long be remembered as the one in which the designer of the Gardens had to retire owing, I regret to say, to ill health. Mr. CURTIS had arranged to go on long leave in April, but a complete breakdown in February necessitated his departure for England on March 7th. In Mr. CURTIS'S retirement the Government lose an able conscientious and hardworking officer. It falls to the lot of few men on their retirement to leave their life's work in so visible and concrete a form.

Eighteen years ago the site of the present beautiful Gardens was practically waste ground. It is now the pride of the Colony and the admiration of all who visit it. I took over charge of the Department on March the 24th as Acting Superintendent, and was appointed to the substantive post on December 7th, the date of Mr. CURTIS's retirement.

2. *The Weather*.—The year has been remarkable for the unequal distribution of the rainfall. Up to August the rainfall was far below the average, since then however the fall has been heavy, and prolonged more than usual. The total fall of the year was on Government Hill 125.93 and on the plain 103.76 inches.

3. The work of the year must I fear be considered not what it should have been as regards new work, owing to the uncertainty which still hangs over us, as regards the possible requirements of the Garden Valley as a site for a new water reservoir. On the other hand more time and attention has been given to the upkeep of the collections and the neat and tidy appearance of the Garden in detail work. As pointed out in last year's Report this uncertainty has a paralysing effect. Several projected improvements are hung up in consequence and it will be a great relief when we know definitely one way or the other what is going to happen. I have already reported to Government my views on the matter in case the Garden site is required.

4. The flower beds and shrubberies have been attended to and heavily manured, and otherwise maintained in good order by replanting where necessary. With the view of having possibly to change our site, I have paid more than the usual attention to propagation, so that our stock will be easily transferred in case we do move, many specimens being kept in tubs, which ordinarily would have been planted out.

The large Iron Plant House.—This has been thoroughly overhauled and replanted, and I have taken advantage of the many alpine plants such as *Didymocarpi*, *Baeas* etc., which Mr. CURTIS had collected to plant up the rockeries with them which suits them much better than being kept in pots.

5. *The Orchid House*.—This is always an attraction to visitors and rarely is it that there are not in flower such things as *Cattleyas*, *Laelias* or *Oncidiums*. The *Calanthes* have not done so well this year owing to the attack of a fungus which despite spraying did them a certain amount of harm and rendered them less floriferous than usual. The *Habenarias* were however particularly good.

6. The usual potting of the other pot plants was done during the year and special attention was given to flowering plants of all sorts.

7. The principal contributors and recipients of plants and seeds were practically those of other years. Plants to the value of \$894 were sold during the year, the whole being plants of a decorative character of which there is a steady demand not only in Penang, but in the Native States, Sumatra, etc.

8. *Governor's Hill Bungalow Gardens*.—

These were kept up in as good order as possible with the means at command. I am glad to say that the Government have slightly increased the Vote for next year, which will enable them to be kept up as they should be.

9. *Herbarium and Library*.—

No botanical tours were made during the year, owing partly to my time being spent on Forest work and partly to the fact that the weather was too boisterous to visit the Langkawis at a time when it was convenient for me to do so. The following Natural Orders *Gesneriaceae* and *Aroidae* have been sent to Singapore on loan for the use of the Director in connection with the preparation of a part of the "Materials for a flora of the Malayan Peninsula" he is preparing. The usual work of mounting and intercalating of specimens has gone on as usual. I regret to say that owing to the resignation of the artist MOHD: HUSSAIN about the middle of the year fewer drawings have been made than usual. I am endeavouring to replace him by training another man this, however, necessarily takes a long time.

10. *Economic Plants*.—The Para Rubber Tree which has so often been spoken of in previous Reports, was again tapped on 15 occasions and gave a daily return of from 1½ oz. to 17¼ ounces. The total tappings for the year amounted to 3 lbs. 6 oz. and the grand total to 22 lbs. 15 oz.

11. *Cotton*.—Perhaps no Agricultural Product has had so much attention given to it all over the world during the year as Cotton. This is of course due to the shortage of crops in America which has had such disastrous effects on the Cotton industry of Lancashire. The subject so far as it affects this part of the world is discussed in the Agricultural Bulletin at some length by the editor and Messrs. BAXENDALE and ARDEN, but unfortunately there are very few reliable data to go upon. The experi-

ments throughout India however with the finer long staple cottons like the Sea Island variety has been, I regret to say, unsatisfactory. Through the kindness of Messrs. PRITCHARD & Co. a small parcel of Egyptian cotton seed was imported by them and distributed to several planters and others. The plants raised from seeds supplied us have been planted on one of the Estates in the Province where they will have a better chance of showing how far they are adapted for growing in the country, than had they been kept in the Gardens. The results will be duly noted. Another of our local Planters has determined to give Sea Island Cotton an exhaustive trial in this country and for this purpose he has asked me to procure for him two Cwt. of the best strain of Sea Island Cotton Seeds. We shall therefore be in a position to tell whether Cotton will be one of the staple cultivations to be added to our list of Agricultural products introduced from America.

12. *Gutta Percha*.—Our seed bearing trees which fruited in 1901, have shown no sign of flowering again.

13. *Coco-nut trees Preservation*.

The number of summonses issued was 103 and fines were recovered to the amount of \$249.50 as against 44 summonses and \$101.50 fines recovered in 1902. A sharp look out was kept over the "Roko" (Cigarette paper) makers in the Province, as it was found that the black beetle was particularly fond of depositing its eggs in the refuse of the Nipah leaves, which form the outer covering of Rokos. The following Table summarizes the work done during the year. The Expenditure being shown in Appendix A.

14. *Expenditure*.—The total amount of Government Grants under the heading of Botanic Gardens amount to \$7,000, of which \$6,868.27 was expended, particulars of which are given in Appendix A annexed.

W. FOX,
Superintendent.

Name of District.	No. of dead Coco-nut trees destroyed.	No. of pieces of Coco-nut trunks destroyed.	No. of heaps of Cattle Manure removed.	No. of heaps of Paddy-husks destroyed.	No. of Notices issued.	No. of Summonses issued.	Amount of Fines recovered.	Remarks.
							\$ c.	
Province Wellesley, Northern District	198	1,649	202	153	340	21	51 50	
Province Wellesley, Central District	285	1 045	203	102	251	15	22 50	
Province Wellesley, Southern District	106	697	95	80	130	9	22 50	
Penang Island.	493	2,701	414	121	635	58	153 00	
Total.	1,082	6,074	914	456	1,356	103	249 50	

APPENDIX A.

Revenue and Expenditure of the Botanic Gardens Department, Penang, 1903.

REVENUE.		EXPENDITURE.	
	\$ c.		\$ c.
Government Grant—		{ Wages	3,197 97
Maintenance of Water- fall Garden ...	4,960 00	{ Stores, Tools and Material ...	125 40
		{ Pots and Tubs ...	294 69
		{ Manure and Cartage ...	68 80
		{ Freights ...	45 07
		{ Office Furniture ...	12 00
		{ Chicks for Plant Sheds ...	52 31
		{ Miscellaneous & Petty Expenses	1,094 64
			4,890 88
		Balance	69 12
		Total	4,960 00
Government Grant—		{ Wages	1,073 27
Upkeep of Grounds of Governor's Hill Bungalow	1,180 00	{ Tools and Attaps ...	32 85
		{ Manure ...	30 37
		{ Flower Pots ...	21 00
		{ Petty Expenses ...	2 47
			1,159 96
		Balance	20 04
		Total	1,180 00
Government Grant— Reafforesting Site of Ex- perimental Nursery ...	50 00	{ Wages	42 00
		{ Balance	8 00
		Total	50 00
Government Grant— Travelling and Personal Allowance ...	440 00	{ Pony Allowance ...	228 39
		{ Passages, Personal and Field Al- lowance ...	183 79
			412 18
		Balance	27 82
		Total	440 00
Government Grant— Expenses of carrying out Provision of Coco-nut trees ...	270 00	{ Allowance to Inspector of Coco- nut trees ...	240 00
		{ Destruction of dead Coconut trees... ..	26 26
			266 26
		Balance	3 74
		Total	270 00
Government Grant— Purchase of Book and Periodicals ...	100 00	{ Books and Periodicals ...	96 99
		{ Balance	3 01
		Total	100 00
Revenue from Plant Sales	\$ 894 80		
" Swimming Bath	8 90		
" Unserviceable Stores	7 64		
Total collected	\$ 911 34		

Annual Report on the Botanic Gardens, Singapore and Penang, for the Year 1904.

Staff.

Mr. R. DERRY returned to the East in January, 1904, and immediately took up the appointment of Assistant Superintendent.

The Foreman-Gardener of the Economic Gardens, EZEKIEL, left in October to succeed RAPPÀ at the Government House Domain, and was succeeded by JOSEPH BENJAMIN who left in two months and a half to take up a post in the Tramways at nearly double the salary.

The constant changes in the posts of Overseers and Foreman-Gardeners during the past few years are detrimental to the progress of the Gardens.

For the work of a Foreman-Gardener some training is necessary even if they have had to manage coolies before, which is rarely the case. This training takes a great deal of time on the part of the Director or his Assistant, all of which is wasted when the man leaves to take up an outside job where his experience is useless, and for his first year or so he is not usually capable of keeping the coolies steadily at work, looking after the tools, stores, or plants, so that this constant change of men not only entails a good deal of extra work, but often an absolute loss, in work done, and tools and stores preserved.

The cooly supply improved during the year and a somewhat better class of men was procurable and in sufficient quantity. There was no sickness of any importance. The watchmen gave no trouble and prevented a good many petty thefts.

Visitors.

The number of visitors to the Gardens showed no diminution, and on the occasions when the regimental band played on moonlight nights there was usually a good attendance. Among the scientific visitors who visited the Gardens during the year were Mr. H. C. PEARSON (Editor of the India-Rubber World, New York), HERR ERNST STIEGEL (Berlin), M. O. COLLET, Dr. HALLIER, Dr. A. K. SCHINDLER (Professor of Natural Science, Pekin), COUNT DE KERGARION (Paris), M. C. & G. DE GINGUE, Dr. PET (Buitenzorg), Staff Surgeon C. G. MATHEW, Mr. G. W. KOEG (The Hague), Mr. T. B. BLOW (Japan), Mr. L. P. RICHMOND (Manila), Dr. DETMER (Jena).

Thefts.

There were no thefts of any importance during the year, a few flowers only being now and then gathered chiefly by passengers. There was one prosecution for flower stealing, and a fine of five dollars was inflicted.

Aviaries.

The only animals added to the Gardens' Aviaries during the year were a specimen of *Attagen minor*, purchased, and a Javanese musang presented. One musang and a crowned pigeon died. The funds of the Gardens not being adequate to keep even the small number of mammals and birds left, it is proposed to dispose of them as soon as possible.

It is regrettable that this necessity has arisen, as the animals were the most attractive part of the Gardens to visitors, and usually the first enquiry of a visitor is, "Where is the menagerie?" A number of animals offered to the Gardens were refused.

Buildings and Upkeep.

The new building, for the Herbarium and Museum, was furnished as far as funds would permit, but more cases are much required, and the specimens of timbers, fibres,

damars and other economic exhibits transferred there with part of the Herbarium. Unfortunately this work could not be continued as the building was very damp and the roof leaked very badly. The old glass house was pulled down as all the wood work was rotten and the rebuilding of it commenced, but had to be stopped for want of funds. In the orchid house the coral-rock tables were reduced in height and repaired, and the building turned into a flower-house or conservatory and kept very bright throughout the year with orchids and flowering shrubs and herbs, proving very attractive to the public.

A number of the drains were rebricked and repaired, but a good deal more is requisite in this work. The remaining mud-drains should be all bricked, especially those round the band-stand, but funds do not permit of this. Considerable difficulty was experienced in getting an efficient mason for the available funds and indeed neither of the two employed were found to be at all satisfactory and had to be discharged.

The long road up to the band-stand and the road to Rogie through the Garden's jungle were remetalled completely and many of the other roads repaired or patched.

A brick wall with iron railings was erected from the main entrance to the Office entrance by the Public Works Department, which is a great improvement.

At the request of the Municipality, a band of jungle along the Tyersall Road was cleared away for a width of 15 feet and a length of four hundred yards, so as to open up this road, and the angle opposite Tyersall entrance was widened.

A number of the Garden seats were repaired or remade and more are nearly finished.

The plants in the large plant-house were re-arranged and many were re-potted, and others replaced by finer specimens. At one end of the house a collection of economic plants was arranged to show the various plants used for the production of rubbers, fibres, spices, etc. Opposite these were arranged a complete set of *Dracænas* and *Cordylines* and on the sides series of *Dieffenbachias*, *Aglaonemas* and *Cyclanthaceæ*. One block was filled with *Anthuriums*, *Philodendrons* and *Alocasias*; another contains ferns, among which are chiefly noticeable splendid plants of *Stenoloma chinensis*, *Asplenium scandens* and *Brainea insignis* with many other rare and curious species. The *Selaginellas* occupy one side of the house, and a very complete collection of *Crotons* is arranged at one end. The *Bromeliads*, *Pandani*, *Cycadææ*, and *Coniferæ* are all grouped in different parts of the house. A very complete series of palms including many very rare species fills one side block. All these plants are well spaced and not overcrowded so that they can be well seen.

A series of tuberous rooted *Begonias* was purchased, and some of them flowered well and lasted a long time in bloom, but the dealer who supplied them would perhaps have done better to supply commoner kinds than the high-class strains received, as these plants are not easy to grow here.

A number of *Caladium* bulbs were also purchased and there was a good show of them. Some very fine strains of *Begonia* were presented by Mr. SANDER, but unfortunately were sent by the ship *Malacca* which was seized by the Russians, and when the plants were at length obtained most were dead.

The flower beds were well manured all over the Gardens, and the nursery beds dug deeply over and manured, and the result was a fine display of herbaceous and half shrubby plants through the year in spite of the drought. Some ornamental water lilies were received from Kew Gardens, and were planted in the lake in baskets being gradually moved into deeper water as they grew stronger. Many commenced flowering very soon and make an attractive display especially in the early morning.

The island on the lake was thoroughly cleared of the large bushes of *Wormia* and masses of *Flagellaria* so as to show up the magnificent plants of *Pandanus Kaida*, *Oncosperma* and rattans, the ground beneath was turtled and some *Bougainvilleas* and *Arundo Donax variegata* planted to give a touch of colour.

All the lakes were cleared of weeds, a work that took some time as the rapidity of growth of *Enhydris*, *Utricularia exoleta* and *Blyxa*, produced an enormous mass of vegetation in a very short period.

The small wood at the upper end of the lake was thinned out, and the clearing of the rockery behind commenced, but this work remains to be finished in 1905.

The extremely dry weather for a considerable portion of the year, entailed a great deal of work in watering, and for this purpose it was necessary to employ water-carts at a considerable expense to convey water from the lake to the plant-house. A scheme for laying in water by pipes from a Municipal main was submitted to Government, but was not proceeded with.

A small portable spraying machine was obtained during the year, and found to be very effective, the insecticide known as Xlall, a preparation of Nicotine, being used. When funds permit it is proposed to get a larger machine for cleaning the trees and shrubs of blight and caterpillars.

New Plants.

The following plants flowered in the Botanic Gardens for the first time :—

Malayan—*Pandanus bicornis*, Ridl.—(Perak).

Pinanga acaulis, n. sp.—(Perak).

Gastrochilus plicatus, Ridl.—(Kelantan).

G. reticosa, Ridl. and *G. minima*, Ridl.—(Borneo).

Schizmatoglottis longispatha—(Borneo).

Acriopsis borneensis, Ridl.—(Borneo).

Caelogyne patens, Ridl.—(Perak).

Duabanga sonneratioides.—(Perak).

Burbridgea nitida, Br.—(Borneo).

Arisaema anomalum.—(Perak.)

Campyandra angustifolia, Ridl.—(Borneo).

Didymocarpus rugosus, Ridl.—(Kelantan).

D. crinitus. var.—(Kelantan).

Crinum Northianum—(Borneo).

Cryptocoryne ciliaris—(Borneo).

Palaequium, sp.—(Malacca).

Clerodendron Bethunianum.—(Borneo).

Cypripedium Chamberlainianum.—(Malay Islands).

Dipodium paludosum.—(Borneo).

Siamese :—*Pentacme siamensis*.

Chinese :—*Sagittaria sagittifolia*, var.

Indian :—*Congea tomentosa*, var. *azurea*.

Bauhinia Vahlia.

Vanda Amesiana.

Rubia cordifolia.

Celsia coromandeliana.

Hibiscus radiatus.

Porana paniculata.

African :—*Lantana salviæfolia*.

Cyanastrum, new white flowered species. *Bursera*.

Dracæna Godseffiana and *D. fragrans*, *Tinnæa Sacleuxii*.

Tephrosia Vogelii, *Aglaonema Mannii*, *Aristolochia Goldieana*.

Strophanthus longicaudatus.

South America :—

Xanthosoma Lindenii, *Lucuma multiflora*, *Gustavia gracilis*, *Arauja grandiflora*, *Hymenocallis*, sp. *Oncidium tigrinum*, *O. varicosum*, var. *Rogersi*, *Cattleya Harrisoniæ*, *Hibiscus*, 2 species undetermined from Mexico.

Localities unknown :—

Oxalis, sp. red flowers received from Sweden, *Heptapleurum stelsnerianum*, *Mucuna sericea*, *Aristolochia Forkelii* (from Kew).

At the end of the year there was a fine show of Burmese dendrobiums, chiefly *Dendrobium crassinode*, *D. primulinum*, and *D. densiflorum*, in the Plant-house.

Plants and Seeds Received.

The number of plants received during the year by presentation was 189 together with 549 packages of seeds.

The donors were Mr. T. B. BLOW (Japanese Seeds); Mr. J. C. HARVEY (Mexico); Messrs. SANDER & CO.; Royal Gardens, Kew; Botanic Gardens, Ceylon; Messrs. DAMMAN & Co.; Mr. ROBERTSON (Australia); Deputy Conservator of Forests, Thaiping; Mr. A. D. MACHADO; Messrs. VEITCH; Mr. EGERTON; Mr. ERICHSON (Denmark); Mr. MICHOLITZ; LADY CROFT; Messrs. HERB (Naples); Mr. CHOA KIM KEAT; Mr. St. V. B. DOWN (Siamese plants); Right Reverend Bishop HOSE; Mr. A. B. LAKE (Selangor); Mr. G. T. GEBEL (Javanese Orchids); Mr. VAN USLAR (Borneo Orchids); Hon. F. G. PENNEY; Herr GIRSCHNER (Governor of the Caroline Islands); and the Botanical Gardens of Porto Rico, Port Darwin, Mauritius, Seychelles, Calcutta, Jamaica, British Guiana, Uganda, Udaipur, Montserrat, Trinidad, Philippines, Natal, Penang, Rangoon, Sydney, Harvard University, Madagascar, Melbourne, Saharanpur, Alipur, and the Department of Agriculture in India (three varieties of cotton seeds).

A number of plants and seeds were also added from the expeditions of the Director to Christmas Island and various parts of the Peninsula.

Seeds and Plants Distributed.

Exclusive of seeds and plants of Para rubber, there were 493 plants and 79 packets of seeds distributed to various private people and gardens in exchange.

The recipients were Mr. J. D'A. PEREIRA, Mr. A. M. BURN-MURDOCH, Mr. J. VEITCH, Messrs. SANDER & CO., Mr. A. D. MACHADO, Mr. ERICHSON, Mr. St. V. B. DOWN, Mr. LUCAS (Jamaica), Right Reverend Bishop HOSE, and the Botanical Gardens and Institutions of Manila, Kew, Hongkong, Penang, Saigon, Selangor, and Buitenzorg.

Herbarium.

Part of the Herbarium was moved to the new building, so as to leave more space in the old office for the Library which was much overcrowded, and six more new cabinets were made.

The following specimens were added:—

Rt. Rev. Bishop HOSE—Bornean grasses and sedges.

Dr. GIMLETTE—Plants from Kuala Lebir, Kelantan.

Dr. E. MERRILL—Scitamineæ of the Philippine Islands.

Royal Gardens, Calcutta—29 specimens of Pandanus, and a number of Rubiaceæ, etc., from the Malay Peninsula, collected by WRAY, KUNSTLER and SCORTECHINI.

Royal Gardens, Kew—37 orchids and balsams, from India.

Mr. A. M. BURN-MURDOCH—Specimens of timber trees chiefly Dipterocarpeæ from Selangor.

A large series of plants was also collected by myself in the Semangko Pass and at Rantau Panjang in August, and also in Perak and elsewhere in February, and a good series of plants was also collected in Christmas Island during a Government expedition in October.

At the end of December, I went on leave to Gunong Pulai, in Johore, and collected a good number of plants in the week spent there.

In the small part of the new building destined for a Museum, a number of specimens were cleaned, sorted and arranged, and as many new cases as could be afforded were obtained. The COLLINS collection of resins, gums, fruit seeds, etc., was arranged in glass-topped boxes. A large series of rattans, resins, Dragon's blood and other specimens of economic importance were obtained at the Agricultural Exhibition held in Kuala Lumpur. Timber specimens were sent by Mr. HUDSON and Mr. MOORHOUSE from Seremban, and specimens of the timbers of Christmas Island were also added to the collection. A fine series of Gutta perchas was presented to Museum by Mr. POBLOTH, and a fine series of fibres prepared by Mr. C. J. SCHIRMER, chiefly from plants grown in the Botanic Gardens and decorticated by his new machine.

Duplicate Herbarium specimens were sent to Kew (538), Berlin (314), Manila (241), and the British Museum (153).

A series of large timber specimens partly obtained by Mr. BURN-MURDOCH and partly obtained in Singapore were forwarded to the Imperial Institute.

Specimens of the Ngai camphor with a large quantity of the dried leaves for analysis were sent to the Botanic Gardens, Buitenzorg, and a quantity of bat-guano from Perak was sent to the Imperial Institute for investigation.

Library.

The following books and pamphlets were presented to the Botanic Gardens Library during the year :—

- Veitch, J. B.—Some lesser-known Japanese trees and shrubs, by the author.
- Sargent, C. S.—Synopsis of the genus *Lonicera*.
 New or little known North American Trees.
 Cratægus in North Eastern Illinois.
 Cratægus in Rochester, N. Y.
 Recently recognized species of *Cratægus*.
 Notes on a collection of *Cratægus* by the author.
- Wildeman, E. de.—Flora of the Congo (continued) by the Belgian Government.
- Rehlig, C.—Berichte über Land und Forstwirtschaft in Deutschland, by the author.
- Busse Walter.—Ueber den Rost der Sorghum Hirse in Deutch Ost Africa, by the author.
- Head, B.—The food of the Gods, by C. N. Harris.
- Creosoting Co.—Creosoted Timber.
- Dundon, P. T.—Paget Sound Timber Preserving Company, by Dr. Von Schrenk.
- Lloyd, G. G.—Mycological Notes, by the author.
- Massart, J.—Notice sur les collections Ethnologiques, by the author.
- Christ, Dr. H.—Zur Farn-Flora Von Celebes, by the author.
 Loxsomopsis costaricensis, by the author.
- Macoun, J.—Catalogue of Canadian Plants (continued), by the author.
- Pardy, A.—Manures in the Natal Market for the Seasons 1902-1903, by the author.
- Subba Rao, C. K.—Sugar cane Cultivation in the Deccan, by the Madras Government.
- Usteri, A.—Beobachtungen über tropische Märkte, by the author.
- Woodrow, Marshall G.—The Mango, by the author.
- Power, F. B. and Less, F. H.—Chemical Examination of Kosam seeds, by the authors.
- Cook, Thw.—Flora of the Presidency of Bombay, Vol. II., part I.
- Medley-Wood.—Natal Plants, Vol. II. part I, presented by the Natal Government.
- Costerus, J. C. and Smith, J. J.—Studies in Tropical Teratology, presented by authors.
- Van Eeden, Houtsoorten—presented by Mr. Van den Son.
- Peredes, P. E. F.—Comparative Anatomy of the barks of the Salicaceæ, presented by author.
- Koningsberger, Dr. J. C.—Tripang en Tripang Vischerei, presented by the Botanic Gardens, Buitenzorg.
- Hissink, D. J.—Bemesting's proeven en omtrent grond analyses, presented by the Botanic Gardens, Buitenzorg.
- Hazewinkel, J. and Wilbrink, G.—Onderzoekingen aan het Proefstation voor Indigo, presented by the Botanic Gardens, Buitenzorg.
- Mohr, Dr. Julius—Over Beslag op Deli Tabak, presented by the Botanic Gardens, Buitenzorg.
- Mohr, Dr. Moet.—de Deli Tabak-oogst Geplukt op Gesneden Worden, presented by the Botanic Gardens, Buitenzorg.
- Mohr, Dr.—Over Tabaksasch als Meststoff, presented by the Botanic Gardens, Buitenzorg.
- Hunger, Dr. F. H. J.—Invloed van het verspenen van Tabak's bibit, presented by the Botanic Gardens, Buitenzorg.
- Hunger, Dr. F. H. J. Physiologische onderzoekingen over Deli-Tabak, presented by the Botanic Gardens, Buitenzorg.
- Hunger, Dr. F. H. J.—Statistiek over den Regenval der Sumatra's oostkuste, presented by the Botanic Gardens, Buitenzorg.

- Tromp de Haas, Dr. W. R.—Over de Cultuur van *Ficus elastica*, presented by the Botanic Gardens, Buitenzorg.
- Tromp de Haas, Dr. W. R.—Jute Cultuur.
- Breda de Haan, Dr. J.—Wortel-ziekte Bij de Peper op Java, presented by the Botanic Gardens, Buitenzorg.
- De Vriens, J. C.—Over Samengesteide en Enkelvoudige Meststoffen, presented by the Botanic Gardens, Buitenzorg.
- Van Hall, Dr. C. J. J.—Inspectie van den Landbouw in West-Indie, presented by the Botanic Gardens, Buitenzorg.
- Koningsberger, Dr. J. C.—Ziekten in Klapperaan plantingen, presented by the Botanic Gardens, Buitenzorg.
- Van Dine, D. L.—Insecticides for use in Hawaii, presented by the United States (America) Government.
- Van Dine, D. L.—A Sugar cane Leaf Hopper, presented by the United States (America) Government.
- Van Dine, D. L.—Mosquitoes in Hawaii, presented by the United States (America) Government.
- Newell, F. H.—Irrigation, presented by the United States (America) Government.
- Pinchot, G. and Merriam, G. H.—Forest Destruction, presented by the United States (America) Government.
- Sternberg, Dr. G. M.—Transmission of yellow fever by Mosquitoes, presented by the United States (America) Government.
- Sternberg, Dr. G. M.—Malaria, presented by the United States (America) Government.
- Haviland, G. D.—Observations on termites (Reprint), presented by the United States (America) Government.
- Brandt, K.—Life in the ocean, presented by the United States (America) Government.
- Oorsey, C. W. L. Mesner and Caine, T. A.—Soil Survey from Arecibo to Ponce, Porto Rico, presented by the United States (America) Government.
- Loew, O.—A New Enzyme of general occurrence, presented by the United States (America) Government.
- Howard, L. O.—The Economic Status of Insects as a class, presented by the United States (America) Government.
- Baum, H. E.—The Bread-fruit, presented by the United States (America) Government.
- Koorders, F. H. and Valeton Th.—Additamenta ad cognitionem Floræ arboreæ Javanicæ, presented by the Buitenzorg Gardens.
- Van Leenhoff, T. W.—Coffee Planting in Porto Rico, presented by the United States (America) Government.
- Musgrave, W. E. and Clegg, M. T.—Amœbas, presented by the United States (America) Government.
- Wilcox, E. M.—The Mexican Cotton—Boll Weevil, presented by the United States (America) Government.
- Shaw, G. R.—The Pines of Cuba, presented by the United States (America) Government.
- Edwards, H. T.—Maguay in the Philippines, presented by the United States (America) Government.
- MacDill, Dr. J. R. and Wherry, Dr. W. S.—Two Cases of a peculiar hand infection, presented by the United States (America) Government.
- Woolley, P. J. and Jobling, J. H.—Hæmorrhagia septicoemia in animals, presented by the United States (America) Government.
- Woolley, P. J. and Jobling, J. H.—Pulmonary lesions produced in Carabaos.
- Merrill, E. D.—Dictionary of Philippine Plant Names, presented by the United States (America) Government.
- Merrill, E. D.—New or Noteworthy Philippine Plants, presented by the United States (America) Government.
- Woolley, P. J.—Texas fever in Philippines, presented by the United States (America) Government.

Woolley, P. J.—Report on *Bacillus Violaceus*, presented by the United States (America) Government.

Herzog, Dr. M.—A fatal infection by *Bacillus aureus fœtidus*, presented by the United States (America) Government.

Herzog, Dr. M.—Forest Manual of the Philippine Islands, presented by the United States (America) Government.

King, Sir George.—Materials for a Flora of the Malay Peninsula (continued).

The following books were purchased :—

Lignum Aloes by Prof. Dr. J. Moeller.

Genera Aroidearum by H. Schott.

Colonial Reports on Seychelles.

Engler's *Pflanzenreich* (continuation).

Nicholson's *Dictionary of Gardening* (supplement).

Index Kewensis (supplement).

Weber's *Chemistry of Rubber*.

Nicholson's *Tropical Agriculturist*.

King's *Text Book of Physics of Agriculture*.

Journal of the Linnean Society.

Botanical Magazine.

Gardener's Chronicle.

Indian Gardening and Planting.

India-Rubber Journal.

Tropical Agriculturist.

The following journals, etc., have been presented by their respective Institutions:—

Jamaica Bulletin, Dominica Agriculturist, Journal of the Department of Agriculture, West Australia, Bulletin du Jardin Botanique (Brussels), Annual Report of the Forest Department of Australia, Acti Horti Petropolitani, Planting Opinion, Indian Forester, Pharmaceutical Review, Chemist and Druggist, Journal D' Agriculture Tropicale, Agricultural News of the West Indies, Journal of the Board of Agriculture, Revue des Cultures Coloniales, Bulletin de la Société d'Etudes Coloniales, Bulletin Economique de Madagascar, Agricultural Journal of the Cape of Good Hope, Bulletin Economique de l'Indo-Chine, Bulletin Economique de Hanoi, Trinidad Bulletin, Report on the Agricultural Work in British Guiana, Report of the Board of Agriculture, British Guiana, United States Experimental Station Records, Udaipur Garden Report, Icones Bogorienses, Technical Reports of the Imperial Institute, Hawaii Bulletin, Barbados Garden Report, Jamaica Garden Report, Trivandrum Garden Report, Transvaal Agricultural Journal, India Rubber World, Kew Bulletin (Appendix), West Indian Bulletin, Smithsonian Institution Report, Missouri Garden Report, Ceylon Garden Report, Natal Garden Report, Hongkong Garden Report, Saharanpur Garden Report, Tobago Botanic Station Report, Proceedings of the Agri-Horticultural Society of Madras, Records of the Botanical Survey of India, Trade and Commerce Report of Canada, Porto Rico Garden Report, Report on Indian Museum, Grenada Garden Report, Uganda Garden Report, New York Bulletin, Madras Forest Department Annual Report, Ceylon Circulars, Merck's Annual Report, Agricultural Ledgers, Bulletin de l'Institut Botanique de Buitenzorg, Queensland Agricultural Journal, Calcutta Garden Report, Report of Calcutta Cinchona Plantations, Bulletin of the Koloniaal Museum of Haarlem, Der Tropenpflanzer, Annales du Musée du Congo, Meteorological Observations of Zomba, Annual Garden Reports of the Botanic Gardens, Gold Coast, Lagos, Zanzibar, Sierra Leone, Seychelles, Mauritius, Mysore, Lucknow, Buitenzorg, Fiji, New South Wales, Adelaide, Brisbane, Melbourne, British Honduras, Antigua and Bermuda.

Publications.

The account of the Gesneraceae of the Malay Peninsula for the Flora was completed and is being published in the Journal of the Asiatic Society, Straits Branch, and papers on new plants of the Peninsula and of the surrounding countries were also published therein during the year. Many of these plants are in cultivation in the Botanic Gardens. The Artist continued to make drawings of plants suitable for publication in the Flora.

The Agricultural Bulletin was published monthly, and continues to be in good demand. The circulation has risen from 250 copies to 600. Several numbers of previous years having been sold out were reprinted.

In one number a list of the palms cultivated in the Botanic Gardens, 236 in number, was published with directions for cultivation. The list has been widely distributed to various gardens and establishments for exchange purposes. Since its publication several more palms including the new *Pinanga acaulis* and *Borassus Machadonis* have been added to the Gardens' collection which now numbers over 240 kinds.

Receipts and Expenditure of the Botanic Gardens, Singapore, for the year 1904.

				\$	c.
By balance in Bank	...	...	...	614	42
Government Grant	...	...	...	11,000	00
By sale of Plants and Seeds	...	...	...	4,779	41
				<hr/>	
				16,393	83

				\$	c.
EXPENDITURE.					
Salaries	...	...	...	6,190	90
Bills	...	...	...	9,624	78
Balance	...	...	...	578	15
				<hr/>	
				16,393	83

Economic Gardens.

A portion of the swampy low-lying ground along the Cluny Road which was partly cleared and stumped last year was finished and planted with Para rubber. Another large patch of ground formerly covered with scrub and Sago palms, was cleared and dug and planted with *Sansevieria zeylanica*, *S. guineensis*, *S. cylindrica* and *S. Kirkii*, together with *Fourcroya gigantea* and *Musa textilis*.

There has lately been a demand for these fibre plants, which it is hoped may be extensively planted as a catch crop for Para rubber. An exhibition of fibres prepared by Mr. SCHIRMER, at the Agricultural Exhibition in Kuala Lumpur, which attracted much attention, was prepared largely from fibres grown in the Botanic Gardens. Among the fibres thus exhibited were several different kinds of *Sansevieria*, *Yucca*, *Agave americana*, *Fourcroya gigantea*, *Karatas Plumieri*, *Pandanus Kaida*, Pine-apple and Ramie.

Experiments were made in the different methods of propagating *Sansevieras* by leaf-cuttings.

The Ramie beds were re-dug and a fresh stock planted.

The cultivation of fibres in the Malay Peninsula has been too much neglected but it bids fair to occupy a more important position in the future.

Cotton.—Owing to the urgency of cotton cultivation throughout the empire further attempts to cultivate cotton of various kinds under different circumstances were made. One hundred and nine varieties of cotton seed were received from the Director of Agriculture of India and three varieties from Jamaica, and one from Kew. The climate and soil of Singapore seems, however, quite unsuited for cotton culture, owing to the excess of rain, and the red-cotton bug, *Dysdercus cingulatus*, in spite of the use of insecticides destroyed nearly all the pods.

Among other important economic plants introduced during the year was a set of fifteen kinds of *Sansevieria* received from Kew Gardens, some of which have too small leaves to be of use for fibre extraction, but several will probably prove valuable additions to the stock of fibre plants suited for cultivation on a large scale here.

Carludovica Jamaicensis, the Ippe-appi, much used in Jamaica for making Panama hats and other such fabrics was obtained from Jamaica and is growing well. The true Panama hat plant *Carludovica palmata*, of which a number of plants were planted out experimentally last year, have not grown as rapidly as might have been expected.

Seeds of the Caroline Islands Ivory-nut palm, *Caelococcus carolinensis*, were received from the Governor of the Caroline Islands, and an additional supply of the Amazons Ivory-nut palm, *Phytelephas macrocarpa*, from Trinidad. The only plants of the latter in the Botanic Gardens which have flowered as yet are all males. It is hoped that some females will be among the newer stock.

Suckers of the Porto Rico pineapple were sent by Mr. J. C. HARVEY, a new kind of pine for the East, and from the same correspondent was received the little wild Tomato of South America, with fruits as big as a cherry, forming a very pleasant fruit, and being a very prolific bearer.

Brucea sumatrana, "Kosam."—A quantity of the seeds of this plant, 24 lbs. in weight, was sent to Messrs. BURROUGHS and WELCOME, whose research-chemists Messrs. F. B. POWER and F. H. LEES published a very valuable paper on the subject. No alkaloid was found but two bitter principles were isolated, neither of which was quassin; as stated by other chemists, "a correct conclusion respecting the active principle of Kosam seeds could apparently only be formed when some definite constituent of them such as the bitter principle (a) isolated by us, is treated clinically with reference to its particular value in the treatment of dysentery."

This, it may be hoped, will be done; meantime further reports as to the efficacy of the seeds have been received in correspondence at the Botanic Gardens.

Paspalum dilatatum.—The Australian Fodder Grass was successfully introduced and grew well, being readily propagated by breaking up the clumps. *Tricholœna rosea* however failed again.

Exclusive of Rubber seeds and plant the chief demand was for Cotton, Nutmegs, Sago, *Brucea sumatrana*, fruit trees, and *Sansevieria*.

Para Rubber.

The demand for plants and seeds of *Hevea brasiliensis* showed no falling off, indeed it was quite impossible to supply anything like the demand. Of seeds 170,175 and of plants 28,665 were disposed of during the year.

As the seed crop was rather irregular this year the grass and weeds had to be cleared beneath the trees for the purpose of collecting them several times which entailed a good deal of extra work. In years when the crop falls at one period it is only necessary to do this once.

Experimental Tapping of Rubber Trees.

A special vote of \$1,750 was sanctioned this year for experimental tapping of Rubber trees, purchase of tools and utensils and erection of a drying house.

A substantial air-tight drying chamber has been erected in the Economic Gardens as well as a work shop for rubber work and a sufficient stock of enamelled plates, pans, collecting jugs, strainers, and aluminium collecting cups and the other usual tools for tapping were purchased and are available for future work.

In view of conducting the experiments on definite lines all trees of large size were numbered and registered, and all possible data, such as girth, description of tree, age whether previously tapped or not, were recorded for each tree.

Altogether 1,285 trees have been so registered and recorded, and of these, including some still under experiment, 880 have been tapped, and it is expected that the amount of dry biscuit rubber will give a pound a tree in all of which the average girth at three feet from the ground is $3\frac{1}{4}$ feet.

The experiments showed that the most favourable time for tapping were morning and evening, and from the same number of trees which produced a total amount of 578 lbs. the morning trees realised 314 lbs. while the evening trees fell to 263 lbs., showing a difference in favour of the morning tapping of 51 lbs. The diminished flow in the evening is no doubt to the loss of water pressure due to excessive transpiration during the hot part of the day, which had not been compensated for by the time of the evening tapping.

Experiments were also made in tapping by various methods, the action and results being carefully recorded, and also to discover the effects of tapping at different intervals of time. Measurements of trees were taken at different times of the day which showed the decrease in girth during the day and the increase towards evening.

Experiments were also carried out in mulching the trees with rotten leaves, and with cowdung.

All the rubber was prepared in the form of biscuit which it is expected will on analysis be found to give 97 per cent of pure rubber. It must be borne in mind that in preparing an almost pure rubber the average yield of a tree will be much less than was

the case with the first shipments from the East when the loss in washing amounted to 35 to 40 per cent, but it should also be expected that a higher market value would favour the purer article.

Drying experiments with the aid of Calcium chloride were carried out, but this could not be fully effected till the drying house was built and dry.

Tables of results of four experiments were published in the Agricultural Bulletin as well as the results of many other observations and experiments, and when all the experimental data of these four and two other experiments have been collected and tabulated and the rubber collected dried and weighed, a full report on this work will be prepared, the results of which will probably be found to be of the first importance.

Up to the present time 462 lbs. of biscuit rubber has been despatched to London for sale and the balance will be forwarded as soon as dry.

The greater part of these important experiments was carried out by the Assistant Superintendent Mr. R. DERRY, who devoted a great deal of his leisure time to this work. A Mandore and ten coolies were employed at the work for six months.

Receipts and Expenditure.

(I).—*Expenses of Carrying out Experiments on Rubber Trees, Vote for 1904, \$1,750.*

EXPENDITURE.

				\$	c.
Salaries of ten coolies and one Mandore	...	...	...	714	82
Cost of one drying chamber	...	...	...	505	22
Cost of one work-shop	...	...	...	200	00
Purchase of tools, jugs, strainers, cups, acid, calcium chloride, and enamelled plates	...	...	...	319	29
Balance	...	...	...	10	67
				<hr/>	
				1,750	00

(II).—*Upkeep of Economic Gardens, Vote for 1904, \$2,800.*

EXPENDITURE.

				\$	c.
Salaries	...	...	...	2,438	50
Tools and stores	...	...	...	329	84
Balance	...	...	...	31	66
				<hr/>	
				2,800	00

Coco-nut Trees Inspection.

During the year notices requiring the destruction of dead or dying Coco-nut trees and piles of rubbish infested by beetles were served on 180 persons, and four persons were prosecuted for not complying with the notice and fines to the amount of 41 dollars were inflicted. Dead trees to the number of 1,050 were destroyed and thirty-eight piles of rubbish removed.

				\$	c.
Vote	...	...	...	210	00

EXPENDITURE.

Transport	...	...	...	188	74
Balance	...	...	...	21	26
				<hr/>	
				210	00

Government House and Domain.

The Overseer RAPPA resigned in October, EZEKIEL Foreman-Gardener in the Economic Gardens, succeeded him. The charge of the Domain, however, reverted to the Aide-de-Camp as was formerly the arrangement till 1893, when at the suggestion of the Director of Gardens they were put under his charge.

A Statement of Receipts and Expenditure of the Department during the year is attached.

*Receipts and Expenditure of the Botanic Gardens Department, Singapore,
during the year 1904.*

Item of Estimate.	Grant according to Printed Estimates 1904.	Extended during 1904.	Total for 1904.	Total Expenditure for 1904.	Balance on 31st December.
	\$ c.	\$ c.	\$ c.	\$ c.	\$ c.
I.—Personal Emoluments	14,010 00	...	14,010 00	12,854 32	1,155 68
<i>Other Charges.</i>					
2.—Expenses of carrying out the Provisions of the Coco-nut Tree Preservation Ordinance ...	210 00	...	210 00	188 74	21 26
3.—Expenses in connection with the Publication of the Agricultural Bulletin ...	300 00	...	300 00	300 00	...
4.—Expenses of carrying out Experiments on the Rubber Trees ..	1,750 00	...	1,750 00	1,739 33	10 67
5.—Grant to Botanic Gardens ...	11,000 00	a 5,393 83	16,393 83	15,815 68	578 15
6.—Travelling and Personal Allowance ...	500 00	190 75	690 75	690 75	...
7.—Up-Keep of Economic Garden	2,500 00	300 00	2,800 00	2,768 34	31 66
8.—Temporary Rice Allowance to Native Employés ...	396 00	...	396 00	385 41	10 59
9.—Furniture for New Office ...	...	600 00	600 00	599 00	1 00
Total ...	30,666 00	6,484 58	37,150 58	35,341 57	1,809 01

a.—This is the balance of last year and the Revenue collected during 1904.

H. N. RIDLEY,
Director of Gardens, S. S.

Botanic Gardens, Penang.

Staff.

No change in the Staff took place during the year and all worked well. There was a good deal of sickness about the middle of the year chiefly Dengue and Malarial fever. The ordinary Malarial fever of which we had a number of cases is said to be of a more virulent type in the Gardens than elsewhere in Penang.

Visitors.

A number of scientific men called in passing through to Buitenzorg where the facilities for studying the Botany of Malaya are unrivalled. Other visitors, especially passengers by the German Mails, continue to increase and it is now necessary to have a man stationed at the gates to regulate the gharries and 'rikishas and to prevent the coolies who linger about the gates annoying people by forcing their company on them as guides. There were no thefts except a very flagrant one at the Governor's Hill Gardens—where a lady tore down from a tree an Orchid in full flower. She was fined \$25.

The Weather.

2. The weather has been fairly normal, the rainfall was about the average. The total fall on the Hill for the year was 134.25 inches as against 123.35 inches on the plain. The wettest month was in August, 26.34 inches were registered on the Hill, and 26.33 inches on the plain respectively. March was the driest month on the Hill with 3.88 inches and February on the plain where 2.02 inches only were registered. The work generally was of a routine character such as propagating by seeds and cuttings the usual stock of plants kept for decoration and sale. Most of our permanent collections of pot plants have been repotted, and the upkeep of Flower beds

and borders has been maintained by manuring, top dressing and replanting where necessary. The exchanges of plants and seeds with other Establishments were as usual and plants and seeds to the value of \$854.35 were sold during the year. These were of the usual decorative character.

Upkeep of Buildings, Etc.

3. No new buildings were erected during the year, but repairs were effected in covering the octagonal Plant House with Nibong laths. This was absolutely necessary as the old wooden laths had become quite rotten. The large iron Plant House was fitted with a new set of Bertam Chicks and several of the smaller plant sheds and the Summer house were re-roofed with attaps. Probably more would have been done had we known definitely whether or not the Gardens will be required for a storage reservoir. What has been said in the three last reports on this head applies with more force as time goes on. Each year adds to the difficulty of moving the contents of the Gardens should it ever become necessary to do so, so that I trust ere long we shall know definitely what is going to be done. The question of quarters for the Overseer and coolies has become a serious one. Not only is the small attap building at the Chetty Temple Nursery far too small to accommodate one-third of the coolies, but it is in a ruinous state of decay and has had to be patched up and strengthened to prevent it falling down. This, as hardly needs pointing out, acts prejudicially on the health of the men when suffering from fever as they so often do.

Herbarium and Library.

4. In June I paid a short visit to Kedah and collected some Herbarium specimens at Gunong Grenong, a hill of about a thousand feet elevation, the interior of which is a vast cave. In December I paid a visit to the Langkawis and obtained some Cypripediums and other plants for our collections. I regret I was unable to visit the Island of Terutau as I had no steam launch at my disposal. I was therefore unable to get the very singular Balsam, Impatiens Mirabilis, which grows there, and which is such a desideratum for Kew, and for Sir JOSEPH HOOKER who is engaged on a monograph of the genus. The Director of Gardens, who is working up the Palms for the "Materials for a Flora of the Malay Peninsula," had the loan of specimens of Dæmonorops and Calami, whilst to Sir GEORGE KING who is elaborating the higher orders at Kew no less than 607 sheets of specimens were loaned comprising 12 natural orders from Compositæ to Verbenacæ.

Governor's Hill Bungalow Gardens.

5. These gardens have been kept in better order than hitherto owing to a slightly increased vote. Some Japanese plants have been introduced and are doing well especially Hemerocallis which flowers very freely. Some new roses have also been planted out and are doing well. Sergeant WELLS, the Signal Director, was in charge until November when he was promoted, and was replaced by Mr. SUTHERLAND.

Economic Plants.

6. The Para Rubber tree mentioned in previous Reports was again tapped on 14 occasions beginning on the 28th July and ending on the 6th September. As will be seen from the annexed table A the returns varied from 1 oz. the minimum, to 13½ ozs. the maximum. The idea was to tap on alternate days but owing to heavy rain this was not always practicable. The total amount obtained was 5½ lbs. of wet Rubber which weighed 3 lbs. 14 ozs. when dry, thus raising the grand total from this tree to 26½ lbs. 13 ozs. of fairly dry rubber for the nine consecutive years that it has been tapped. This gives close on an average of 3 lbs. per year, a magnificent result with rubber at its present price of say 5 shillings and sixpence per lb. The extraordinary high price obtained for Straits Rubber has induced the Forest Department in Lower Burmah to take up its cultivation and 100,000 seeds were supplied to them during the year through this department. As far as can be seen at present it seems impossible to overstock the market for years to come; so great is the demand for rubber for almost every conceivable purpose.

Gutta Percha.

7. The Gutta Percha trees in the Waterfall Valley fruited in August. Between 2,000 and 3,000 plants were raised which will be planted in the Forest Reserve at Batu Feringgi. Not a single enquiry for Ramie was received during the year.

Cotton.

8. The experiments during the year with Egyptian and Sea Island varieties of Cotton must be considered as having established the fact that in the cultivation of Cotton the Straits Settlements cannot compete with other Cotton-growing countries. This is especially so with the Egyptian variety.

The plant grows fairly well, but the impossibility of protecting it from rain when the pods are ripening will prevent it from ever becoming a staple crop. Reports

from Malakoff and Caledonia Estates where it has been tried corroborate our own experiments. As regards Sea Island Cotton the extensive trial at Golden Grove Estate is not yet complete so that a final judgment on that variety must be deferred to the next report.

Coco-nut Trees Preservation.

9. The number of notices issued during the year in Penang and Province Wellesley was 650. There were 5 prosecutions in Penang with 4 convictions. In Province Wellesley there were 19 prosecutions and 17 convictions. The fines realised being \$66.50, a very small sum which is I fear not sufficiently deterrent. The Inspector reports that the districts from Bagan Tuan Kechil as far as Ara Rendang, and from Bukit Tengah to Bukit Mertajam were towards the close of the year badly infested with beetles. The following table summarizes the work done during the year, the expenditure being shewn in Appendix C.

The Royal Horticultural Show.

10. In response to a notice of the Royal Horticultural Society of England which was published in the *Gazette*, that an exhibition of Colonial Fruits, either fresh or preserved in Syrups or tins, etc., would be held in London in December last, I got together with the permission of Government a small collection of 26 kinds of our local fruits and vegetables which the natives use as sweetmeats. The Secretary of the Royal Horticultural Society, the Rev. W. WILKS, M.A., informs me in a letter: "The fruits attracted considerable attention and the Council have awarded them a Silver Banksian Medal." This is distinctly encouraging and shews the possibility of a trade industry being opened up with the mother country when the small land-owner has been educated up to a knowledge of the advantages to be derived from fruit cultivation.

Agricultural Show.

11. The first of the new series of annual Agricultural Shows was held in Kuala Lumpur in August and was a complete success. As full reports have appeared in the Bulletin and the Press it is unnecessary to allude to it further than to say that Penang came in for a share of the prizes. The nutmegs and cloves were particularly fine and were easily first.

Expenditure.

12. The total amount of Government Grants under the heading of Botanic Gardens amounted to \$7,510, of which \$7,374.43 was expended, particulars of which are given in Appendix C.

A Statement of Receipts and Expenditure of the Department during the year is attached.

Receipts and Expenditure of the Botanic Gardens Department, Penang, during the year 1904.

Item of Estimate.	Grant according to Printed Estimates 1904.	Extended during the year 1904.	Total Grant for 1904.	Total Expenditure for 1904.	Balance on 31st Dec., 1904.
	\$ c.	\$ c.	\$ c.	\$ c.	\$ c.
1.—Personal Emoluments	6,264 00	...	6,264 00	5,463 00	801 00
2.—Expenses of carrying out the Provisions of the Coco-nut Tree Preservation Ordinance ...	270 00	...	270 00	262 34	7 66
3.—Maintenance of Waterfall Gardens...	4,960 00	...	4,960 00	4,907 33	52 67
4.—Purchase of Books and Periodicals ...	100 00	...	100 00	83 79	16 21
5.—Travelling and Personal Allowance ...	440 00	...	440 00	439 54	0 46
6.—Up-keep of Grounds of Governor's Hill Bungalow ...	1,500 00	240 00	1,740 00	1,681 43	58 57
7.—Temporary Rice Allowance to Native Employés ...	216 00	...	216 00	216 00	...
Total ...	13,750 00	240 00	13,990 00	13,053 43	936 57

W. FOX,
Superintendent, Forests and Gardens.

APPENDIX A.

Date of Tapping, 1904.	Weight of wet Rubber obtained at each operation, in ounces.														Total weight of wet Rubber.		Weight when dry.		Remarks.	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	lb	oz.	lb	oz.		
From 28th July to 6th September ...	0	1	2	2½	3¾	4¾	7¾	8	*	4½	10½	8	13	13½	11	5	0	3	14	* The 9th tapping only 4½ ounces of wet rubber was obtained owing to a sudden shower of rain washing the rubber from the tin cups.

APPENDIX B.

Name of District.	No. of Coco-nut trees destroyed.	No. of pieces of Coco-nut trunks destroyed.	No. of heaps of Cattle Manure removed.	No. of heaps of Paddy-husks destroyed.	No. of Notices issued.	No. of Sum-moneses issued.	Amount of Fines recovered.	Remarks.
Province Wellesley, Northern District.	225	547	120	9	78	} 19	\$ c.	
Province Wellesley, Central District.	41	323	188	6	104		54 00	
Province Wellesley, Southern District.	55	129	119	...	64			
Penang Island.	219	1,498	824	60	404	5	12 50	
Total.	540	2,497	1,251	75	650	24	66 50	

APPENDIX C.

Revenue and Expenditure of the Botanic Gardens Department, Penang, 1904.

REVENUE.		EXPENDITURE.	
	\$ c.		\$ c.
<i>Government Grants.</i>		{ Wages	3,409 26
Maintenance of Water-fall Gardens ...	4,960 00	{ Stores, Tools and Materials ...	143 70
		{ Pots and Tubs	268 04
		{ Manure and Cartage	81 95
		{ Freights	39 23
		{ Typewriter ribbon	1 60
		{ Chicks for Plant Sheds	96 98
		{ Miscellaneous & Petty Expenses	866 57
		Balance	4,507 33
			52 67
<i>Government Grants.</i>		Total	4,960 00
Upkeep of Grounds of Governor's Hill Bungalow	1,500 00	{ Wages	1,490 76
Extension	240 00	{ Tools and Attaps	33 13
		{ Manure	79 93
		{ Flower Pots	77 61
	1,740 00	Balance	1,681 43
			58 57
<i>Government Grants.</i>		Total	1,740 00
Travelling and Personal Allowance	440 00	{ Pony Allowance	240 00
		{ Passages, Personal and Field Allowance	199 54
		Balance	439 54
			0 46
<i>Government Grants.</i>		Total	440 00
Expenses of carrying out the provisions of Coconut trees Preservation Ordinance ...	270 00	{ Allowance to Inspector of Coconut trees	240 00
		{ Destruction of dead Coco-nut trees... ..	22 34
		Balance	262 34
			7 66
<i>Government Grants.</i>		Total	270 00
Purchase of Books and Periodicals	100 00	{ Books and Periodicals	83 79
		{ Balance	16 21
Total Government Grant	7,510 00	Total	100 00

	\$ c.
Revenue from Plant Sales ...	851 45
, Swimming Bath ...	2 90
Total collected ...	854 35

Annual Report on the Botanic Gardens, Singapore and Penang, for the Year 1905.

Staff.

No changes took place among the Staff during the year except that caused by the dismissal of JAPHET S. ISAAC, Foreman Gardener, of the Economic Gardens, who was succeeded by SATHIANATHAN.

The cooly supply was still short and the men obtained were an inferior lot. Very few stay for any length of time as Javanese labour is scarce anywhere now, and the men can get employed at higher wages outside. A considerable number run away immediately after receiving their pay without giving any notice, and this is especially the case when it happens to be necessary to pay the salaries early in the month. The Ordinance to prevent this is quite inefficacious, as it is much too expensive in time and money to hunt for the fugitives, even if it were possible to find them again.

There was no sickness of any importance among the coolies during the year.

Visitors.

As was to be expected, the number of visitors to the Gardens fell off very largely owing to the abolition of the menagerie. It is no exaggeration to say that hundreds of people enquired for the animals and left the Gardens as soon as they found they were there no more. The natives, who used to come in crowds on Native Holidays, have ceased to come, and the European travellers who had been to Singapore before, or who had heard from others of the menagerie, were surprised to find the animals gone, and many left the Gardens when they discovered the fact.

The Regimental band played in the Gardens four times only and the performances were well attended.

A large number of persons interested in rubber cultivation and other vegetable products visited the Gardens. Among these were M. CIBOT (Paris), Mr. JOHN ALLEN (Warrington) interested in oilseeds, Mr. VERNET (Agricultural Department of Annam), Dr. WATERHOUSE (Honolulu), Mr. G. KAYABASHI (Osaka), Mr. HAGEDORN (Samoa), Dr. PREUSS (New Guinea), M. LAURENT (Deli), M. BRUINSMA (Inspector-General of Forests, Buitenzorg), Mr. SCHEITIN (Illinois, U.S.A.), Mr. STRICKLAND (Madras), Dr. SCHWARA (Tokio), Mr. GOODRICH (Australia), CARL LINOW (Bangkok), and many others.

Professor ENGLER of Berlin, spent a week in Singapore, studying the Aroids, wild and cultivated, and other local plants.

Prince and Princess ARISUGAWA visited the Gardens on the occasion of their visits, to Singapore.

Thefts, etc.

There were no very important cases of theft during the year, but there were three prosecutions: one Chinaman, for gathering Champaca flowers, fined \$10; another for digging up roots in the Garden jungle, fined \$2, and one for cutting large quantities of Heliconia leaves, alleging, when first detected, that he had paid one of the Officials for them. He was fined \$30.

There was a case of suicide in the Gardens, a Dutchman having shot himself in the little summer-house near the lake. This is the first case of the kind for about 18 years.

Aviaries.

The remaining birds and animals were sold off during the year, mostly at a very low figure. The Mias, the old Binturong, the best of the hybrid Apes, an Arctogale, and the white Porcupine were sent to the Zoological Society's Garden in London,

Mr. GOODFELLOW kindly conveying them there. All arrived safely except the white Porcupine, which succumbed in the Red Sea.

The cages were for the greater part pulled down, and some of the ironwork sold. A great deal of the iron and woodwork was found to be completely rotten, and it would have entailed a considerable expense to have renewed it.

The remaining black swan was found dead by the lake one morning, and there is reason to believe it was killed by a dog belonging to a visitor.

Buildings and Upkeep.

The Aroid-house was practically re-built, the woodwork replaced by brick pillars and T iron, and roofed with chicks laid over wire netting. The glass-house has been completed and has proved very satisfactory for cultivating plants which require a dryer air than in the open sheds. The large mud-drain round the band-stand, which was unnecessarily broad and very unsightly, was narrowed and bricked all round, adding an extra width of two feet to the road all round; the total length of this drain is 200 yards. The Rhopaloblaste avenue road had become very rough and worn: and the mud side-drain was bricked for 77 yards. The path was raised a foot for 247 yards and regravelled, and the edges returfed. The old deep open drain running from the band-stand across the grassplot was filled in and a drain of 6-inch earthen pipes run for the length of 110 yards and a terminal portion of brick drain of 21 yards long with three cemented catchpits at various points. The Sabal avenue from the rockery to the canna ground was re-formed and re-gravelled for 90 yards, and an open drain of 60 yards was bricked on one side. The path leading from the terminus of this avenue to the band-stand was re-dressed, re-gravelled, and the drains on both sides re-bricked for a length of 90 yards, and one cemented catchpit was made. The Red-stemmed palm avenue had an unsightly and too deep mud-drain running for 98 yards. This was partly filled in and a brick drain laid, the edges being returfed. Two catchpits were also built at the upper end, and connected by twelve 6-inch earthen pipes so as to drain off from the band-stand a considerable quantity of water during rain. The road by the old well was improved by bricking the open drain for a distance of 37 yards and re-made the drain beneath the path with 6-inch pipes and two cemented catchpits.

The mud drain round the aviary hill along the main drive from the big white Champaca tree to the new Herbarium was filled in and bricked for a length of 170 yards. A twenty-four foot culvert was made under the main road between the plant house and the office. Some of the trees surrounding the old well being found to be in a dangerous state, were removed and the wall of the well, much broken by the roots, was repaired.

The very dry weather from May to November occasioned as in last year a great expenditure in cart hire for conveying water from the lake to the plant houses, including the cost of coolies loading and unloading the water. It is estimated that this item cost no less than \$1,000. As these spells of dry weather seem to be becoming more constant every year, it is hoped that a proper water supply may be laid on from the lake to supply the Gardens, and do away with this heavy expenditure.

A fine series of water-lilies was established in pots which were sunk in the lake, at first in shallow water and as they grew larger transferred to baskets and moved to deeper water, all round the edge of the lake. They flowered well and formed quite an attraction especially in the early morning when they were at their best. *Nymphaea stellata*, *Devoniensis* and *O'-Marana* were particularly fine. More plants of the *Victoria regia* were also planted and soon flowered.

A number of Gladioli, obtained from Messrs. SANDERS, were planted out in a bed and flowered very well. It is seldom that these plants are seen in Singapore.

In the large plant house, the ferns were re-arranged, and a number of local species added. The collection of Adiantums is now a fairly good one and contains some very fine species. The other ferns were arranged according to groups.

Professor ENGLER of Berlin, the greatest authority on Aroids, during his stay in Singapore, identified many of these plants of which the names had been lost.

New or Noteworthy Plants.

The following were among the most interesting of the plants which flowered here for the first time:—

Malayan:—*Cryptocoryne pontederiaefolia*.—(Johore).

Monophyllaea Horsfieldi.—(Perak).

- Bauhinia integrifolia*.—(Malay Peninsula).
Bauhinia bidentata.—(Malay Peninsula).
Chirita rupestris.—(Lankawi).
Pholidota grandis, n. sp.—(Selangor).
Ixora Scortechinii.—(Tringganu).
Homalomena Lindenii.—*Alocasia Lindenii* Hort.—(New Guinea).
Plocoglottis borncensis, n. sp.—(Borneo).
Saccolabium brachystachys, n. sp.—(Borneo).
Canavalia obtusifolia, var *insularis*.—(Christmas Island).
Arisæma umbrina.—(Borneo).
Vanda trichoglottis.—(Borneo).
Fagera speciosa.—(Borneo).
Artanema sesamoides.—(Johor).
Eranthemum album.—(Selangor).
 Indian :—*Trichodesma zeylanicum*.
 Vanda Bensoni.
 Mussaenda macrophylla.
 Lagerstræmia indica.
 Shan States :—*Globba new species*.
 Africa :—*Clinogyne ugandensis*.
 Australia :—*Melochia Holtzei*.
 Cynoglossum australe.
 South America :—*Cecropia palmata*.
 Eichornia martiana.
 Tibouchina semi decandra.
 Stemmadenia bella.
 Stigmaphyllon ellipticum.
 Wulfia stenoglossa.
 Erythrochiton braziliensis.
 Ormosia falcata.
 Chamædorea martiana.
 Attalea Cohune.
 Montrichardia arborescens.
 Gliricidia maculata.
 Passiflora amabilis.
 Pitcairnia maidifolia.
 Solanum atropurpureum.
 Solanum pyracanthum.

New Introductions.

Among the most interesting of the foliage plants introduced during the year were :—

FERNS.—*Nephrolepis Piersoni*, *Adiantum glaucophyllum*, *A. excisum*, *A. rhodophyllum*, *A. stenochlamys*, *A. decorum*, *A. formosum*, *A. intermedium*, *A. Victorix*, *A. Hendersoni*, *A. Williamsi*, *A. Lawsoni*, *A. Flemingi*, *Meniscium Hosei* (Borneo), *Alsophila Burbridgei* (Borneo), *Anisogonium decussatum* (Borneo), *Lindsaya cultrata* var (Borneo), *Asplenium porphyrorachis* (Borneo), *Diplazium polypodioides*, *Pleopeltis affine*, *Aspidium Plantaginium* (all from Borneo).

CYCADEÆ.—*Stangeria schizodon*, *Schizocycas Miholitzii*, (one of the two plants of this rare and curious Cycad made good growth during the year).

AROIDS.—*Philodendron cannaefolium* (S. America) *Piptospatha insignis*, *Raphidophora grandis* n.sp. *Pothos* sp. and a number of *chismatoglottis* of various kinds were also introduced from Borneo.

LILIACEÆ.—*Gloriosa Rothschildiana* from Uganda, *Dracœna phrynoides* from Africa and another species with deep green leaves ornamented with round green spots was obtained from Borneo.

PALMS.—*Martinezia corallina* (Guiana) *Chamœdorea* sp. and *Malortica gracilis* from Mexico, *Calamus rudentum* and *C. rivalis* from Ceylon, *C. n.sp.* from Borneo, *Zalacca borneensis* from Borneo, *Indes causiarum* (Porto Rico) *Livistona Woodfordi*, and *Ptychosperm n.sp.* from the Solomon Islands.

CONIFERÆ.—A number were introduced from Japan including *Thujopsis dolabrata*, *Sciadopitys verticillata*, *Juniperus rigida*, *Chamœcyparis breviramea*, *C. obtusa* and several varieties of *C. pisifera*; and among plants of other orders chiefly noticeable were a new and handsome *Begonia* from Borneo, *Pedilanthus tinthymaloides*, var *variegata* (Rangoon) *Pandanus Luzonensis* (Philippines) *Hydnocarpus Heterophyllus* (Saigon) *Musa Gilletii* (Congo) *Alocasia Singaporensis* (Rangoon).

Plants Received.

During the year 4,158 plants and 368 packets of seeds were received, besides the usual poor cleared stock of flower seeds. The donors were Mr. MICHOLITZ; Mr. SCHIRMER; Messrs. BOEHMER (Japan); Mr. J. O'BRIEN; Mr. E. M. HOLMES; Mr. C. WOODFORD (Solomon Islands plants); Mr. S. MOORHOUSE; Mr. A. D. MACHADO; Mr. VADE; Mr. LUCAS (Jamaica); Mr. H. W. WALKER; Mr. PEREIRA; Messrs. DAMMAN; Dr. GIMLETTE; Mr. C. GOLDHAM; Colonel PENNEFATHER; Mrs. FREER; Mr. ST. V. B. DOWN; Mr. J. C. HARVEY (Mexico); Captain AHERN (Manila); Messrs. HERB (Italy); Dr. BUSSE; Messrs. SANDER; Mr. BURCKHARD; Colonel L. POWER (Madeira); Mr. S. ARDEN; Right Reverend BISHOP HOSE; Mr. CHOA KIM KEAT; Mr. W. W. WALLACE (Amoy); Mr. HEWITT; and the Directors of the Botanic Gardens of Kew, Sydney, Saigon, Jamaica, Ceylon, British Guiana, Natal, Entebbe, Uganda, Congo, Trivandrum, Calcutta, Trinidad, Arnold Arboretum, Rangoon, Porto Rico, Port Darwin and the Agricultural Department of Manila.

The Director during a month's stay on leave in Sarawak obtained a large number of rare and new plants of which 7 cases were brought or sent to Singapore. They consisted chiefly of ferns, palms, Orchids and Aroids.

Plants and Seeds Distributed.

Exclusive of Para rubber seeds and plants, 1753 plants and 371 lots of seeds were distributed to various persons and establishments in exchange. The recipients were Mr. GEBEL, (Batavia) Mr. ST. V. DOWN, Messrs. DAMMAN, Mr. HARVEY, Dr. GIMLETTE, Mr. MACHADO, Superintendent of Works and Surveys (plants for Cape Rachado) Dr. MCCLOSKEY, Herr GIRSCHNER (Carolines) Col. Power, J. D. PEREIRA, Messrs. SANDER, Professor GAMMIE, (Poona) Resident Councillor, Malacca, Professor JACQUET (Hanoi), Col. PENNEFATHER, Superintendent Government Plantations, Perak, Conservator of Forests, Kuala Lumpur, Mr. GOLDHAM; Resident, Perak, R. H. C. CRAWFURD (Bahamas) J. C. O'BRIEN, G. T. HARE, W. S. LYON (Bureau of Agriculture Manila) S. ARDEN (Batu Tiga Gardens) CHOA KIM KIAT, C. ROBELEN; St. Joseph's Institute, St. Mary's College, VALENTINE DUKE (Ceylon) Mr. NONGCHIE, (Istana, Johor) Mr. VON USLAR, Mr. BURCHARD, W. R. SMITH (Buluwayo) L. E. KIRWAN (Madras). The Gardens and Botanic Institutions of Kew, Sydney, Lagos, Ceylon, Melbourne, Trivandrum, Buitenzorg, Natal, Uganda, British Guiana, Old Calahar, Saharunpur, Rangoon, Jamaica, Gold Coast, Trinidad.

Herbarium.

The Herbarium Cabinets were transferred to the new building, but little could be done with the museum portion of the building as there was no money for furniture and the whole building was very leaky and damp for a great part of the year.

A considerable collection of herbarium specimens was obtained by the Director during an expedition on leave to Sarawak, 13 specimens of Hongkong plants were presented by Mr. DUNN, 8 specimens from Perak and Malacca by Mrs. BLAND. Five specimens were received from Calcutta.

Three hundred and twenty-five specimens of Japan plants were received in exchange from and a few specimens from the Right Reverend Bishop HOSE, Mr. BARNARD and others.

Specimens were sent for naming or exchange to Calcutta, Sydney, the British Museum and Kew, and Dr. ENGLER took three packets with him for Berlin; 316 plants were sent to Dr. TRELEASE and a collection of varieties of Paddy was sent to the Imperial Institute.

The Collection of *Piperaceæ* was sent to M. C. De CANDOLLE, to be examined for the working out of the order for the Flora of the Peninsula which he has undertaken.

Publications.

The Monograph of the Malay Peninsula Gesneraceæ, was published in the *Journal of the Straits Branch of the Asiatic Society*, and also a paper on the Aroids of Borneo.

The *Agricultural Bulletin* was published as regularly as could be done, and was in as much demand as ever. A list of the Aroids cultivated in the Gardens was published and copies distributed to Gardens and other Institutions for exchange purposes.

The Artist continued making drawings of rare and interesting plants, and also made a number of diagrams for the Botanical Lectures at the Medical School. A course of these lectures was given by the Director to the students lasting for about 3 months, two lectures a week being given. This being the first course delivered and there being no diagrams, specimens, books, etc., in readiness when the school commenced work, occupied a very large proportion of the Director's time during the session.

Library.

The following books and papers were added to the Library during the year :—

PRESENTED.

- Van Hall, C. J. J.—Inspectie Van den Landbouw in West Indie.
 Edwards, H. T.—Abaca.
 Barraclough, Th.—Ramie, Rhea and China grass.
 Woodrow, G. M.—The Mango.
 Wildeman, E. de—Notices sur les plantes utiles et interessantes de la Flore du Congo, (continuation).
 Raciborski, Dr. M.—Parasitische Algen und Pilze Java's.
 Watts, Fr.—Manurial experiments with Sugarcane in the Leeward Islands.
 Vines, S.—Proteases of Plants.
 Beccari, O.—Palme nuove papuane.
 Beccari, O.—Li Palmi del genere *Trachycarpus*.
 Busse, W. Uber.—Heil und Nutzpflanzen Deutsches Ost Africa.
 Busse,—Uber das auftreten epiphytischer kryptogamen von Kamerun.
 Busse,—Weitere Beitrage zur gattung *Strychnos*.
 Eckart, C. F.—Field experiments with Sugar Cane, Honolulu.
 Eckart, C. F.—Comparative analyses of varieties of Cane.
 Eckart C. F.—Irrigation Experiments.
 Pit.—Eenige Proeven met Phosphor zuur Bemestung.
 Kramers, J. G.—Andere Mededeelingen over Koffie.
 Hissink, D. J.—Een studie over Deli-Tabak.
 De Candolle, A.—*Tiliaceæ et sterculiaceæ novæ*.
 Lundia Damazei.
 Observations Heratologiques.
 Tromp de Haas, W.—Uit Kommsten van de in 1904 verrichte aflappings proeve van *Hevea Braziliensis*.
 Bottomley, John—Cotton growing in the Northern Territory, S. Australia.
 Wellborn, W. C.—Soil fertility of the Philippines.
 Barber, A.—Haustoria of sandal roots.
 Barber, A.—Report on the work of Samalkot Experimental Sugar farm.
 Freer, P. E. and Polk, M.—Description of the new buildings and Catalogue of Library of Government Laboratories, Manila.
 Duthie, J. F.—Flora of Upper Gangetic Plain.
 Duthie, J. F.—Cultivation of oranges in Dominica.
 Martelli, U.—*Webbia*.
 Herzog, M.—The Plague.

Wherry, W. B.—Glanders.

Merrill, E. D.—Revision of species of Blanco's Flora des Philippines.

Strong, Dr. R. P.—Clinical and Pathological signification of *Balantidium Coli*.

Lewis, G. N.—Anticatalytic decomposition of Silver oxide.

Christ, T.—*Filices Faurianæ*.

Filices Borneenses.

Filices Uleanæ Amazonicæ.

Smith, J. J.—Die Orchideen von Java.

Smith, J. J.—Die Orchideen von Ambon.

Purchased.

Mueller Ferd ver.—*Fragmenta Phytographiæ Australiae* (parts.)

The following journals were also presented by the Editors:—

Chemist and Druggist, India Rubber World, Tropical Agriculturist, Weekly Times of Ceylon, Queensland Agricultural Journal, Trinidad Bulletin, Jamaica Bulletin, West Indian Bulletin, Agricultural News, Journal of the Board of Agriculture, Acta Horti Petropolitani, Bulletin des Etudes Coloniales, Natal Agricultural Journal, Tropenpflanzer, Cape of Good Hope, Agricultural Journal, Journal of New York Botanic Garden, Contributions from the Botanical Laboratory of the University of Pennsylvania, Experiment Station records, Indian Forester, Kew Bulletin, Bulletin of the Agricultural Society of Western India, Journal d'Agriculture Tropicale, Journal of the Department of Agriculture, Western Australia, Bulletin van het Koloniaal Museum, Haarlem, Circulars of the Botanic Gardens, Ceylon, Annual Reports of Agricultural Department of British Guiana, New South Wales, Grenada, Cape of Good Hope, Parks and Gardens of Detroit, Uganda, Zurich, Bureau of Forestry Manila, Trivandrum, Santa Lucia, Bureau of Laboratories Manila, Radipur, Ceylon, Mycological Notes, Notizblatt, Report of Botanical Survey of India, Circulars of Department of Agriculture, Cuba, Bulletin of the Imperial Institute, British Honduras Society of Agriculture, University of Colorado Studies, Mercks Annual Report, Journal of the Department of Agriculture, West Australia, Natal Agricultural Journal.

The following journals were purchased:—Gardener's Chronicle, Indian Gardening and Planting, India Rubber Journal, Botanical Magazine.

RECEIPTS AND EXPENDITURE OF THE BOTANIC GARDENS, SINGAPORE, FOR THE YEAR 1905.

RECEIPTS.		EXPENDITURE.	
	\$ c.		\$ c.
By Balance in Bank on 1st January, 1905 ...	654 52	Salaries ...	6,039 23
Government Grant for the year 1905 ...	8,000 00	Pots and Tubs ...	816 76
By Sale of Plants and Seeds ...	5,581 72	Cartage ...	729 07
By Sale of Rubber ...	2,440 00	Gravel, laterite, Sand and Manure ...	426 93
Interest ...	30 83	Timber and Planks ...	292 66
		Lime and Bricks ...	336 66
		Tools and Stores ...	659 59
		Petty Expenditure ...	552 42
		Wardian Cases ...	387 48
		Baskets, etc. ...	44 12
		Telephone ...	90 00
		Birds and Animals Food ...	661 42
		Plants and Seeds ...	488 03
		Petty Repairs ...	391 75
		Uniforms, etc. ...	128 00
		Freight on Plants and Seeds ...	1,001 01
		Bertem Chicks ...	74 81
		Acid, Jeys' Fluid, etc. ...	110 13
		Books and Papers ...	63 00
		Bonus to Assistant Superintendent ...	500 00
		Gratuity to Aviary-Keeper ...	75 00
		Refunds to Government ...	1,200 00
		Miscellaneous ...	378 97
		Balance in Bank on 31st December, 1905 ...	1,261 03
Total ...	\$16,707 07	Total ...	\$ 16,707 07

Economic Gardens.

During the year, a piece of ground, one and a half acres, lying near the citronella grass patch, was cleared and dug, and planted with rows of *Ficus elastica*, alternated with Coffees of different kinds, and Bananas. The soil here is very good though somewhat damp, and is not subject to flooding as is a good part of the ground in this part of the Garden. The *Ficus* made very good and rapid growth, although some plants were attacked by *Glyphodes* Caterpillars.

The grass beneath the rubber trees had to be cut twice during the year in order to secure the seeds. This work took a great deal of time, as the area is large.

Many rubber seedlings were grown to supply the very large demand for them. A plague of small brown slugs attacked the young plants in the beds, and also damaged the young trees planted out.

The Ramie beds were dug and fresh ones made. The *Sansevieria* cultivation was also increased as much as possible. A number of *Bromelia* Fibre plants were transferred to this part of the Garden where they made fair growth.

Besides Rubber plants for which there was a much larger demand than it was possible to supply, the chief demands were for fruit-trees, Betel-nuts, Cananga, Nutmegs, Tea, Coca, Timber trees, and Shade trees, Ramie, *Musa textilis*, *Sansevieras* and *Fourcroya*.

Para Rubber.

The demand for plants and seeds of Para rubber still kept larger than any possible supply, of seeds 390,724 were disposed of as well as 8,920 plants. Most of the seed went to the Colony and Native States, lots were also sent to Jamaica, Lagos and Nigeria. These long distance voyages were usually very successful, thus of 7,500 seeds sent to Jamaica, after nearly 3 months travelling, Mr. FAWCETT reports "all germinating very well we shall scarcely lose 500."

One hundred were sent to Old Calabar experimentally, a two months' voyage and ninety came up. Of 135 sent to Kew, 123 germinated. These seeds were sent in charcoal carefully damped, and packed in biscuit tins. These successful experiments show that Para Rubber seed though short-lived can be sent to almost all parts of the world with but a comparatively small loss.

Applications were received for seed from all parts of the world, many of which were from places where there could be no chance of successful cultivation of the plant. As the stock was very early over-booked, a large number of requests had to be refused.

					\$	c.
Vote	...	...	...	...	...	2,850 00

EXPENDITURE.

					\$	c.
Salaries of 26 Coolies	...	...	...	...	2,385	15
Hand Cart	...	...	...	...	35	00
Tools and Stores	...	...	...	...	211	66
Baskets, etc.	...	...	...	...	75	80
Pots and Tubs	...	...	...	...	121	52
Manure	...	...	...	...	20	47
Balance	...	...	...	...	00	40
					<hr/>	
					2,850 00	
					<hr/>	

Inspection of Coconut Trees.

During the year notices were served on 209 persons, and 885 dead and dying trees and fifty piles of rubbish harbouring beetles or likely to do so were removed and destroyed. No prosecutions were necessary. The red beetle is not by any means exterminated in Singapore nor is it really possible to utterly exterminate it, but it is kept in check to such an extent that it is really comparatively rare, and the amount of harm it does is very small now.

					\$	c.
Vote	...	...	...	...	...	210 00

EXPENDITURE.				\$	c.
Transport	...	...	...	197	78
Uniform	...	...	...	8	00
Balance	...	...	...	4	22
				210	00

Experimental Rubber Tapping.

The vote of \$1,200 for these experiments was renewed this year, and the experiments were continued. The calcium chloride house was used during the year but was not so effective as was hoped, though it certainly aided in quicker drying. Sixteen men were employed during the latter part of the year, in tapping and preparing the rubber. A large iron pan was purchased for drying the calcium chloride, and a brick oven built for heating it. The rubber sent home last year fetched 6s. 9½d. and 6s. 3½d. a lb., being the highest market rates at the time. The sum of \$2,440 was obtained by the sale. The money advanced by the Government was refunded and a bonus of \$500 was given to the Assistant Superintendent. The remainder was paid into an account for carrying on further experiments. A report on the previous year's work was presented to the Legislative Council, and ordered to be published which was done in November. Nearly a thousand pounds of rubber was made also during the year, which will also be sold in 1906. The result of the experiments made during the year will be published as soon as they are completed.

Vote	...	...	...	...	\$	c.
				1,200	00	
EXPENDITURE.				\$	c.	
Wages	...	...	...	786	88	
Calcium Chloride, Tools, etc.	...	...	...	405	91	
Balance	...	...	...	7	21	
				1,200	00	

RECEIPTS AND EXPENDITURE OF THE BOTANIC GARDENS DEPARTMENT, SINGAPORE, FOR THE YEAR 1905.

ITEM OF ESTIMATE.	Vote for 1905.	Expended in 1905.	Balance on 31st December, 1905.
	\$ c.	\$ c.	\$ c.
1.—Personal Emoluments ...	9,036 00	8,988 00	48 00
<i>Other Charges.</i>			
2.—Expenses of carrying out the Provisions of the Coco-nut Trees Preservation Ordinance ...	210 00	205 78	4 22
3.—Expenses in connection with the Publi- cation of the Agricultural Bulletin ...	300 00	300 00	...
4.—Expenses of carrying out Experiments on Rubber Trees ...	1,200 00	1,192 79	7 21
5.—Grant to Botanic Gardens ...	* 16,707 07	15,446 04	1,261 03
6.—Travelling and Personal Allowance ...	500 00	361 60	138 40
7.—Up-keep of Economic Garden ...	2,850 00	2,849 60	40
Total ...	30,803 07	29,343 81	1,459 26

* \$8,707.07 of this amount is the Revenue collected during the year and the balance remained in 1904.

H. N. RIDLEY,
Director of Gardens, S. S.

Botanic Gardens, Penang.

Staff.

1. No change in the Staff took place during the year and all worked well. There is difficulty in keeping trained Gardeners. No sooner do they get to know the rudiments of their work than they leave, and the same task of teaching has to be recommenced. There was the usual amount of sickness chiefly Malaria, the ordinary cases are treated at the office where a stock of simple medicines is kept and only the complicated cases being sent to Hospital.

Visitors.

2. The number of Visitors especially on Mail days seem to increase indeed the number of passengers brought by the German Mails is amazing. There were fewer scientific visitors but among the latter was the Inspector-General of Forests in Netherlands India. His mission was to study the methods of cultivating and preparing Para Rubber and also to visit the Teak Forests of Burma. I am glad to be able to report that no thefts occurred during the year.

The Weather.

3. The year under review must be distinctly classed as a dry one. The total rainfall on the Hill amounted to just over 100 inches, 100.09 as against 134.25 last year. On the plain 78.31 only was registered as against 123.25 a difference of nearly 45 inches. Usually the effect of a dry year is to cause many Forest trees to flower that only do so at long intervals, so far however this effect has not been noticeable.

4. For reasons mentioned elsewhere the work of the first three parts of the year was of a routine character. A special effort was made however to have a bright display of plants at the Show. A fine batch of the new pink flowering tobacco, *Nicotiana Sanderiana*, a group of well flowered pinks and other annuals, together with a fair show of Orchids were sent, and helped to brighten up the plant section considerably. As regards the competitive exhibits in this section, Penang hardly did itself justice. It is with pleasure I have to report the great interest shewn in the cultivation of roses by a number of our wealthy Chinese, and also to some extent in Orchids. The demand on our stock of the former plants was so great and which could not be met that I suggested importing some from home. Upwards of 200 of the best sorts of roses have been specially imported for them, and also a number of Cattleyas, the beautiful South American Orchids. It is hoped this awakened taste and love of gardening will increase.

5. A new walk lined with rockeries has been commenced, starting from the wooden rustic bridge, and running parallel with the stream to the stone bridge at the top of the Gardens, this when finished will form a most pleasant walk, it is the intention to have a good collection of Penang ferns on these rockeries.

6. The exchanges of plants and seeds with other Establishments was not quite up to last year and the amount realized in sales of plants amounted to \$566.80 as against \$854.35 for 1904. The amount collected represents our normal sales, the higher amount in 1904, being due to a large collection of plants sold to the Kedah authorities for the wedding festivities which took place that year.

Upkeep of Buildings, Etc.

7. A vote of \$500 was put in the Estimate for coolie lines, as however the Overseer's Quarters were badly in need of repair, \$200 of this sum was used in repairs to them, leaving \$300 for new coolie lines which have been erected, but which are too small to accommodate all our coolies. I hope to see the lines extended if possible during the present year.

8. The plants houses have had repairs effected where necessary and all the tables in the Orchid houses have been cemented as a means of keeping away white ants which have proved so troublesome. The roofs of the Iron house and No. 1 the Begonia house have had new sets of chicks.

Herbarium and Library.

9. The only collecting tour I was able to take was in October when the new steamer "Sea Gull" was placed at my disposal for a few days and I took the opportunity of visiting Pulau Terutau principally to get the *Impatiens Mirabilis* which I was unable to get the previous year. I got a stock, some of which have since been sent to Kew. I regret to report that although the greatest possible care was taken in packing, the largest specimen sent, arrived in a damaged condition. It is a notoriously

bad traveller, as it is as brittle as a carrot. A number of other plants were obtained. The specimens loaned to Kew last year are still there, and are being worked up by Mr. GAMBLE an eminent Indian Botanist for the "Materials for a Flora of the Malayan Peninsula."

10. The usual service Periodicals and a number of new books on Economic Botany and Agriculture have been added to the Library together with presentation copies of the Reports and Bulletins of various kindred institutions.

Governor's Hill Bungalow Gardens.

11. These have been kept up in good order during the year under the charge of Mr. SUTHERLAND. One of the drawbacks to good cultivation is the want of manure (which exclusive of cost and cartage to the foot of the Hill) cost \$1.00 per picul to carry up, a price that is prohibitive except in small quantities for special things. The Tindal who has been employed there for some years fell ill towards the close of the year and I am afraid will not be fit for work again up there.

Economic Plants.

12. To such an extent has Para Rubber usurped the attention of Agriculturists that such staple products as Coffee, Tea, Ramie, Cotton, Pepper and other well known products have been entirely neglected, and the demand is still for Rubber. New Estates are being formed and old ones floated into companies so that there is still even locally a strong demand for seeds. It is however the neighbouring countries of Burma and Sumatra that the large orders for seeds come. Over a quarter of a million seeds were sent to Burma last year from the Straits alone. Letters of enquiry as to the supply of seeds and to the suitability of such places for growing Rubber as the Nicobars and Mysore on the one hand, to Samoa on the other have been received. The Veteran tree in the Gardens here was again tapped during the year and produced 4 lbs. 12½ oz. of fairly dry Rubber. This makes the 10th consecutive year of tapping and raises the total production of this tree to 31 lbs. 9 ozs.

Cotton.

13. As mentioned in last years' report it was that too early to form an opinion on the large trial of Sea Island Cotton which was being conducted at Golden Grove Estate. I regret to say that equally with Egyptian Cotton, it was a failure. Mr. A. CRAWFORD the General Manager writes. "We picked some very nice Cotton at first, but then we got rain which yellowed it and that little red bug showed up in thousands. I showed some of it to a Cotton broker who told me that the staple was very short and not of much value. We have now given it up entirely".

14. At the request of the General Manager of Malakoff Estate, the Department imported from India some 200 plants of Ipecacuanha, they were planted out in March. I saw them a few months afterwards most of them were alive but having lost their original leaves they looked anything but promising. It is a very slow grower and comes to maturity slower than any crop I am aware of.

Coco-nut Trees Preservation.

15. The number of notices issued during the year in Penang and Province Wellesley was 1023 as against 650 in 1904. There were eleven cases of prosecution in Penang and 12 in the Province. The fines realized being \$45 only.

The Inspector reports that he found many dead trees in the Central District of the Province and that the villages near Bukit Mertajam were infested with beetles.

Appendix B and C summarizes the work done during the year and shews the expenditure respectively.

General.

16. The year under review is remarkable for two events.

1st:—The decision of the Municipal Commissioners not to apply for the site of the Waterfall Gardens for making an impounding reservoir and 2nd:—The Agricultural Show. As regards the 1st. this decision was arrived at late in the year and it need hardly be said was a great relief, at last to know something definite, for it will be remembered that for the past three years this uncertainty has hung over us and paralyzed our work. It was obviously useless to go on with any fresh work knowing that the possibility of having to clear out at any time might happen. It will now be possible to take up several much needed improvements.

17. The second event of importance was the Agricultural Show which was held in Penang in August last and which might be said was under the auspices of this

Department. As separate Reports have been submitted on this matter it will be sufficient to say briefly that it is admitted to have been biggest and most successful Show ever seen in the Straits Settlements. The fact that, there were 1541 Exhibitors and no less than 20,000 exhibits shown will give some idea of the amount of work thrown on myself as Honorary General Secretary in particular and this Department in general. Indeed it not too much to say that more than half my time of the year under review was taken up by work in connection with the Show.

18. In July, I reported on a Scheme for re-afforesting the catchment area supplying the Bukit Mertajam reservoir and submitted an Estimate of cost for carrying it out. This has received the sanction of the Government and the work will be started early in 1906.

The Municipality were engaged for some weeks fitting a Venturi water Meter on the 24" main pipe in the Gardens and connecting it with an automatic recorder which was placed in a small building erected to receive it at the back of the Garden's Office. The necessary openings to get at the main have been screened by suitable plants.

Expenditure.

19. The total amount of Government Grants under the heading of Botanic Gardens amounted to \$7,600 of which \$7,420.98 was expended, particulars of which are given in Appendix C.

W. FOX,
Supt. of Botanic Gardens.

APPENDIX A.

Date of Tapping, 1905.	Weight of dry Rubber obtained at each operation, in ounces.														Total weight of wet Rubber.		Weight when dry.		REMARKS.
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	lbs.	oz.	lbs.	oz.	
From 2nd December to 28th December ...	$\frac{3}{4}$	$2\frac{1}{4}$	$2\frac{3}{4}$	3	$3\frac{3}{4}$	4	5	5	$6\frac{1}{4}$	$6\frac{1}{2}$	$7\frac{1}{4}$	$11\frac{3}{4}$	$9\frac{3}{4}$	$8\frac{1}{4}$			4	$12\frac{1}{4}$	

APPENDIX B.

Name of District.	No. of Coco-nut trunks destroyed.	No. of pieces of Coco-nut trunks destroyed.	No. of heaps of Cattle Manure removed.	No. of heaps of Paddy-husks destroyed.	No. of Notices issued.	No. of Summons issued.	Amount of Fines recovered.	REMARKS.
Province Wellesley, Northern District.	414	1,568	104	54	232	7	\$ 12 00	and costs \$3 50.
Province Wellesley, Central District.	350	755	98	61	174	5	18 00	and costs \$2 50.
Province Wellesley, Southern District.	92	470	99	140	151	<i>Nil</i>	<i>Nil</i>	
Penang Island.	428	2,299	790	55	466	11	15 00	and costs \$4 50.
Total.	1,284	4,692	1,091	310	1,023	23	45 00	

RECEIPTS AND EXPENDITURE OF THE BOTANIC GARDENS DEPARTMENT,
PENANG, DURING THE YEAR 1905.

Item of Estimate.	Grant according to Printed Estimates 1905.	Extended during the year 1905.	Total Grant for 1905.	Total Expenditure for 1905.	Balance on 31st Dec., 1905.
	\$ c.	\$ c.	\$ c.	\$ c.	\$ c.
1.—Personal Emoluments	4,776 00	...	4,776 00	4,270 00	506 00
2.—Expenses of carrying out the Provision of Coco-nut Trees Preservation Ordinance ...	300 00	...	300 00	298 02	1 98
3.—Maintenance of Waterfall Gardens...	4,960 00	...	4,960 00	4,953 66	6 34
4.—Purchase of Books and Periodicals ...	100 00	...	100 00	91 65	8 35
5.—Travelling and Personal Allowance ...	440 00	...	440 00	288 04	151 96
6.—Up-keep of Grounds of Governor's Hill Bungalow ...	1,800 00	...	1,800 00	1,789 61	10 39
Total ...	12,376 00	...	12,376 00	11,690 98	685 02

W. FOX,
Superintendent of Forests and Gardens.

APPENDIX C.

REVENUE AND EXPENDITURE OF THE BOTANIC GARDENS, PENANG, 1905.

REVENUE.	ESTIMATES.	EXPENDITURE.	
	\$ c.		\$ c.
<i>Government Grant.</i>		{ Wages	3,502 37
Maintenance of Water-fall Gardens ...	4,960 00	{ Store, Tools and Attaps ...	427 42
		{ Pots and Tubs	146 51
		{ Manure and Cartage ...	193 80
		{ Freight	56 82
		{ Chicks for Plant Sheds ...	79 43
		{ Miscellaneous & Petty Expenses	547 31
			4,953 66
		Balance	6 34
<i>Government Grant.</i>		Total	4,960 00
Upkeep of Grounds of Governor's Hill Bungalow	1,800 00	{ Wages	1,516 86
		{ Tools and Attaps	117 47
		{ Manure	66 10
		{ Vegetable Seeds	18 38
		{ Flower Pots	35 80
		{ Miscellaneous	35 00
			1,789 61
		Balance	10 39
<i>Government Grant.</i>		Total	1,800 00
Travelling and Personal Allowance	440 00	{ Pony Allowance	240 00
		{ Passages and Field Allowance...	48 04
			288 04
<i>Government Grant.</i>		Balance	151 96
Expenses of carrying out the Provisions of Coconut trees Preservation Ordinance ...	300 00	Total	440 00
		{ Allowance to Inspector of Coconut trees	240 00
		{ Destruction of dead Coco-nut trees... ..	58 02
			298 02
		Balance	1 98
<i>Government Grant.</i>		Total	300 00
Purchase of Books and Periodicals	100 00	{ Books and Periodicals	91 65
		{ Balance	8 35
Total Government Grant	7,600 00	Total	100 00

	\$ c.
Revenue from Plant Sales ...	566 80
Do. Swimming Bath ...	8 10
Total collected ...	574 90

W. FOX,
Superintendent of Forests and Gardens.

Annual Report of the Botanic Gardens, Singapore and Penang, for the Year 1906.

Staff.

1.—There was no change in the Staff during the year, except that an apprentice Sub-Overseer, by name of SILVESTER PAUL, was taken on in May. The Superintendent of Penang went on sick leave for a year, in March, and it was suggested that the Assistant Superintendent of the Singapore Gardens should take his place during his absence as has had to be the system previously, but, in view of the Agricultural Exhibition in August, and the heavy increase of work of the department due to the rapid development of the agriculture of the Peninsula of late years, it was found impracticable to reduce the staff to the Director only, so that Mr. PEEL (Ag. Collector of Land Revenue) superintended the work of the Penang Gardens. The Clerk of the Department, Mr. J. S. ISAAC, and the Artist, Mr. C. DE ALWIS, were on leave for three months each during the year. The coolies were as poor a lot as ever, the demand for labour on estates at higher wages than is allowed for the Botanic Gardens made it impossible to secure men other than sickly and worn-out labourers rejected by planters.

Visitors.

2.—A very large number of visitors, sometimes as many as six in a morning, came during the year to consult the Director, chiefly on the subject of rubber planting. The opening up of the Federated Malay States, due to the immense development of rubber cultivation, has immensely increased the number of visitors to the Garden in search of information, and has equally increased the correspondence of the department, and the prospective opening up of the territory of Johore which will follow on the completion of the railway will, without doubt, further increase the work in the near future.

Among the more important scientists, agriculturists and others who visited the Gardens and spent some time there were P. OLSON-SEFFER (Mexico), Dr. SCHLECHTER, Dr. DEISLER, Mr. UNGER (Yokohama), Professor CAMPBELL (Stanford University, U.S.A.), Mr. SHAW-HELLIER (Jamaica), Mr. A. W. PRAUTCH (Manila), Mr. RYAN (Ceylon), Mr. TAUPIN (Madagascar), Dr. A. H. SUGGETT (Mexico), Mr. H. PRICE (Boston, U.S.A.), Mr. BIENENFELS (San Francisco), M. VERNET, Dr. WEGENER (Berlin), H. H. PRINCE YUGALA (Siam).

Thefts.

3.—The most important theft during the year was of five hundred rubber seedlings by natives at night from the Economic Gardens. Very extensive thefts had occurred of this nature all over the Peninsula, and seedlings were being shipped in vast quantities to Dutch Borneo. A Malay was arrested with a large number of the source of which he could give no credible account, but the case against him was not considered sufficiently clear so that it was dismissed. A Chinaman was caught in the evening collecting *Wormia* leaves, and fined five dollars, and there were a few thefts of flowers, fruit, etc., of the usual style.

The regulations as to dogs admitted to the Gardens when led by a string only having been allowed to be relaxed somewhat, as has previously happened, certain visitors brought dogs under no control which did damage in the Gardens, and the rule had to be strictly enforced again, and some little trouble was caused by thoughtless riders galloping their horses on the turf and spoiling it.

Roads and Drives.

4.—The exceptional humidity of the year caused much damage to the Garden drives, and the following urgently needed repairs were executed and paid for out of the Gardens Vote.

The drive from the top of the plant house to the cross ways below the band-stand was remetalled with three inches of laterite, gravelled and rolled, being of length of 200 yards and width of 11 feet.

The drive from the terrace steps to the cross ways by the end of the red-stemmed palm avenue was remetalled with three inches of laterite, gravelled and rolled for a length of 80 yards by 18 feet width.

The road from the godown to the plant house was remetalled with three inches of laterite, gravelled and consolidated for 95 yards and 11 ft. width.

The four-foot way from the main entrance to the drive near the old aviary was regavelled for 135 yards.

The road from Garden Road to the officers' quarters was remetalled with three inches of aterite, gravelled and consolidated for 200 yards and 15 ft. in width, and re-gravelled for 97 yards.

The main drive from the office to the band-stand, which is steep and had scoured, was patched to a considerable extent.

The Garden road of a length of nearly five hundred yards, running from Tyersall Road to Dalvey Road, was remetalled by the Public Works Department.

Drains and Culverts.

5.—A mason and coolie were employed nearly the whole year in patching and renewing urgently needed work. Two small drains with cemented catchpits were made across the road between the plant houses and godown. The side drains from terrace steps towards the old aviary for 75 yards length and 6-7 inches wide were renewed.

The side drains along the four-foot path from the main entrance to the old aviary were patched and repaired. The side drain from the main entrance along the drive for 295 yards was renewed. The large culvert near the officers' quarters was lengthened and a new catchpit made. The cement paths in the plant-house and sheds were repaired and as much of the old aviary demolished as time allowed, the bricks being used for repairs. The unsightly culverts on the band-stand paths have been renewed and lowered so as to admit of a regular even path, and at the same time the side drains on both sides of the path for 40 yards on each side were renewed. The drain on one side of the main drive from the plant-house steps to the band-stand has been deepened and renewed for a distance of 90 yards.

New or Noteworthy Plants.

6.—Among the more interesting novelties which flowered during the year were:—

Malayan:—*Didymocarpus perdita*.—(Pulau Battam).

Vanda hastifera.—(Borneo).

Aeschynanthus tricolor.—(Borneo).

Aeschynanthus Lobbiana var?—(Borneo).

Habenaria xanthocheila.—(Penang).

Gastrochilus pulchellus n. sp.—(Borneo).

Globba brachyanthera.—(Borneo).

Clerodendron n. sp.—(Borneo).

Begonia oblongifolia.—(Borneo).

Begonia promethea.—(Borneo).

Peperomia n. sp.—(Borneo).

Hapaline appendiculata n. sp.—(Borneo).

Schismatoglottis brevipes.—(Perak).

Medinilla speciosa.—(Selangor).

Tacca vespertilio n. sp.—(Perak).

Tacca minor.—(Kelantan).

Strophanthus Jackianus.—(Sumatra).

Ceratolobus laevigatus.—(Perak).

Cypripedium glaucophyllum.—(Java).

Saccolabium sp. new.—(Perak).

Siam:—*Aneilema sinicum*.

Habenaria geniculata.—(Shan States).

Ruellia sp.

China:—*Lycoris radiata*.

Licuala peltata.

Christmas Island:—*Abutilon Listeri*.

A. auritum.

Africa:—*Tinnæa aethiopica*.

Crinum sp. Accra.

Culcasia Manii.—(Flowers and fruits).

Amaryllis Bellandonna.

Sansevieria grandicuspis.

Madagascar :—*Brexia madagascariensis*.

South America :—*Pitcairnea andræana*.

Solanum rubrum.

Solanum Lobelii.

Solanum texanum var *tricolor*.

Salvia hispanica.—(Cuba).

Sagittaria natans.

Utricularia sp.

Dracontium polyphyllum.

Garden origin :—*Crinum hybrid*.—(Todarö).

Crinum Northianum—fruited for the first time, the fruit being hitherto unknown.

The water lilies in the lake were propagated and made a fine show throughout the year, and a number of new kinds were introduced. There was a good exhibition of Gloxinias for most of the year, some very fine strains having been obtained. The Gramatophyllums in the Gardens did not flower at their usual time in August and September, but commenced flowering in December.

New Plants Introduced.

7.—Among the new plants of interest introduced were Palms, *Cocos datil*, *Yatay*, *Calamus paspalanthus*, *Dæmonorops propinqua*, *Gaussia princeps*, *Copernicia*, 3 species, *Areca flammula*, *Roscheria melano*, *Choetes*. Among Ferns, *Aspidium erythrorum*, *A. descursivopinnatum* and *viridescens*, *Sophoroids*, *Gymnogramme lottia*, and *Lygodium japonica* from Japan. A collection of succulents from Hamburg, and additional set of *Nympheas* and *Cyperus papyrus* from Dreer of Philadelphia, and a collection of the *Yautias* (Keladi) of Cuba.

Plants Received.

8.—During the year 6,371 plants and 438 packets of seeds were received, beside the usual stock of flower seeds purchased. The donors were :—

MESSRS. GIBBS, STEPHENS, ST. V. B. DOWN, CHOA KIM KEAT, MICHOLITZ, HOE ENG WATT, VON USLAR, LOHER, P. S. FALSHAW, M. LAURENT, SNOW, BEAUCLERK, COL. POWER, R. LITTLE, DR. GIMLETTE, BIDWILL, J. C. HARVEY, E. M. HOLMES, PROFESSOR SARGENT, DR. SCHLECHTER, BOEHMER & CO., SANDERS & CO., HERB & CO., DANMAN & CO., DREER & CO., and the Botanic Gardens of Saigon, British Guiana, Baroda, Cuba, Rangoon, Berlin, Trinidad, Guiana, Madras, Washington, Sydney, Annam, Hamburg, Arnold Arboretum, Nogent sur Maine, Hanoi, and Philadelphia.

Export.

9.—There were, excluding Para Rubber plants and seeds, 1,964 plants and 314 lots of seeds exported. The recipients were Dr. PREUSS, Chief Surgeon, Luang, Prabang, Mr. J. HARVEY, Mr. A. D. MACHADO, Mr. WOODFORD (Solomon Islands), Mr. DREER, Mr. CHOA KIM KEAT, Mr. CHATTERJEE, Messrs. SANDERS & CO., Mr. HOE ENG WATT, COL. POWER, Mr. BEAUCLERK, Mr. HEWITT, Mr. TAUPIN, Mr. ABRAHAMS, Mr. WILLIAMS, Mr. DOWN, Mr. BIRD, Messrs. DANMAN & CO., Mr. J. D. PEREIRA, Mr. RANKIN, Mr. GOODFELLOW, the Botanic establishments of Sydney, Jamaica, New Guinea, Penang, Teynampett, Christmas Island, Hamburg, Washington, Trinidad, Melbourne, British Guiana, Port Darwin, Fiji, Kew, Cuba, Thaiping, Berlin, Hanoi, S. Nigeria, as well as the Royal Engineers Hospital, Blakan Mati, Pulau Pisang and Raffles Lighthouses, General Hospital, Government House, P.W.D. Grounds, Forest Department, F.M.S., Residency Malacca, Ordinance Office Pulau Brani, Kandang Kerbau Hospital, Colonial Secretary's Bungalow, etc.

Herbarium.

10.—As it was impossible for the Director to make any expeditions this year, except one to Malacca and Province Wellesley, no great amount of collecting could be done. A large collection of herbarium was received from the Manila Botanic Gardens, and a large number from the Buitenzorg Gardens. Indian and Philippine plants were received from the British Museum, and specimens were received from Kelantan from Dr. GIMLETTE, and from Selangor by Mr. A. M. BURN-MURDOCK, who also sent some wood specimens and two cases of plants collected by Mr. Fox and the Forest Officers in Lankawi and Penang. Specimens from Southern Siam were received from Mr. DOWN, and a number of interesting plants from Sarawak collected by Mr. HEWITT.

Five hundred and eighty-three specimens were sent to Kew, and a case containing a five-stemmed Betel-Nut Palm and other specimens of climbers, etc., 472 specimens to Mr. YUSUN KUDO of Japan in exchange for plants previously received, 153 to the British Museum, 386 to Manila, 156 to Dr. TRELEASE of Missouri, 24 specimens of Palms to Dr. BECCARI, 238 specimens to Professor SARGENT, Arnold Arboretum, 238 to the Botanic Gardens, Calcutta, 164 to Sydney, and 90 to West Australia.

Additional glass cases were obtained and a series of Dammars, Rubbers and Gutta Perchas arranged and labelled. A fine collection of Dammars from the Moluccas, named and priced, was presented by Mr. W. D. DIEPENHEIM, who also presented a collection of Oils Tea, Spices, Sugars and other Economic produce from the Eastern Islands.

Library.

11.—The following books and pamphlets were received during the year:—

- BURKILL, T. H.—*Gentianarum species Asiaticæ*.
 „ *Swertia angustifolia*.
 „ *Parasite upon a Parasite*.
 MAIDEN, J. H.—*Useful Australian Plants*.
 „ *Weeds of New South Wales*.
 „ *Allium fragrans*.
 SARGENT & PECK—*Cratægus species, of Albany*.
 ALBERT, F.—*El Cultivo del Olivo*.
 „ *El Karri e Eucalyptus diversicolor*.
 „ *Los Servicios de Aguas e Bosques*.
 CLARKE, C. B.—*New Philippine Acantheaceæ*.
 ELMER, A. D. E.—*Leaflets on Philippine Botany "Rubiaceæ"*.
 „ *A Fascicle of Benguet figs*.
 „ *Additional New Species of Rubiaceæ*.
 „ *Pandanus of East Leyte*.
 AHERN, Capt. G. P.—*Notes on India Rubber and Gutta Percha*.
 „ *Charcoal Industry in the Philippines*.
 „ *Annual Report on the Philippine Forests*.
 CASTILLO, LIUS.—*La Caza de la Ballena*.
 MERRITT, M. L. & WHITFORD—*A Preliminary Working Plan for the Forests of the Philippines*.
 GARDNER, R.—*Mechanical Tests of Thirty Philippine Woods*.
 FAIRCHILD, D.—*Our Plant Immigrants*.
 LIPPINCOTT, J. B.—*The Yuma Reclamation*.
 HENRICKSEN, H. C.—*Vegetable Growing in Porto Rico*.
 PIPER, C.—*Contribution X from the National Herbarium*.
 KRAMER, H.—*Origin and Nature of Color in Plants*.
 BREDA, DE HAAN.—*Report on Arachis hypogæa*.
 CRAMER, P.—*Report on Cassava*.
 CHRIST, H.—*Filices Insularum Philippinarum*.
 „ *Filices Cavalerianæ*.
 LENDENFELDT—*Relation of Wing Surface to Weight*.
 NEWELL, T. H.—*The Work of the Reclamation Service*.
 MACGREGOR, K., & WORCESTER, D. C.—*List of the Birds of the Philippine Islands*.
 HULLETT, R. W.—*Presented 5 Volumes of the Transactions of the Linnean Society*.
 WRIGHT, H.—*Hevea Braziliensis, Editions 1 & 2*.
 WILLIS, J. C.—*Rubber in the East*.

Also the usual series of Journals, Reports and other publications of the various Botanic and other Establishments of the world.

Purchased:—*Le Caoutchouc en Indo-Chine* by C. & A. SPIRE.

The Gardeners' Chronicle, Botanical Magazine, Journal of Linnean Society, Indian Planting and Gardening, India Rubber and Gutta Percha Trades Journal, and Pflanzenreich.

Publications.

12.—The printing of the Volumes on Monocotyledons for the Materials for "A Flora of the Malay Peninsula" was commenced, and is expected to appear in a month or two. They are divided into two volumes, which are being printed simultaneously. The first volume contains the Hydrocharideæ and Orchideæ, the second the rest of the orders. Papers on the Begonias and on the Scitamineæ and the Grasses and Sedges of Borneo and a complete account of the expedition to Christmas Islands and the Flora thereof were published in the "Journal of the Straits Branch of The Royal Asiatic Society" by the Director, and also an article on the Scitamineæ of the Philippines, published in a Manila Journal. All the types of the species described are conserved in the Botanic Gardens, Herbarium.

The "Agricultural Bulletin" was published as regularly as could be done by the printers, and there was no falling off in the demand for it. Mr. J. B. CARRUTHERS became assistant Editor in the beginning of the year. Most of the articles dealt with Rubber cultivation and manufacture, but fibres, oil-grasses and other subjects were treated of. The article on Malayan drugs, printed many years ago in the "Straits Medical Journal" by the Director, and long unprocurable, was reprinted and very much augmented. Investigations were also made into the action of copper sulphate on water weeds, and especially on the laterite-forming Bacterium *Crenothrix*, and an account published in the Bulletin.

The Artist continued making drawings of important plants, and towards the end of the year, in the rainy season, made a large series of drawing of the soft Fungi, of which little or nothing is at present known, and which are almost impossible to preserve even in alcohol in this country, so that coloured drawings are the only way of recording and identifying them satisfactorily. Of a few drawings sent previously to Kew of these plants all proved to be unknown previously to science. A few more supplementary lecture diagrams were also made by the Artist. The lectures to the Medical Students were delivered by the Director from September to December twice a week, as on the previous occasion.

Agri-Horticultural Show.

13.—The Annual Exhibition was held this year at Singapore, and was probably the largest Exhibition of the kind ever held in the East. The exhibits from all parts of the Peninsula were remarkably good on the whole, and the Exhibition was attended by very large crowds of visitors and some delegates from Java, India, Ceylon, Burmah and other places. The secretarial work of the Exhibition, which was very heavy, was effected by the Director and Mr. J. S. ISAAC, Clerk of the Botanic Gardens Department.

Economic Garden.

14.—This part of the Gardens has steadily increased in usefulness and importance, not only to the local community, but to all the tropical parts of the Empire, and indeed it would be difficult to over-estimate its utility. All tropical plants are experimented with and stocks of all for which there is or is likely to be an exceptional demand are maintained in considerable quantities. It may give some idea of the work carried out if it is mentioned that during the year plants or seeds have been despatched on sale to countries as remote as the West Indies, including Cuba, Samoa, Honolulu, Queensland, New South Wales, West Australia, Fiji Islands, Philippines, New Guinea, China, Hongkong, Borneo, Sumatra, Java, India, Ceylon, Egypt, Lagos, Nigeria, and Madeira, while the local demand from the Colony and Federated Malay States has increased enormously.

Apart from the ordinary interchange between gardens, so greatly has the work increased that the addition of five men has been sanctioned for the new year. At the present time the labour employed is quite inadequate for the due maintenance of the garden, nor is it possible, even at a time when agriculture is developing in the Peninsula at such a rate, to carry out experiments which are urgently required. A request for an additional assistant so as to put the Gardens of the Straits Settlements on the level in staff of some, at least, of the smaller Gardens of the other Colonies was inserted in the Estimates for the next year, but circumstances prevented this addition to the staff being made.

The keen demand for Para rubber seed from the Garden trees necessitated the frequent mowing and cleaning of the ground and drains so as to procure every possible seed, and as this part of the Garden is hardly above sea-level and the ground frequently flooded the growth of the weeds is very rapid. Watchmen have had to be employed too to prevent the seeds and plants in the nurseries from raiders. The largest undertaking in this Garden, apart from the routine and urgent work, during the year consisted in digging the young Rubber ground formerly under grass three times over so as to thoroughly eradicate the grass and weeds. The plot is 300 yards long and 120 yards wide, and when it had been thoroughly cleaned and was sufficiently dry it was planted up in blocks with Tapioca, Ground-nuts, Ramie, Lemon Grass, Citronella and Cus-Cus. Hitherto it had been impossible to grow the rubber trees here on account of a plague of brown slugs which, concealed by day in the

grass weeds, attacked the buds of the rubber by night preventing its growth. The result of this cultivation of catch-crops between the young rubber has been the extermination of this pest, and the growth of the young plants very satisfactory.

The question of catch-crops for rubber has been one of the most important ones of the year, and is the subject of a large quantity of the garden correspondence. It is regrettable that the paucity of the staff prevents time being given to experiments on this subject carried out as they should be.

A good deal of Colonial interest during the past two years has been taken in fibres of all sorts, and the plot of land opened last year has been maintained and large stocks of the most likely fibres for cultivation here have been raised.

Among the most free-growing fibres as judged by its strong development of leaves is *Sansevieria guineensis*. *S. zeylanica* has grown well also, but is not quite so quick in supplying a good stock of leaves. *S. sulcata* and *S. cylindrica* have proved healthy, but, though furnishing the largest supply of fibre for the leaf and being the easiest to handle for machine work, are unfortunately too slow as a catch-crop in this country.

Mauritius hemp grows well in ordinary soils. Sisal hemp has been kept under observation, but does not seem to do well; it is essentially a plant for dry sandy loose soil.

The Coffee and Rambong ground has been well maintained. No part of the Gardens is well suited to these plants, but for the purpose of meeting the demand for Rambong (*Ficus elastica*) cuttings it has been possible to produce 150 rooted cuttings by marcotting, and though the parents may never develop into robust plants they will serve as stock plants. The demand is chiefly, however, for seed and seedlings, and a strong batch of seedlings raised here were disposed of through the year.

Export of Para Rubber Seed.

15.—During the year a very large number of Para Rubber seeds and plants were sent out to all parts of the world, of these a large number were supplied from the Botanic Garden trees, others were obtained outside from various plantations and packed and shipped. The packing of these seeds for long distances entailed a great amount of work, as they had to be packed in tin boxes, 150 seeds in a tin with burnt rice dust. Two tins were then enclosed in a canvas covering, addressed, and then sent by post, so as to avoid the seeds being heated in the hold. This plan has been proved eminently successful, and the percentage of seed that arrived safely at long distances such as Jamaica, Solomon Islands, West Africa, etc., has been very high.

The following were the localities to which the seeds were sent :—

Seeds from the Economic Garden Trees.

Singapore	...	...	...	...	15,510
Province Wellesley and Perak	...	...	...	...	48,950
Selangor...	...	...	...	...	80,795
Christmas Island	...	...	...	...	2,400
Borneo	...	...	...	...	100
British Solomon Islands	...	...	...	...	600
British Guiana	...	...	...	...	2,100
Queensland	...	...	...	...	150
Philippine Islands	...	...	...	...	500
Honolulu	...	...	...	...	800
Mexico	...	...	...	...	900
Sumatra...	...	...	...	...	2,000
Uncertain destination	...	...	...	...	2,800
Total					157,605

**Seeds Purchased elsewhere, Packed and Shipped
at the Botanic Gardens.**

Jamaica	...	...	...	...	200,000
Lagos and Nigeria	...	...	...	...	80,000
Pahang	...	...	...	...	43,000
Sumatra	...	...	...	...	10,000
Kelantan	...	...	...	...	7,000
Borneo	...	...	...	...	300
					345,300

Total number of seeds exported 502,905.

A larger number of seedlings also were exported, viz:—

Singapore	...	...	...	...	3,200
Borneo	...	...	...	...	8,050
Sumatra	...	...	...	...	3,200
Uncertain destination	...	...	...	...	100
					14,350

It is gratifying to note that far the larger portion of these seeds have gone to various parts of the British Empire, and only comparatively few to other countries.

Other Plants Exported.

Ficus elastica is less in demand, and only 510 plants were exported this year to Sydney. A large number of seeds were exported to Southern Nigeria, 1,000 Coconuts were purchased and packed and transmitted there, and several bags of Nipa seeds and of Sago seed. These are reported to have arrived in good condition. Mangosteen and Durian seed were also sent. The latter is especially a bad traveller, as the seed is very fleshy and soon spoils.

Experiments on Rubber Tapping.

16.—A series of experiments were carried out through the year to test the effect of tapping at all seasons of the year, and a special and full report was sent to the Government on the result. There was a vote of \$1,200 allowed for these experiments, which actually cost \$1,178.50. This vote was refunded to the Government from the money received by the sale of the rubber made during the experiments, which amounted to \$2,600.41, so that the experiments cost the Colony nothing at all. A quantity of Latex was supplied to the Agricultural Exhibition to make into Crepe with a Crepe Machine, and a quantity of rubber in different forms sent to the Exhibition in Ceylon.

Inspection of Coconut Trees.

17.—Notices were served on 192 persons during the year, and 720 dead trees, 294 stumps, and 60 piles of rubbish likely to harbour beetles or already containing them were destroyed. There were no prosecutions.

					\$	c.
Vote for the year	...	...	...	...	210	00
Expenditure	...	...	...	...	193	64
Balance	...	...	...	...	16	36

HENRY N. RIDLEY,

Director of Gardens, S. S.

BOTANIC GARDENS,
Singapore, February 23, 1907.

The following details of Revenue and Expenditure are appended. It is noticeable that there is a balance of \$1,875.74 at the end of the year, which requires explanation. The annual vote supplied by the Government is not adequate for the expenses of the Gardens, and one-third of the cost is made on sales, and, as the money for the sales does not come in till late in the year, it is essential to keep a strong balance for the early part of the following year.

RECEIPTS AND EXPENDITURE OF THE BOTANIC GARDENS FOR 1906.

RECEIPTS.		EXPENDITURE.	
	\$ cts.		\$ cts.
By Balance in Bank on 1st January 1907	1,261 03	Wages of Coolies	5,939 09
Government Grant for the year 1906	8,000 00	Petty Expenses and Assistant Superintendent's Transport ...	910 26
By Sale of Economic Plants and Seeds and Revenue Recovered	8,037 71	Cartage	1,022 65
By Sale of Ornamental Plants and Seeds	1,270 52	Laterite (181 cubic yards) ...	398 20
Interest on the above	30 28	Gravel (129 cubic yards) ...	219 30
		Manure (61 cubic yards) ...	76 25
		Sand (46 cubic yards) ...	73 60
		Purchase of Plants and Seeds ...	1,803 37
		Telephone	90 00
		Methylated Spirit, Jeye's, etc. ...	44 55
		Timber and Planks	528 02
		Pots and Tubs	517 79
		Cloth for Packing Parcels ...	127 25
		Tools and Stores	958 05
		New Wardian Cases	194 00
		Books and Papers	292 09
		Freight and Postage on Plants and Seeds sent out	2,979 32
		Uniforms	47 25
		Packing Tins	161 00
		Lime and Bricks	164 19
		Purchase of New Safe	179 40
		Miscellaneous	60 65
		Balance in Bank on 31st December 1906	1,875 74
Total ...	\$18,599 54	Total ...	\$18,599 54

RECEIPTS AND EXPENDITURE OF THE BOTANIC GARDENS DEPARTMENT, SINGAPORE, DURING THE YEAR 1906.

ITEMS OF ESTIMATES.	GOVT. GRANT.		EX-PENDITURE.		BALANCE.	
	\$	c.	\$	c.	\$	c.
1.—Personal Emoluments	12,864	00	11,906	07	975	93
OTHER CHARGES.						
2.—Expenses of carrying out the Provisions of the Coconut Trees Preservation Ordinance	210	00	206	70	3	30
3.—Expenses in Connection with the Publication of the "Agricultural Bulletin" ...	300	00	300	00	—	
4.—Expenses of Carrying out Experimental Rubber Tapping	1,200	00	1,191	50	8	50
5.—Grant to Botanic Gardens	18,599	54	16,723	80	1,875	74
6.—Travelling and Personal allowance ...	500	00	384	65	115	33
SPECIAL EXPENDITURE.						
7.—Furniture for Herbarium	1,000	00	1,000	00	...	

Botanic Gardens, Penang.

Staff.

1.—Mr. Fox went on leave on March 23rd, and there being no Officer of the Department available to take his place, I was placed in temporary charge in addition to my other duties.

This arrangement continued during the remainder of the year, but it could hardly be considered satisfactory.

The Overseer, MAHOMED HANIFF, looked after the technical work and did it extremely well; the Gardens were kept by him in excellent order, but in the absence of a properly qualified European, scientific research made little or no progress.

In addition to this the Clerk was transferred and a new man with no experience of the work took his place.

The Inspector under the Coconut Trees Preservation Ordinance and the Mandor on the Hill died during the year.

Buildings and Upkeep.

2.—The office ceiling partially collapsed and it was found necessary to make immediate repairs. So much damage had been done in the past to the wood flooring by white ants that it was decided to put in a cement flooring. A special vote of \$1,500 was granted by Government and this work was carried out. The roof of the building was raised and the whole structure generally improved.

In the plant houses the atap roofing was replaced by ruberoid, which has proved quite satisfactory and is more lasting.

In several of the houses the tables were cemented as a means of keeping away the white ants.

The roads were kept in good repair and the general condition of the grounds and buildings reflects great credit on the Overseer in charge.

The new rockery near the stream below the wooden rustic bridge was practically completed. A large number of ferns have been placed there, and a large specimen of the *Impatiens Mirabilis* or Gouty Balsam obtained from the Langkawi Islands added.

This rockery forms a very pleasant addition to the Gardens.

Plants.

3.—No new variety of plant was added to the Gardens during the year. The Overseer, however, performed several grafting experiments.

The grafting of the well known "La France" rose on the common local variety proved a success, a fine rose with a most delicate odour being obtained. Some interesting results were also obtained by grafting the violet *Allamanda* on the yellow variety.

A visit was paid to the Langkawi Islands in August, when a number of orchids and another specimen of the *Impatiens Mirabilis* were obtained.

A number of plants were supplied to the Government Plantations, Perak, and some promised in return from the Taiping Hills.

Plant sales, exclusive of \$74.25 received for rubber seeds, realised \$319.25 as against \$566.80 in 1905. This falling off was mainly due to the fact that certain restrictions were placed on the sales owing to there being no European in regular attendance at the Gardens.

Publications.

4.—The usual periodicals were received during the year, and an interesting work presented by Messrs. VEITCH and SONS containing a good deal of useful information especially with regard to varieties of Orchids.

Para Rubber.

5.—The old Para Rubber tree at the Gardens was tapped in November and December and 4 lb. 4½ oz. of dry rubber obtained; this makes a total of 35 lb. 13½ oz. from the tree since it was first tapped. The tree reached the height of its production in 1905 when 4 lb. 12½ oz. of rubber were obtained. The upper branches are beginning to wither and there is little doubt that it will now deteriorate. Although the Experimental Garden on Penang Hill has been abandoned and is now partially covered with secondary growth, experiments were made on four of the Para Rubber trees standing there. As the altitude is about 2,000 feet the results were interesting. The age of the trees was about 12 years and the total dried rubber obtained 6 lb. 6 oz. Appendix A. gives the results of the various tappings.

If proper implements for tapping the trees and drying the rubber were obtained, it might be of advantage to systematically tap all these trees as well as those in the Botanic Gardens themselves, where 21 trees exist ready for tapping. 3,600 rubber seeds were sold from the Gardens during the year for \$74.25, the price ranging from \$20 to \$7.50 per thousand.

Penang Hill.

6.—The coolies employed in the compound of the Governor's Hill Bungalow and the vegetable gardens were placed under the charge of Mr. FERNANDO, the Public Works Overseer on the Hill. The supervision was infinitely better than it had been for the previous two or three years, and the gardens gave evidence of increased industry on the part of the coolies. That this increased industry was not spontaneous was evident from the fact that several complaints were received from the coolies regarding the increased severity of the tasks they were called on to perform.

A new additional vegetable garden was started just below Belle Vue Bungalow and has proved a success.

Preservation of Coconut Trees.

7.—Owing to the death of Mr. BALHATCHET the returns for the first four months of the year could not be found.

The number of notices issued during the last eight months of the year in Penang and Province Wellesley was 450.

There were 13 prosecutions in Penang, 12 convictions being obtained; the fines realised amounted to \$40.

Appendix B. summarises the work done under this head. The fines inflicted by the Magistrates for breaches of this Ordinance are so small that they do not act as a sufficient deterrent.

General.

8.—As Honorary Secretary for Penang, I attended the Agri-Horticultural Show at Singapore in August. A fair number of exhibits were taken from Penang and a large proportion of prizes obtained, including the cup for the best collection of fruits and the first prize for the best Palm.

9.—The weather during the year was more irregular than usual; rain fell incessantly during the first eight days of November, while the fall in December was unusually high.

The total rainfall on the Hill was 123.79 inches, and at the Gaol 112 inches, as against 100.9 inches and 78.31 inches respectively in 1905. The latter year was, however, an exceptionally dry one.

10.—Nothing further was said regarding the proposal to make a large impounding reservoir on the site of the Gardens, and it is hoped that the necessity for it may not arise.

The Municipal Commissioners acquired a large tract of land above the waterfall for the purpose of improving the present Catchment Area.

Expenditure.

11.—The usual statement of expenditure is to be found in Appendix C.

W. PEEL,

Acting Superintendent of Gardens.

APPENDIX A.

Date of Tapping, 1906.	Weight of dry Rubber obtained at each operation in ounces.														Total weight of dry Rubber		REMARKS.
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	lb.	oz.	
I.—Old Tree in Botanic Gardens:—																	
From 19th November to 15th December ...	$\frac{3}{4}$	4	$6\frac{1}{4}$	$4\frac{3}{4}$	$5\frac{1}{2}$	$6\frac{1}{2}$	6	$7\frac{1}{2}$	$6\frac{1}{2}$	$5\frac{1}{4}$	4	4	4	$3\frac{1}{2}$	4	$4\frac{1}{2}$	
II.—Trees on Penang Hill:—																	
From 11th July to 6th August	a	$\frac{3}{4}$	$1\frac{1}{4}$	2	$1\frac{1}{4}$	$2\frac{1}{2}$	1	1	1	$1\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{4}$	$2\frac{1}{2}$	$1\frac{1}{2}$	1	$4\frac{1}{4}$
	b	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{1}{2}$	1	$1\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{3}{4}$	1	1	1	$1\frac{1}{4}$	$1\frac{1}{4}$	...	$11\frac{1}{2}$
	c	$\frac{3}{4}$	1	$1\frac{1}{2}$	$1\frac{1}{2}$	2	$1\frac{3}{4}$	$1\frac{1}{2}$	$1\frac{1}{2}$	2	2	$2\frac{1}{2}$	2	$1\frac{1}{2}$	$2\frac{3}{4}$	1	$8\frac{1}{4}$
	d	$1\frac{1}{4}$	$1\frac{1}{4}$	2	$3\frac{1}{4}$	$3\frac{1}{2}$	$3\frac{1}{4}$	$3\frac{1}{4}$	4	4	$3\frac{3}{4}$	$3\frac{1}{2}$	$3\frac{1}{2}$	6	$3\frac{1}{2}$	2	14

NOTE:—Two and a half ounces of scrap were collected from the tree in the Gardens, and five and a half ounces from the trees on the Hill.

W. PEEL,
Ag. Superintendent of Gardens.

APPENDIX B.

RETURN OF THE INSPECTOR OF COCONUT TREES FOR THE LAST 8 MONTHS OF THE YEAR 1906.

No. of Notices issued during the year from 1st May to 31 December.	No. of dead Coconut Trees destroyed.	No. of dead Coconut Trunks destroyed.	No. of heaps of Cattle dung destroyed.	No. of heaps of Paddy-husk destroyed.	Amount of Fines received.		REMARKS.
					\$	c.	
<i>Penang District :</i>							
250	166	816	179	2	40	00	13 Prosecutions. 12 Convicted. 1 Withdrawn.
<i>Northern District :</i>							
87	109	133	40	...	...	...
<i>Central District :</i>							
68	74	202	33	...	...	...
<i>Southern District :</i>							
45	52	116	43	...	...	...
450	401	1,267	295	2	40	00	

W. PEEL,
Ag. Superintendent of Gardens.

APPENDIX C.

EXPENDITURE OF THE BOTANIC GARDENS, PENANG.

GOVERNMENT GRANT.	ESTIMATED 1906.	EXPENDITURE.	
	\$ c.		\$ c.
Maintenance of Waterfall Gardens	4,960 00	{ Wages 3,752 04 Tools and Materials 111 31 Manure 188 00 Freight 9 00 Ruberoid Meranti Laths and Attaps for Plant Sheds 552 02 Flower Pots 88 54 Metal for Road 93 75 Miscellaneous and Petty Expenses 156 04	
		Balance	4,950 70 9 30
		Total	4,960 00
Upkeep of Grounds of Governor's Hill Bung- low	1,620 00	{ Wages 1,245 53 Tools and Materials 59 24 Vegetable Seeds 59 19 Manure 107 00 Flower Pots 37 50 For carrying Manure and Flower Pots to Hill Gardens 71 22 Miscellaneous and Petty Expenses... 5 99	
		Balance	1,585 67 34 33
		Total	1,620 00
Travelling and Personal Allowance	440 00	{ Pony Allowance 240 00 Sea and Field Allowance 140 70	
		Balance	380 70 59 30
		Total	440 00
Expenses of carrying out the Coconut Trees Pre- servation Ordinance ...	300 00	{ Allowance to Inspector of Coconut trees 234 84 Destruction of dead Coconut trees 63 72	
		Balance	298 56 1 44
		Total	300 00
Purchase of Books and Periodicals	100 00	Books and Periodicals	38 86
		Balance	61 14
		Total	100 00

W. PEEL,

Ag. Superintendent of Gardens.

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Annual Report on the Botanic Gardens, Singapore, for the Year 1907.

Staff.

The Director went on nine months' leave from April 22nd, and Mr. FOX came from Penang to act in his absence on April 26th, Mr. R. DERRY replacing him in Penang. Mr. C. B. KLOSS, who was temporarily acting during the absence of the Assistant Superintendent in 1903, acted in a similar capacity from August to November 30th. The Artist Mr. C. DE ALWIS ceased work at the end of the year. There was a good deal of sickness among the coolies during the year, Diarrhœa, Fever and Beri-beri.

Visitors.

There was the usual number of ordinary visitors to the Gardens during the year, and among others, SIR NATHANIEL NATHAN, Dr. TREUB (Buitenzorg), Mr. KELWAY BAMBER (Ceylon), Mr. T. S. BURROUGHS, the Hon'ble STANFORTH SMITH, Director of Agriculture for Papua, Messrs. A. BRIZON and DUCHEMIN from Saigon, Dr. H. BRENIER (Sous-directeur de l'agriculture), Hanoi, and Professor J. PONCHAT, (Professeur d'agriculture and M. THIBAudeau), Administrateur de Hanoi, Tonkin, and many planters and others interested in agriculture.

Roads and Drives.

An extra vote of one thousand dollars allowed of a good deal of repairs and re-making of roads and drains. The long road from the main entrance to the Band-stand was re-metalled. The road from Office entrance to the Band-stand re-metalled. The roads on both sides of the Office and from the old aviary to the main road were re-metalled. The road behind the Band-stand leading to the Potting-shed was patched and repaired.

A new drain was built on four sides of the Garden Office leading to a tank for storage of water, and another on both sides of the road below the Band-stand leading to the plant houses was made. Guttering was supplied to the Garden Office.

Buildings.

The quarters of the Clerk and Foremen-Gardeners, and those of the Watchmen were re-attaped. A new store was built in the Economic Gardens, and new quarters for the Carpenters were built near the Godown. Two new latrines were built in the Cooly Lines. Old wooden stages for Orchids were replaced by bricks. The remainder of the old aviary buildings was cleared away, the ground dug and planted up and the old monkey cage repaired, painted and converted into a shelter. Repairs were also made to the ventilators of the Herbarium building.

The long proposed scheme for supplying water from the well and lake to various parts of the Garden was definitely commenced. A two horse-power oil engine was erected and a tank for the water was put up in the Garden jungle. The work was not finished by the end of the year. This will be an immense improvement to the Garden. The cost was paid from the money obtained by the sale of rubber made during the experiments.

New and Noteworthy Plants.

The following were among the most interesting plants which flowered or fruited for the first time in the Gardens:—

Heptapleurum tomentosum.—(Selangor).

Dendrocolla pardalis.—(Sarawak).

Schismatoglottis nervosus.—(Sarawak).

Curculigo racemosa.—(Sarawak).

Impatiens sp.—A very pretty dark pink balsam (Sumatra).

Scutellaria javanensis (Java).

Statice sinensis.

Lobelia nicotianæfolia.—(Ceylon).

Palicourea garberioides.

Bryonopsis laciniosa.

Randia sp.—Shrub with white flowers. (Madagascar).

Begonia Kewensis.

Clerodendron sp.—(*Cl. disparifolium* of Kew, but not the plant of the Malay Peninsula known by that name).

Gomphia decora.

Passiflora ambigua.

Calyptrogyne sarapiguensis.—(S. America).

Marcgravia umbellata developed several bunches of buds, which however never opened.

Dendrocalamus pendulus.—Both the big clumps of this splendid Bamboo began to flower and die at the end of the year.

Cola acuminata.—Fruited heavily in the Economic Gardens for the first time, a batch of seedlings was raised.

Dichopsis oblongifolia.—Fruited heavily in the Economic Gardens and also in the Garden jungle.

Camoensia maxima, produced fruit for the first time. A species of *Canthium* received some years ago from Uganda, under the name of *Matagonda* "Edible fruit" fruited this year. It is a shrub with small green flowers, and little round yellow fruit. It does not appear to be a very valuable addition to our stock of dessert fruit.

Plants and Seeds Received.

During the year there were 7,535 plants and 358 packets of seeds received, the donors being Messrs. E. L. HOLMES, Professor SARGENT, Dr. SCHLECHTER, A. D. MACHADO, J. D'A. PEREIRA, L. BOEHMER & Co., H. DREER, F. GLAZEBROOK, H. ENG WATT, C. CURTIS, CARTER & Co., DAMMAN & Co., T. D. TAITE, Hon'ble W. J. NAPIER, H. CANNELL & SONS, C. B. KLOSS, ST. V. B. DOWN, J. C. HARVEY, M. HERB, JAMES VEITCH & SONS, Mr. T. W. BROWN, Mr. VALENTINE KNIGHT, Mr. BEAUCLERK, Mr. LYON, Mr. WEBERBOUR, and the Botanic Gardens of Kew, Grenada, Taiping, Manila, Buitenzorg, Washington, Rangoon, Ceylon, Calcutta, Sydney, British Guiana, Trinidad, Seychelles, Honolulu, Berlin, Durban, Congo, Hongkong, Cairo, Nogent sur Marne and the Arnold Arboretum.

Plants and Seeds sent out.

Excluding Para Rubber seeds and plants, 2,491 plants and 236 packets of seeds (ornamental and foliage) were sent out. The recipients were Messrs. C. CURTIS, H. ENG WATT, ST. V. B. DOWN, Dr. SEFFER, Dr. SCHLECHTER, H. DREER, A. D. MACHADO, MISS GAGE BROWN, Mr. MARINER, BOEHMER & Co., V. KNIGHT, S. BIDI & Co., A. M. BURN-MURDOCH, Mr. BEAUCLERK, M. LYON and the Botanic Gardens of Rangoon, Buitenzorg, Penang, Lagos, Natal, Brisbane, Ceylon, Trinidad, Hongkong, Kew, Jamaica, Calcutta, Madras, Trivandrum, Queensland, Honolulu and Sydney. Plants were also supplied to Government House Domain, General Hospital, Hospital Grounds at Labuan, Chief Police Officer's quarters, Municipal Roads and Reservoir and Military Gardens at Tanglin and Blakan Mati. This does not of course include the plants and seeds sold.

Herbarium.

Except a short trip during the Easter Holidays to Johore made by the Director, it was impossible to make any botanical expeditions. A collection of 234 specimens from Southern India was made by the Clerk Mr. J. S. ISAAC when on leave, and presented to the Herbarium; 100 specimens of Philippine plants were received from Mr. COPELAND of Manila, 25 specimens from Bintang Island from Mr. C. B. KLOSS and 84 specimens from the Botanic Gardens of Buitenzorg.

Three packets of specimens were sent to the British Museum, two to Dr. BECCARI, three packets to Prince ROLAND BUONAPARTE and 93 fungi in alcohol, with drawings made by the Artist, to Kew. The account of these fungi, the first

collection of Agaricini sent from the Peninsula, are described in the "Kew Bulletin" and contain a considerable number of new species.

The whole Herbarium was re-poisoned, a work which occupied four men for four months, and used 50 gallons of Methylated Spirits and Corrosive Sublimate. This was considered necessary as on one morning it was found that the termites had during the night invaded the building and had carried tunnels almost into the cabinets. As there are a large number of types and cotypes of different species of plants in the collection the loss of which would be irreparable, the assistance of the Public Works Department was called in to minimize the risk of the destruction of the building and its more valuable contents, by painting the vulnerable parts of the building with Jodelite.

Publications.

Three volumes on the Monocotyledons of the Malay Peninsula by the Director were published during the year, forming part of the series of the "Materials for a Flora of the Malay Peninsula" which are being published under the direction of Sir GEORGE KING.

The "Agricultural Bulletin" was published monthly as usual.

Library.

During the year 76 monthly, five weekly and three quarterly publications of other establishments, 158 books, annual reports and pamphlets were received. Nearly all these are obtained in exchange for the "Bulletin" and Gardens Reports.

The Agricultural Show.

This Show was held in Kuala Kangsar this year, and the Superintendent Mr. W. Fox represented the Settlement at it. Comparatively few exhibits were sent from Singapore.

REVENUE AND EXPENDITURE FOR THE YEAR 1907.

"Up-Keep of Botanic Gardens."

REVENUE.

		\$	c.	\$	c.
By balance in Bank on 1st January, 1907	...	1,875	74	...	
Government Grant for the year 1907	...	8,000	00	...	
By sale of Economic Plants and Seeds	...	6,312	63	...	
By sale of Ornamental Plants and Seeds	...	1,030	27	17,218	64
(A sum of \$1,420.55 for the sale of Economic Plants and Seeds, supplied during the year not collected up to 31st December).					

EXPENDITURE.

		\$	c.	\$	c.
Wages	...	6,656	29	...	
Bills	...	8,022	94	14,679	23
Balance in Bank on 31st December				...	2,539 41

Inspection of Coconut Trees.

Notices were served on 174 persons but no prosecutions were necessary. Three hundred and forty-five trees and forty stumps were destroyed and fifty piles of rubbish likely to contain beetles. The beetles can perhaps hardly be stated to be quite extinct in the Island, but they have become pretty scarce nowadays and the destruction of trees by them now is quite insignificant. Care will have to be taken in the future to prevent their return.

		\$	c.
Amount allowed in the Estimate to carry out this Ordinance	...	210	00
Amount Expended on transport	...	204	08
Balance	...	5	92

ECONOMIC GARDENS.

A small store was erected in the Economic Gardens in place of the old wooden shed which was in use for so many years.

The Municipality in making a new road in the neighbourhood asked to be allowed to take soil from the hill opposite in the arboretum to fill up a swamp. This was permitted on condition of the hill being levelled and turfed. The excavations necessary were very unsightly for some time but by the end of the year they were filled in and levelled, and will shortly be turfed.

The Garden was kept up in a very good condition as well as could be expected, considering for the greater part of the year, the European staff was reduced to the Assistant only. The export of plants and seeds of economic interest was greater than usual, not only in Para Rubber, but in other products, a matter of satisfaction as it shows that the agriculture of the tropical English colonies is not being confined to Rubber only.

There was a demand for seeds of the Oil Palm (*Elaeisguineensis*) due to an article in the "Agricultural Bulletin" of this year pointing out the value of this plant in cultivation. Fibre plants were also in great request and though the cultivation of these has been slowly making its way in the Peninsula, still there are signs of its really playing an important part in the local cultivation in the near future.

Catch crops for rubber as represented by Ground-nut, Citronella and Lemon-grass, were in demand. Camphor seedlings were taken for trial in several of the Estates in the Federated Malay States. Fruit trees were required also largely for the Federated Malay States, where the supply of fruit is by no means what could be desired.

The Para Rubber seed crop was the biggest on record, viz., 410,600 of which 405,600 seeds and 13,100 seedlings were disposed of. The Gutta Percha fruited well and 1,380 seeds were sent to Mauritius, but travelled very badly. Of *Willughbeia firma*, 18 seedlings were sold. Besides these 100,000 Rubber seeds were purchased, packed and sent to British New Guinea.

Fibre plants were sold as follows:—Ramie 3,170, Sansevieria 10,000, Manila Hemp 130, Mauritius Hemp 150 and of Fruit trees various kinds 1,700 plants and 12,000 seeds.

A big sending of Coconuts to Lagos was 3,000 nuts in crates, and requiring 30 carts to convey them to the docks.

Of Tapioca 300 plants, Coffee 125, Citronella 160, Lemon-grass 250, Camphor 750, Cocoa 160, Nutmeg 172, Oil Palm 3,030 seeds, Ground-nuts 50 lbs. seeds.

The greater part of these seeds and plants were supplied to the Federated Malay States and Johore, chiefly to Selangor and Perak. Of other Colonies, Lagos, British New Guinea, Southern Nigeria, and the Caroline Islands were the chief recipients.

The total export of plants and seeds this year was:—

Economic Plants	...	...	...	...	18,085
Ornamental Plants	...	...	...	...	6,744 = 24,829
Economic Plant Seeds	...	...	...	...	525,310

Ornamental Plant Seeds (sold and exchanged) 558 Packets.

This export entailed a very large amount of labour and correspondence. An extra seed boy to collect seed was employed, and a larger number of men than usual were required to gather the large crop of rubber seeds. When the Gutta Percha trees were fruiting, the fruit bats attacked the fruit in such numbers that it was with difficulty that any of the crop was saved at all. The lower part of the best tree was covered with cloth and nets, lights were put in the tree and a Tamil Batcatcher employed.

Experimental Rubber Tapping.

During the absence of the Director, Mr. FOX the Superintendent from Penang Gardens carried on the researches as to growth and returns of the Rubber trees, though for the whole nine months he was required to do the whole work of the two Gardens single handed. The records were carefully kept, and the report will be shortly completed. The rubber prepared during the experiments was sold locally and fetched \$3,194.32. Part of the money obtained by the sale of the rubber was utilized in installing a water supply to the Botanic Gardens, which has long been needed, and which was otherwise unprocurable. This installation cost five thousand dollars.

Summary.

Considering that the Staff was this year reduced by the Director's absence for over eight months to Mr. FOX assisted by the Clerk Mr. J. S. ISAAC the amount of work executed was very great. The Gardens were kept in good order and many improvements made, the export of seeds and plants and correspondence exceptionally large, and a considerable amount of experimental research carried on, and the "Agricultural Bulletin" published monthly, all this work could not have been effected but by great energy and industry on the part of the Assistant and of the Clerk.

H. N. RIDLEY,

Director of Gardens, Straits Settlements.

Annual Report on the Botanic Gardens, Penang, 1907.

Staff.

1. The Gardens were in charge of the Collector of Land Revenue with the assistance of MOHAMED HANIFF, Garden Overseer, up to March 26th, when Mr. FOX (Superintendent) returned from leave. Mr. FOX only remained up to April 23rd, when he proceeded to Singapore to act for the Director of Gardens, and was replaced on the following day by the writer, Assistant Superintendent, Botanic Gardens, Singapore, who remained in charge of the Gardens for the remainder of the year.

MOHAMED HANIFF was on leave for three months from the 17th June, this being his first leave after 18 years' service.

The check roll shows much broken time, due to Fever and acute Diarrhoea, but equally or possibly more, to slight feverish symptoms which disincline a cooly to turn out without the incentive of mustering on the spot, and this is unavoidable as the lines have been placed one mile distant from the Gardens with the object of obtaining good sanitation.

The Year's Work.

2. Despite these changes a large programme of work has been carried out, an important item of which was the increased maintenance and renewal of stock consequent on large sales of palms and general decorative plants. This will be better understood if I say that the revenue collected by sales amounted to \$1,111.24, which constitutes a record in the revenue return of these gardens. The highest returns previously recorded were \$974 in 1897, and \$1,014 in 1894.

3. Inadequate accommodation has always been the drawback to the maintenance and renewal of stock but on the representation of Mr. FOX an acre of land has been purchased at the Garden entrance and this difficulty will disappear. It will now be possible to maintain small lots of fruit trees and other useful economic plants. In this direction the most notable additions include *Palaequium oblongifolium*, or getah taban, raised from seeds obtained within the Garden, and although only three trees fruited the crop was exceptionally heavy; and although 3,670 seeds sold to the Conservator of Forests, and 500 seeds to the Government of Mauritius, a batch of 1,550 seedlings was reserved for the Gardens. *Hevea brasiliensis* practically failed as a seed-crop, 4,700 seeds were sold and 250 seedlings raised. Other additions include 200 nutmegs, 300 durians, and a few mangosteens. Of other economics of which specimens only were received the following may be cited:—West Indian Bread-nut (*Artocarpus nucifera*), Australian fodder grass (*Paspalum dilatatum*), ten species of Bow string Hemp, *Sansevieria* (species), Bornean Lemon (*Citrus* sp), *Eugenia uniflora*, *Eugenia brasiliensis*, *Anona reticulata*, *Psidium guava* (Trinidad), and some good varieties of bananas and pineapples.

Free Issues.

4. Trees and shrubs were supplied free to the Supreme Court grounds, District Hospital, Government Quarters, and Residency; the latter also received a miscellaneous selection of pot plants. A small lot of seeds was given to the Pulau Tikus College.

Exchanges.

5. Plants were supplied free to:—

Botanic Gardens, Rangoon	...	2 cases miscellaneous Ferns
Botanic Gardens, Singapore	...	1 plant <i>Amorphophallus Titanum</i>
German Consul, Padang	...	1 case of Palms
Mr. Tong Takin, Kwala Lumpur	...	6 <i>Adiantums</i>
Mr. Beauclerk do.	...	1 box of <i>Cannas</i>

Received in exchange from:—

Plantations Department, Perak	...	20 packets of Seeds
Do., do.	...	48 Ferns and Bulbs
Botanic Gardens, Jamaica	...	1 packet of seeds <i>Cyphomandra betacea</i>
Do., Ceylon	...	1 do. do.
Do., Calcutta	...	4 do. Palms
Do., Trinidad	...	1 do.
Do., Singapore	...	4 do. and 341 plants
Do., Rangoon	...	4 do.
Agricultural Department, Honolulu	...	54 do.
Commissioner, Honolulu	...	40 packets of Seeds
Messrs. Damman, Naples	...	23 do.
Messrs. Herb, do.	...	26 do.
Messrs. Cooper, Nurseries, Victoria	...	34 do.
E. C. Ollenbach Esq.	...	6 <i>Phalæ nopsis</i>
C. Curtis Esq.	...	1 packet of seeds and 25 Bulbs
Dr. Wright, Perak	...	20 Bulbs, <i>Caladiums</i>
W. Allen Esq., Rangoon	...	11 Orchids
W. Beauclerk Esq., Java	...	46 Orchids
Mr. Mohammed Haniff (Overseer)	...	Ferns, Orchids and Aroids, several cases
Mr. Tong Takim	...	29 <i>Caladiums</i> tubers
D. Logan Esq.	...	25 seeds, <i>Spondias lutea</i>
J. Irving Esq.	...	1 packet of seeds
The Residency	...	7 plants
Mr. Cerutti	...	1 lot Rose-cuttings

From the Royal Botanic Gardens, Kew, a wardian case of 50 plants of (*Manicoba*) Ceara Rubber, said to be a superior variety, was received and these have been planted at Tasek Glugor Forest Reserve in Province Wellesley.

6. Some new ferns and palms were added to the Garden collections from the Botanic Gardens, Singapore, and several flowering or decorative plants. The collection of *Caladiums* was enriched by some new choice varieties. From the German Consul at Padang the gigantic terrestrial aroid (*Amorphophallus Titanum*) has been received. The collection of *Cannas* is large and includes many novelties and made a fine display during the latter months of the year.

7. A sum of \$129.24 has been expended in the purchase of plants and seeds. This is a very small amount compared with the receipts and it should be mentioned that it is not as easy now as formerly to obtain new plants, particularly novelties, by exchange, owing to the preference for temperate rather than tropical plants in home gardens. To obtain new varieties a small sum must be expended for which an assured return may be expected. New plants if novelties are much in demand.

Routine.

8. During the absence of the Superintendent for one year, the garden was kept in good order and the general appearance maintained. There remained, however, some urgent arrears which have now been carried out. All the South American *Cattleyas*, the beautiful Orchids so much admired, were losing their vigour and these have been

re-potted and are making new growths. In the other plant houses all the pot-plants have been re-potted, rearranged, and represent care and culture.

Improvements.

9. The Penang Garden is now 25 years old and when first commenced it contained many interesting indigenous specimens of trees and palms which have been preserved, while the groups and specimens since planted have made so much growth that the time has arrived for some landscape effects. Some years ago the waterfall was the most striking natural feature of the garden, but latterly it was not easy to view from any part of the garden, and escaped the notice of most visitors. The best view of it which is from the Band-stand has been improved by the removal and pruning of superfluous foliage. The waterfall itself is considerably overgrown and if permission can be obtained it should be recleared during the next dry weather.

The most important landscape effect has, however, been obtained by opening a vista from a point on the main drive near the entrance to the garden looking across the stream towards the plant nurseries. The two cascades over the stream are brought prominently into view and a long border of brilliant coloured Cannas between the cascades of water furnishes a pleasing picture. Some other flower-beds have been added and the general appearance of this part of the garden has been made brighter. The work involved the removal of a huge clump of the common and rather formidable bamboo (*Bambusa spinosa*). This species grows into an almost impenetrable mass which is difficult to destroy (unless by fire which cannot be used in a public garden) so that the task of removing it proved an arduous one.

The main drive already referred to has been slightly improved by reducing an ugly bend.

10. By far the largest undertaking however has been the commencement of converting the ravine running from the circular road to the swimming bath into a natural rockery for the reception of the large collection of Aroids and certain shade-loving Palms.

It will perhaps be well to explain here that this so-called bath is really the Garden reservoir, which supplies the plant sheds and nurseries with water through one-inch iron pipes, and that since the club swimming bath started at Tanjong Bungah the Garden bath has fallen into almost entire disuse. The reservoir is essentially necessary and must be maintained, but the Garden funds would not stand the cost of renewing the dilapidated buildings (dressing-rooms, etc.,) which were so very occasionally used and the opportunity was therefore taken to utilize the ravine for the purpose stated. When completed (considering the richness of Aroids in the Malayan flora) a most interesting and valuable collection of these plants will be permanently established for study or enjoyment in a cool retreat. Several species of epiphytic Aroids already abound on trees growing in the ravine; others have been planted. In building the rockery, the bed of the stream has been contoured so as to form a feature of the work. Of the Aroids planted which include duplicates of all our Anthuriums, Alocasias, Amorphophallus, Spathiphyllum, Dieffenbachia, Schismatoglottis, Homalomena, Aglaonema, Philodendron, Pothos, Schizocasia and Caladiums all have grown well.

At the time of writing the plants of *Spathiphyllum cannaefolium* furnish a nice display of white flower-spikes which are deliciously fragrant in the mornings and evenings. A little time must elapse before the Anthuriums represent their best; but those specimens which have flowered exhibit more perfect and better coloured spathes under the natural shade than is ever obtained with pot-plants under artificial shade.

Aquatic Aroids and the 'Keladi' or Colocasias and Xanthosomas are not yet provided for.

Upkeep and Buildings.

11. The dam across the reservoir was found to be leaky. The faces have been re-cemented and a new hardwood water gate provided. The reservoir has also been thoroughly cleaned and the accumulated wash-sand removed.

The bertam chicks on the iron or No. 1 plant house have been entirely renewed. Many of the posts and beams of No. 3 plant house have been renewed and painted, and the whole roof renewed with split nibongs.

The circular drive from the Aroid ravine as far as the Band-stand or a distance of 200 yards has been re-metalled with 3 inches of granite by the Public Works Department. The same department has also renewed the two rustic bridges crossing the stream near the fern rockery.

Library and Herbarium.

12. For the former the usual periodicals have been purchased or received from other Botanical and Agricultural Establishments. Mr. WRIGHT'S Cantor lecture on Para Rubber was purchased, and Volume IX, Part II of the Annals of Calcutta Botanic Garden, containing descriptions and drawings of the Orchids of North-West Himalaya presented. Various volumes of periodicals and journals have been bound.

The Herbarium building although repaired is still very unsatisfactory. During the latter part of the year the excessive damp and consequent mould on the specimens has been very troublesome, but with the aid of charcoal fires in chatties the Herbarium has been kept as dry as possible. Something however must be done, or the life of the Herbarium will not be a long one, and considering the cramped space for Office and Library, and the urgent need of a room suitable for a store for tools, seeds, bulbs, rubber, and other specimens, this need would be met by converting the Herbarium into a store and erecting a new one on arches instead of a ground-floor on sloping ground. A space of 30 by 20 feet would suffice for a herbarium.

Owing to arrears and pressure of work, I was not able to suggest any collecting trips, but the garden Overseer paid a visit to the Singapore Gardens and obtained eleven cases of miscellaneous plants, all desirable additions to this garden.

Rubber Notes.

13. Including the trees at the old experimental nursery on the hill there are 43 Para trees in the garden; of these seventeen are over three feet in girth, nineteen over and seven under two feet. I had expected there were more. In the absence of MOHOMED HANIFF it was necessary to train a man to tap and 21 trees were tapped and 35 lbs. of Rubber obtained. Now that a man can tap without injury, this work will proceed better although the drying process is difficult and long, through smoking being necessary owing to the damp situation of the garden. The old Para tree supplied two pounds of dry Rubber making the grand total from this tree 37 lbs. 13½ ozs. All the Rubber is not yet dry enough for sale.

Governor's Hill Bungalow Garden.

14. The labour band has been very unsatisfactory, but thanks to the energy of the Overseer in charge (Mr. FERNANDO), the grounds have been maintained in good order.

The Rainfall amounted to inches 124.17 of which amount 57.41 inches fell in the three months of September, October, November, or an average of 19 inches. As might be expected in such inclement weather the vegetable supply fails but improves with the dry season, when unfortunately the want of a water supply is a serious drawback.

A few introductions such as Lima and Runner beans are promising and a few seedlings of the Tree Tomato (*Cyphomandra betacea*) have been raised.

Vegetables are no longer supplied free, and since last September a sum of \$15.37 has been collected for supplies to Government Bungalow. This amount is included in the Waterfall Garden Return. A sum of \$51.89 was expended in the purchase of new roses, which arrived in perfect condition and will be planted when established. Flower and vegetable seeds cost \$25.22.

Coconut Trees Preservation.

15. The number of notices issued in connection with infected trees and manure not properly stored amounted to 755.

Fortunately for this Settlement beetles are the only pest and the dreaded Bud-Rot has not appeared; but the area to be inspected is far too large for one Inspector, and a Sub-Inspector is allowed for next year.

There were nine prosecutions in Penang and four in Province Wellesley. The fines inflicted amounting to \$15.50 only. I strongly think this leniency will result in more unnecessary work for the Inspectors and the real work of inspection will fall into arrears. It may not seem a serious breach of the Ordinance for a small foot bridge or fence of coconut stems to be used and in solitary instances there would not be any danger of maintaining breeding grounds for the beetles, but if every one so utilized their fallen stems (and this is done in Province Wellesley far too much) an additional danger in this direction would exist, as the attention of the Inspectors would be divided between unburied stems and standing trees.

General.

16. I attended the Agri-Horticultural Show held at Kwala Kangsar in August and took charge of the Penang exhibits. There were 122 exhibitors and 700 entries

in 168 classes. The Settlement was very successful and carried off 48 first prizes, 24 second prizes, 7 third prizes, and 3 exhibits were highly commended.

Excepting horticulture (plants and flowers) all the large divisions were well represented, and while there is a general consensus of opinion as to the educational and other advantages of such shows, there does not appear to be any probability of a higher or other standard forthcoming. To effect a change in the present practice of agriculture I suggest that the best prospect of improvement lies in the encouragement and assistance of school gardens as is done in the West Indies and Ceylon. Without such early teaching the market gardener will fail to realize that quality may be made or modified by selection and varied cultivation, and the small coconut planter will proceed on the same lines as hitherto, waiting years for a crop instead of being profitably engaged in cultivating as catch crops, citronella or lemon-grass oils, improving his property and at the same time assisting to build up a large oil industry. A larger demand for vegetable oils seems probable and the countries best equipped will be naturally the first to reap the benefit. An Agricultural Show would determine whether the oil was purer or a vegetable more succulent; to the observant it would most likely indicate the direction in which improvement might be expected, but first of all the methods of agriculture as now practised must be altered, and I cannot conceive how such alteration can be effected except in the way suggested.

17. Appendices * are attached showing Revenue and Expenditure of the Waterfall Gardens, Governor's Hill Bungalow grounds, Transport and Personal Allowances Coconut Trees Preservation; and * returns of the work done under the Coconut Tree, Preservation, and the Rainfall recorded at the Hill, Fort, and Prison.

R. DERRY.

Acting Superintendent of Forests and Gardens.

22nd January, 1908.

Return of Rainfall for the Criminal Prison, Fort Cornwallis, and Government Hill during the year, 1907.—(Contributed.)

MONTHS.				Prison.	Fort.	Government Hill.
January	...	...	...	1'54	1'79	3'89
February	...	...	...	80	1'12	1'18
March	...	...	...	6'34	6'50	7'69
April	...	...	...	1'43	1'10	2'34
May	...	...	...	5'94	5'96	10'51
June	...	...	...	4'18	5'81	11'97
July	...	...	...	8'10	5'80	14'73
August	...	...	...	4'68	3'82	5'88
September	...	...	...	8'07	10'23	15'96
October	...	...	...	12'63	6'45	19'71
November	17'16	11'95	21'74
December	7'42	6'50	8'57
Total ...				78'29	67'03	124'17

* Not printed.

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STRAITS SETTLEMENTS.

ANNUAL REPORT

ON THE

BOTANIC GARDENS

SINGAPORE AND PENANG,

FOR THE YEAR

1908

BY

H. N. RIDLEY,

Director of Gardens, Straits Settlements.



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Annual Report on the Botanic Gardens, Singapore, for the Year 1908.

Staff.

The Director returned from leave on the 24th January, and Mr. DERRY, the Curator, left on the same day for long leave, Mr. T. W. MAIN was appointed as Assistant Curator on 1st April. The Department now has for the first time in its existence two European Assistants in Singapore. This addition to the staff has been urgently required for many years, as the amount of work demanded of the Department has increased to such an extent that a single Assistant could not cope with it; Mr. MAIN takes charge of the Upper Garden, and Mr. DERRY the Economic Garden.

The coolies worked fairly well, but as the price of labour keeps up so high in Singapore and the Malay States still, the Gardens Department loses many of the best men who leave for higher pay outside.

In the early part of the year there was a good deal of Malaria in the Lines, as there was in other parts of Singapore at the time, and on the return of the Director steps were taken at once to remedy this; the secondary scrub round the Lines which was swarming with mosquitos was cut down and destroyed, and all tins, broken pots and other breeding grounds removed, the mud drains from the Lines bricked, and the place generally cleaned up, when the fever immediately disappeared there being no more cases.

Before this work was executed, however, one coolie who was attacked died in three days. This is only the fifth death in the Gardens Coolie Lines within the past twenty years. The other cases being two from Beri-beri some years ago during the absence of the Director on leave, one case of rapid acute Diarrhœa, (probably ptomaine poisoning), and one baby girl. When it is considered that of the large number employed during this period many are men who have left other employment in the Native States on account of ill health, this speaks a good deal for the healthiness of the Coolie Lines.

Visitors.

The number of foreign Botanists and Agriculturists who visits the Gardens still increases, and among the better-known visitors this year were:—Prof. CZAPEK, Mr. E. D. MERRILL (Philippines), Dr. H. WINKLER (Breslau), Dr. F. W. FOXWORTHY (Manila), Dr. M. SIEDLECKI (Cracow), Prof. N. J. TISCHLER (Heidelberg), Governor E. Y. MILLER (Palawan), Mr. G. C. DRUCE (Oxford), Dr. H. P. STEVENS, Mr. HERBERT WRIGHT and C. KELWAY BAMBER, Mr. DUBEDAT and M. JOURDAN of Phuquoc, E. J. KAPPLER (Manila), C. E. HERBERT (Port Darwin), Mr. WATERHOUSE (Honolulu), Mr. A. H. BENSON Agricultural Department, Brisbane, Mr. C. S. BANKES (Manila); besides the usual large number of planters from the Malay States, Borneo, Sumatra, Riouw and other neighbouring countries.

Garden Rules.

The Garden Rules were revised with the approval of His Excellency the Governor and gazetted. Few alterations were necessary, but a regulation as to Motor Cars was added.

Buildings.

During the year the Clerk's and Foreman-Gardener's quarters in the Economic Gardens were entirely rebuilt by the Public Works Department, a new glass house was built in the Upper Gardens at a cost of \$970. It measures 52 feet long, 12 feet broad and 11 feet 6 inches high and on the outer side a row of frames was built 52' x 5' x 2½'. This house is most useful for delicate plants, succulents, orchids and the

like. A new office of brick and plaster was built in the Economic Gardens, for the Assistant in charge of this part of the Gardens. It measures 20' × 14' × 12' and cost \$800. Two latrines for visitors were built of brick in the shrubbery where the animal cages formerly were, size of building 12' × 8' × 6'. In the Coolie Lines the drains were bricked for a length of 780 feet, viz., 346' × 12" × 10", 82' × 14" × 14", 250' × 8" × 12"; several silt tanks were built and the wells were repaired, the buildings of the Coolie Lines and Policemen's quarters were partially reattaped, and others were repaired and an extra room was built on to the Artist's quarters. The well in the nursery was redug, bricked and cemented.

The wooden floor of the Gardens Office was removed and the ground filled in and covered with cement and concrete by the Public Works Department. This had proved necessary on account of the persistent attacks of termites which invaded the office during the night and nearly destroyed the books and papers in the office.

Roads and Drives, Beds, Etc.

All the roads in the Upper Gardens were re-gravelled and repaired where necessary. The lower circle path round the band-stand was relaid with laterite. Two new rollers were purchased for this work.

The lake was cleaned of waterweeds on several occasions and some hundreds of loads of silt and mud were taken out of the upper end in April and banked up on the side being kept in place by piles, and a large cement tank 4' × 4'—6" × 4' was built to receive the silt brought down in rain storms from Garden Road and Tyersall Road. As this silt is brought down from the mainroads into the Garden the Municipality was asked to take steps to turn the road drains from the Gardens, but nothing effective was done.

Side drains, the bricking and repairing of the side drains all over the Gardens was pushed on and a large number of the remaining earth drains were bricked. In all, 917 yards of brick drain were laid down in the Upper Gardens. Catch tanks were also built where necessary.

New or Noteworthy Plants.

The following plants of interest flowered for the first time in the Gardens:—

Dendrobium Lankawiense.—Lankawi.

Do. *pachyglossum*.—Perak.

Bulbophyllum variabile.—Perak.

Coelogyne carnea.—Perak.

Wallichia disticha.—India.

Dædalacanthus parvus.—India.

Begonia paupercula.—Selangor.

Burbridgea schizoecheila.—Borneo. (Flowered and fruited. The fruits of this genus were not previously known.)

Baryxylum rufum.—Saigon.

Dendrocolla N., *sp.*.—Manila.

Wormia meliosmæfolia.—Malacca.

Geodorum pulchellum N. sp..—Siam.

Dendrobium sp..—Philippines.

Sterculia alata.—India.

Ceropegia Woodii.—Natal.

Cyperus papyrus.—Africa.

Gloriosa rothschildiana.—Africa.

Urginia micrantha.—Africa.

Kicksia africana.—Africa. Flowered and fruited.

Cotyledon pachyphyllum.

Caryocar nuciferum.

Hibiscus Californicus.—North America.

Dichorisandra aubletiana var persicariæfolium.—South America.

Euterpe stenophylla.—South America.

Cuphea petiolata.

Amorphophallus titanum received from Padang flowered and the great flower spike and enormous leaf which followed it were very attractive to visitors. A *Salvia* received under the name of *Zurich* proved very successful as a bedding plant and a useful addition to the beds. There was a good show of *Antirrhinums*, a plant not very well suited to our climate, *Mussaenda erythrophylla* of the Congo was remarkably beautiful and plants sent to Kew attracted the notice of visitors there, causing a demand in Europe for the plant which had long been lost out of cultivation in Europe.

Plant Houses.

All the plants in these houses were repotted and renewed, many old plants taken out and replanted in the Gardens, and replaced by younger plants. The flower house was with some difficulty kept bright with flowers throughout the year. The herbaceous plants last so short a time in full flower in this climate, that to keep a house of this size well stocked requires a very large amount of stock plants to be kept growing. The houses were highly appreciated by the visitors, the fine exhibition of *Adiantums*, the big *Amorphophallus titanum* and *Platynerium* and *Thamnopteris* especially attracting remark.

Beds and Borders.

Several of the ornamental borders were replanted and heavily manured and the one by the Garden Office continued for a length of 75 feet. The other parallel to Garden Road was entirely taken up, trenched and manured and replanted. The *Canna* beds were trenched to a depth of two-and-a-half feet and heavily manured and replanted the result being a superb show of *Cannas* of great size and brilliancy. Several others of the smaller beds were redug, manured and replanted and in many cases new soil was brought and the worn-out soil changed. Several new beds were built. By the lake, vistas were cut through the *Wormia* bushes and ornamental beds of purple grass and other bright plants were made on the further side. New *Victoria regias* and other water lilies were planted and all well manured. No less than 500 loads of manure were used in this part of the Garden this year.

Expeditions.

The Director made several short expeditions during the year to various places in search of plants. In the early part of the year a few days were spent at Cucob in Johore, where a number of rare and new plants were obtained including one new genus of *Scitamineæ*, later a visit was made to Tebrau, and by the assistance of Mr. BRYCE who resided there a day was spent at Sednak along the railway. Many plants were obtained here. The Agricultural Exhibition was held at Kuala Lumpur this year and during the week of the show the plant collector who accompanied the Director made useful collections in the neighbourhood. After the show was over visits were made to the Batu Caves and Klang Gates, a remarkable mass of sandstone with a very distinct xerophytic flora. A number of new plants were obtained here, though the season had been so dry that many plants were out of flower. In November, an expedition was made to the main chain of the Peninsula at Telom by the Director, Mr. H. C. ROBINSON, and Mr. C. B. KLOSS. The Director went to Tapah first to await the arrival of the other members of the party, and as there was some delay, spent the time in collecting in the neighbourhood of Tapah, where a number of interesting plants including some new ones were found, the most noticeable being a fine new *Phrynium* with highly ornamental foliage, of which on the return living plants were brought to the Gardens. On the arrival of the party a start was made from Telom through the Batang Padang valley. It was reached in three days and during the stay of nearly three weeks, the Director and plant collector made extensive collections. A very large number of novelties were obtained, the most interesting being a new genus of *Liliaceæ* allied to *Tupistra* and a number of plants of the Himalayo-Javanese flora previously unknown in the Peninsula including *Sanicula*, *Sarcopyramis* and *Disporum*. An account of this flora is being prepared for publication.

In all these expeditions living plants of interest and beauty were brought successfully to the Botanic Gardens.

Herbarium.

Besides the large series of plants obtained by the Director on his expeditions there were received the following additions to the Herbarium:—

Borneo plants—a large series from Sarawak containing many novelties from Mr. J. HEWITT, Mr. C. J. BROOKES, and Mr. LEWIS.

A set of FORBES' plants (895) from Java, Sumatra, and Borneo, received in exchange from the British Museum.

One hundred and ten Indian plants from Mr. R. D. HUDSON.

Three hundred and seventy-two Plants of Texas collected by LINDHEIMER presented by the Missouri Gardens.

Specimens were also received from Mr. BURN-MURDOCH from Selangor, Mr. FOXWORTHY (Borneo), Mr. MICHOLITZ, Mr. MERRILL and Mr. ELMER from Manila.

The collection of *Laurineæ* was loaned to Mr. GAMBLE for the flora of the Peninsula. Five hundred and seventy-six plants were sent in exchange to the British Museum, 1,600 to Kew, 256 to Berlin Botanic Gardens and 195 to the Manila Botanic Department.

Three pairs of new cabinets were made for the Herbarium.

Publications.

An index to the three volumes of Monocotyledons of the Malay Peninsula published the previous year was printed. A full account of the *Scitamineæ* of the Philippines was completed. A paper on a number of new and rare Malayan plants were published by the Director in the "Journal of the Royal Asiatic Society," Straits Branch, and also a list of the ferns of the Malay Peninsula and an account of the Labiates of the Malay Peninsula.

The "Agricultural Bulletin" appeared monthly as usual and was in much request. It was found necessary, however, to make some changes in the method of publication. Formerly it was to a large extent printed by the Government Printing Office. But this occasioned great delay in the appearance of the numbers and as the planters were anxious to have the reports of the Association meetings brought out punctually on the first of the month, it was necessary to transfer the whole of the publication to the American Mission Press. The cost of having the "Bulletin" thus published by an outside Press was, however, considerably in excess of the revenue obtained for the "Bulletin" by subscriptions and sales. To meet this it was necessary to procure advertisements and to increase the cost of the "Bulletin" from \$3 a year to \$5 for subscribers.

The number of subscribers to the "Bulletin" is steadily increasing.

The Artist resigned his position at the end of the year. The Botany lectures to the Medical Students were delivered by the Director twice a week from August to the end of October.

Water Installation.

The installation of a water supply to the Gardens was completed early in the year. This work was commenced late in 1907, but it was not until this year that the installation was completed.

The scheme has proved an entire success far beyond expectations and has proved a great saving of both money and labour.

The engine worked constantly during the year and gave no trouble. The water is pumped up by means of a two-horse-power oil engine from the lake well into a 5,000-gallon iron tank at top of the Gardens and radiates from there by means of pipes to different parts of the Gardens and Plant Houses. In all six standpipes are at present in use.

Economic Gardens.

In the Economic Gardens a new Office was built and furnished as mentioned in a previous paragraph, and the quarters of the Clerk and the Foreman-Gardeners were entirely rebuilt by the Public Works Department.

About $3\frac{1}{2}$ acres of scrub were cleared and dug at the end of the Garden, 20 extra coolies and a Mandore were employed on this work for two months. A part of the wood on the top of the hill was thinned out and cleared of climbers and ferns, and Nutmegs and Cloves were planted through it in lines. It seems clear thus Nutmegs do better in partial shade than in full sun. The scrub on the hill sloping to Cluny Road, was thinned out for planting Camphor trees, and the Gutta Percha trees on this ground were cleared round, and are making a good growth. Crotalaria seed was sown

in several of the new cleared portions of the ground but came up badly. Dal (*Cajanus indicus*) was planted on the top of the hill where Coffee used to be cultivated with a view of improving the soil. Though this plant grows well and becomes large, it fruits very poorly, otherwise it would be a valuable addition to our annual crops.

There were a number of trees added to the Arboretum and a fair stock of fruit trees, and other trees of economic value kept up.

Seeds of the Manicoba Rubber, *Manihot piauhyensis* and *M. dichotoma* were received from Kew, germinated well and were planted out.

The Rubber Experiments were continued during the year, and some Experiments were made with Chemical Manures.

Plants and Seeds Exported.

The demand for Para Rubber seed still continued, for the African and West Indian Colonies chiefly, 330,345 seeds were exported. The recipients reported very well of the germination of the seeds after long voyages. Ten thousand three hundred plants of Para Rubber were also disposed of mostly in the Island of Singapore. Seeds of the Manicoba rubber were also sent to Penang, Taiping, Christmas Island and Johore.

A considerable number of plants of economic use were supplied to Christmas Island, and the Lighthouses were supplied with fruit trees and vegetable seed.

Ramie was in demand again owing to the formation of the Malayan Ramie Company, which is establishing its plantations in Borneo. Three thousand plants were supplied, and the results are reported as extremely good. Three varieties were sent, the one known as Singapore strain giving the best results. Five hundred and thirty other fibre plants were supplied to other cultivators. Spices were in small demand. Six hundred and three plants of Nutmegs, Cloves, Vanilla and *Cinnamomum* were sent out. Shade trees, four hundred with twelve pounds of *Albizia*, and about a thousand fruit trees, were disposed of, and 150 Gutta Percha plants exported.

Twelve pounds of Brucea seed were supplied to Messrs. BURROUGHS and WELLCOME, and a quantity of bark of *Rouheria Griffithiana* to Buitenzorg for investigation.

Experiments in packing Durian seed for export to long distances were made. This seed is a very bad traveller, and though in much demand for other Colonies it seemed impossible to get it to them in a fit state for germination. A number of seeds were sent to West Africa packed in various ways. It was found thus they travelled best dry with no packing at all, over 90 per cent germinating on arrival.

Exhibitions.

A number of specimens of Rubber, living plants of *Hevea brasiliensis*, trunks of trees showing tapping, and specimens of flowers and fruits, etc., of Para Rubber were sent to the International Exhibition in London in the Autumn where they attracted much remark. Mr. R. DERRY at home on leave represented the Colony and took charge of the exhibits.

The Agricultural Exhibition was held this year at Kuala Lumpur, and the Director visited it.

Coconut Trees Inspection.

The red beetle seems to have got quite scarce among the estates and most of the harm is now done by the black one. These, however, seem quite to have disappeared from the vast accumulations of sawdust at the sawmills in Rochore, where they formerly bred in myriads and gave some trouble as it was impossible to destroy the immense amount of sawdust, in which they bred. Much of this ground has now been built over, and the beetles seem to have entirely disappeared; another kind of beetle was found in some trees with the black beetle; a large species of *Elater*. Only a few were found and these had apparently entered the burrows of the *Oryctes* to feed and are probably harmless.

REVENUE AND EXPENDITURE OF THE BOTANIC GARDENS, SINGAPORE,
FOR THE YEAR 1908.

REVENUE.		\$	c.
By balance in Bank on 1st January	...	2,539	41
By Government Grant	...	8,000	00
By sale of Prepared Rubber	...	2,756	16
By sale of Plants and Seeds	...	7,327	80
By balance on the account of prepared rubber sale on			
1st January, 1908	...	6,404	67
Interest	...	62	14
Total		27,090	18

EXPENDITURE.		\$	c.
Salaries of Garden Employees	...	7,414	89
Bills on Gardens Account	...	10,724	22
Purchase of Tools, etc., through Crown Agents	...	492	75
Expenditure from Rubber Sales Account	...	6,982	71
Balance in Bank on 31st December	...	1,475	61
Total		27,090	18

BOTANIC GARDENS,
25th March, 1909.

HENRY N. RIDLEY,
Director of Gardens, S. S.

Annual Report on the Botanic Gardens, Penang, 1908.

Staff.

1. Mr. DERRY was in charge till the end of January when I came up from Singapore on the return from leave of Mr. RIDLEY, and resumed my substantive appointment. The only other change was necessitated by the breakdown of the Clerk, Mr. AERIA, who was more or less ill for some months; he took leave for six weeks and was temporarily replaced by Mr. INGRAM.

The health of the coolies has been fairly good, with perhaps fewer cases of Fever and Diarrhœa than usual. Several cases of Beri-beri occurred.

Weather.

2. The year under review has been a very wet one. The rainfall returns show that over 111 inches fell on the plain and 171 inches on the Hill against 124 inches on the Hill last year and 70 inches on the plain. September was the wettest month and January the driest. Appended are the Returns for the year. On the 26th of September was experienced the most destructive storm for many years past. The roads were blocked in many places owing to the numbers of trees blown down, four large trees were blown down in the Gardens which is comparatively sheltered. The fallen trees included a fine Norfolk Island pine over 70 feet tall. On the same date no less than eight inches of rain fell. The effect of the heavy rains on our hilly roads entailed an unusual amount of labour in keeping them in repair, and in many cases the entire labour staff did nothing else for days but repair the roads, so great was the scouring.

The Year's Work.

3. Naturally after my long absence (nearly two years) I found some arrears of work; much credit is due, however, to Mr. DERRY who worked hard in bringing the Gardens back to efficiency after they had been without a Superintendent for a year,

the aroid ravine which he started and the improvements in the landscape of the lower part of the Garden being noticeable. In both cases these have been extended during the year. The chief work, however, has been the establishment of a nursery for the propagation of plants of a decorative character.

4. Prior to going on long leave in 1906, I applied to Government for authority to purchase an acre of land on the right at the entrance to the Gardens from the Hindu Trustees. This was granted but nothing was done until my return. The work of clearing, felling and getting the ground prepared into nursery beds occupied the first half of the year. During the latter half some thousands of young plants have been reared and are now available for sale and to replenish our own depleted stock. Provision has been made to reserve a portion of the nursery for the propagation of our best fruit trees, and plants of an economic interest. I hope soon to be in a position to supply these plants which hitherto we have not been able to do. The small plot of ground near the stable has been made into a palm nursery exclusively.

The fern rockeries started in 1904 have had small but important additions of rare ferns added to them. The plants have grown well and this portion of the Gardens is the coolest and most pleasant especially in the middle of the day.

Upkeep and Buildings.

5. Four out of the six plant houses have had their roofs entirely renewed. The Begonia House near the entrance has been re-covered with rubberoid and partly with bertam rods. The plants had suffered so much from the excessively wet year that it was absolutely necessary to reconstruct the roof to give them the requisite shelter, and I am glad to say that the result has been entirely satisfactory as the Begonias are much improved in appearance. The large iron house although covered last year with bertam chicks suffered so much damage from the storm in September that it was found necessary to replace the chicks with split bertam rods which are much stronger than chicks and moreover much cheaper as they were obtained from the jungle by our men. The palm house near the nursery sheds has been similarly covered and the posts and beams renewed where necessary. The summer house was reattaped during the year.

A new stone culvert leading from the band-stand road to the stream was made, to carry off the storm water that had hitherto found its way over the grass leaving numerous debris in its course. Two new plant stages faced with stone were made near the potting sheds. The dam of the lily pond was raised, the pond cleaned out and some *Nymphæ* planted; I regret to say that all the plants were eaten by a kind of slug which nibbled off the leaf stalks.

The Public Works Department erected new quarters near the Coolie Lines for the Sub-Overseer and Tindal.

Library and Herbarium.

6. The remarks made in former Reports with reference to the difficulty of keeping the Herbarium free from damp during the wet weather held good to a greater degree than before, the only method of drying being the charcoal fires which had to be kept going almost continuously during the latter half of the year.

The natural order Anonaceæ was loaned to the Director, Singapore, and I have had an application from Mr. GAMBLE who is editing the "Materials for a Flora of the Malay Peninsula" (Dicotyledons) for the loan of specimens belonging to the natural orders in the Apetalæ and Gymnosperms, these will be despatched early in 1909. I was not able to make any botanical tours but I obtained permission for the Overseer to visit the Perak Hills. He brought back with him an assortment of Ferns, Aroids, and Orchids.

The usual periodicals have been received and those of the previous year have been bound as also were some other books of reference that required it. Several text books were purchased among them being the latest edition of HERBERT WRIGHT'S work on Para Rubber. Thanks are due to the Government of India for the presentation of Volume VI, Part II of the Annals of the Botanic Gardens, Calcutta, and to the authorities of the Science and Forestry Bureau, Manila, for their valuable publications.

Exchanges of Plants and Seeds.

7. Owing to the absence of any collecting trips for the past two years, and also to the increasing difficulty in finding new plants of a novel type suitable for exchange our receipts have not been so great as they were three years ago. Seeds have been sent to other Botanic establishments as they have ripened. Among the

seeds received from the Royal Botanic Gardens, Kew, were a thousand each of the two new varieties of Manicoba Rubber. Of the variety called "Jiquie" *Manihot dichotoma* 202 seeds germinated, whilst of the variety "Remanso" *Manihot Piauhyensis* out of a similar number of seeds only 12 have germinated so far. These two rubbers are fully discussed in the "Kew Bulletin" No. 2 for 1908 and are said to be infinitely superior to "Ceara Rubber" (*Manihot Glaziovii*). As regards their suitability for this country it is hardly likely that they will seriously compete with *Hevea brasiliensis*, for not only is the rubber from the last-mentioned species better, and fetches a higher price to the extent of nearly sixpence per lb., but the former is essentially a rubber adapted for a drier and less fertile country than the Malayan region. That it is to be reckoned with however as regards the world's supply of rubber is shown by the fact that according to the "India Rubber World" a German Company has bought 800,000 acres in Bahia with the intention of planting these rubbers; and other Companies are being formed for its cultivation. It is, however, important to have another species of rubber on hand in case of disease on a large scale attacking the Para, and I propose planting out the young stock now on hand as possible seed suppliers of a future date.

Para Rubber.

8. The two chief estates in Province Wellesley, Caledonia, and Bertam are going steadily and increasing their acreage; and on the Island it is noticed that some of the Chinese spice planters are planting up Para where once nutmegs and cloves were grown. The old tree in the Gardens was again tapped during the year and yielded 3 lbs. 8 ozs. of dry rubber making the total yield since the first tapping over 40 lbs. A photograph of this tree was sent to the Rubber Exhibition at Olympia together with the actual rubber it had produced. Unfortunately the rubber obtained from it some years ago had not kept well but had become very black and tacky and consequently when it was sold at the close of the show it could only be classed as "rejections" and brought only \$37.03. The exhibit nevertheless created a good deal of interest.

Sale of Plants.

9. These fell off considerably during the year owing partly to depleted stock and partly to the fact that last year a larger number than usual of the kinds of plants sold such as Ferns, Begonias, Palms, etc., was purchased which checked the demand this year. The amount realized \$375 as against \$1,111 last year.

Governor's Hill Garden.

10. Notwithstanding the usual unsatisfactory labour supply and the excessive rainfall 171 inches, the plants and grounds were maintained in an efficient condition and Mr. FERNANDO deserves credit for the neat appearance of the grounds. Mr. CURTIS presented a hundred bulbs of tuberous-rooted Begonias and Messrs. HERB of Naples a collection of bulbs which have been potted up for experiment as to their suitability for the Hill.

Coconut Trees Preservation.

11. The appointment of a Sub-Inspector of Coconut Trees made last year has been entirely satisfactory. He is stationed on the Island thus allowing the Inspector to devote the whole of his time to Province Wellesley. It is now possible for the Districts at the back of the Island to be visited properly and regularly, a thing impossible before. From the Returns appended it will be seen that on the Island 328 notices were issued calling on owners to destroy 371 dead trees, 594 trunks, and 35 heaps of manure. There was only one prosecution; owners readily complying with the notices served on them. The difficulty, however, in the case of the small holdings, is to find the owner.

In the Province 316 notices were served to destroy 338 dead trees, 980 trunks, 39 heaps of manure, and four heaps of paddy husks. There were three prosecutions during the year with small fines amounting of \$7.50. On the whole the Province is fairly free from beetle attack, the District most attacked during the year was from Sungai Nior as far as Simpa.

General.

12. I attended the fifth joint Agricultural and Horticultural Show which was again held at Kuala Lumpur in August, the first of the series having been held there in 1904. On the whole the Show was a good one, far more so than the comparatively local Show held the year previous at Kuala Kangsar. To the trained eye, however, one or two Divisions were weak, markedly so, in the Horticultural section. Penang

and the Province again scored heavily taking one silver cup won by LOW CHIT MUN, Balik Pulau, for best collection of cultivated fruits, 53 1st prizes, 43 2nd prizes, 20 3rd prizes, 8 silver and 3 bronze medals; the amount of money prizes won by the Penang Contingent was \$364. The classes in which Penang won easily were as usual spices, fruits, and oil. By the kindness of the Hon'ble Resident Councillor and on the invitation of Dr. BUSSY, the Honorary Secretary of the Agricultural Division, I attended the Grand Industrial and Agricultural Show held in Deli at the end of August and beginning of September. As I have submitted to Government a special Report on my visit, it is only necessary to say here that I gained considerable instruction from my visit.

Angsenna Trees Disease.

13. For the past two years an obscure disease has been attacking the Angsenna trees along the road sides. These trees are quite a feature of Penang and whether covered with golden bloom, or out of flower with their graceful foliage, are alike of conspicuous beauty. Any serious damage to them is of the greatest importance; up to the present over 50 large trees have succumbed to this disease, attempts have been made to check it by digging trenches round affected trees, and treating with sulphate of copper and lime. On my representation the Municipal Commissioners arranged for Mr. GALLAGHER, the Government Mycologist of the Federated Malay States, to visit Penang and report on them; I showed him the attacked trees, and gave him a history of the cases and together we examined the roots. Mr. GALLAGHER has succeeded in finding the hyphæ of a fungus in the cell tissue from which he is trying to make cultures. He has submitted a preliminary Report, but, until his investigations are complete, it will be necessary to wait for his recommendations for the eradication of the disease. It is surmised that this is the same disease that carried off the magnificent Avenue of the same tree which adorned the sea shore in Malacca some 30 years ago.

A statement of the *Expenditure is attached, and the usual Rainfall and other *Returns are appended.

W. FOX,

Superintendent, Forests and Gardens, Penang.

Abstract of Rainfall for the Fort, Government Hill, and the Prisons during the Months, January to December, 1908.

MONTHS.				Fort.	Prisons.	Government Hill.
January	...	...	...	1'45	2'40	6'53
February	...	...	...	4'56	3'72	5'78
March	...	...	...	4'81	3'81	8'81
April	...	...	...	5'83	8'93	14'95
May	...	...	...	8'54	15'53	20'30
June	...	...	...	6'87	10'42	14'68
July	...	...	...	6'13	7'06	10'56
August	...	...	...	14'55	14'66	15'75
September	...	...	...	33'70	25'54	40'94
October	...	...	...	12'24	10'17	16'82
November	...	...	...	5'91	4'23	11'18
December	...	...	...	6'74	4'79	4'90
Total ...				111'33	111'26	171'20

* Not printed.

STRAITS SETTLEMENTS.

ANNUAL REPORT
ON THE
BOTANIC GARDENS
SINGAPORE AND PENANG,
FOR THE YEAR
1909.

BY

H. N. RIDLEY,

Director of Gardens, Straits Settlements.



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Annual Report on the Botanic Gardens, Singapore and Penang, for the Year 1909.

Staff.

There were no changes in the staff during the year. The coolies worked fairly well, and there was no sickness excepting a little mild fever.

Visitors.

The usual large number of Botanists and Agriculturists from all parts of the world visited the Gardens, as well as many planters from the Federated Malay States and elsewhere. In December a large number, some hundreds of American tourists who were travelling round the world, visited the Gardens, and expressed much satisfaction with what they saw. Among the better known visitors during the year were M. A. PRINZHORN (Hanover), Count DE KERCHOVE DE DENTERGHEM (Ghent), Mr. and Mrs. ISENBERG (Honolulu), Mr. M. L. MERRIT (Forestry Department, Manila), Prof. D. MAGNUS (Berlin), Dr. P. J. CRAMER (Buitenzorg), Dr. BERKHOUT (formerly of the Forest Department, Java), MAX FLEISCHER (Berlin), Mr. SANDEMAN (Berlin), Dr. FUJINI, Prof. I. IJAMA and Prof. SUKETERU KIKKAWA from Japan, M. DUWEL (from Algiers), M. DULAC (Botanic Gardens, Saigon), Mr. S. DUNN (Botanic Gardens, Hongkong), Mr. and Mrs. TALBOT-CLIFTON (Lytham Hall, Lancs), Miss GIBBS, Mr. GARDENER (Jamaica), Mr. EARLE (Boston, U.S.A.).

The Band of the Middlesex Regiment played by moonlight on many occasions, and the Fifes and Drums every Wednesday before sundown. This was very popular with the children, who attended in great numbers.

Motor cars are admitted to the Gardens under regulations, and there has been cause for but little complaint. A few have proved a nuisance to other visitors by smoking, a matter remedied by ordinary care by the chauffeur, and except in wet weather seem to do but little harm to the roads. In most Botanical Gardens it appears they are not admitted at all. There were no thefts of any importance.

Roads and Drains.

The heavy rains during January to March hindered work considerably, and damaged the roads and paths considerably. By substituting brick drains for the old mud drains much of the denudation damage is prevented, and the roads are not only made better but are much less expensive to keep up. During past years, whenever funds would permit, the plan of brick draining all roads liable to heavy wash of rain has been carried on gradually, and there are now left very few roads which require this. Four hundred and sixty-four yards of brick drain, varying from 18 inches wide and seven inches deep to eight inches by six, were built during the year. The larger part of this was the drain running through the palm valley. The drain behind the band-stand was altered and a new catch-pit built. An extra catch-pit was built at the upper end of the lake, where the drains from the roads enter the Garden, and the open drain thence to the lake was piped. This has given a great deal of trouble, as the water brings down a large quantity of silt off the roads which is eventually carried into the lake, silting it up. Various attempts have been made to obviate this, but though improved the condition is not yet quite satisfactory. The Rogie road was patched and gravelled and the side drains re-opened, and the long border road, Garden road, terrace paths, road to store, and other roads re-metalled, raised or gravelled. The band-stand paths were covered again with sand for the benefit of the children who play there.

A side path leading to the barrack grounds was closed and turfed over, and the fence closed at that point. It was seldom used, and nuisances caused by the 'rikisha coolies stationed outside were thus stopped.

Buildings.

A large *Spathodea* tree fell during the night of November 8th on the potting shed, and completely destroyed three-quarters of it, which had to be rebuilt. The tool-shed was repaired and enlarged. A new soil-shed was built. A small cement

tank for germinating aquatics was made and has proved very useful. The new seedling sheds were built, which proved very useful. The glass houses have been most successful, a number of plants, and notably succulents and gloxinias, are now cultivated with ease and in considerable numbers, a thing impossible before.

Beds and Borders.

The borders along the long border road were entirely renewed, re-trenched, manured and replanted with foliage and flowering plants, and have proved one of the great attractions of the Garden. The borders of the road leading from the terraces to the plant sheds was also entirely remade, and a rockery of coral made on each side, which was planted with small foliage plants, many of them rare and beautiful plants from Borneo and the Peninsula. This rockery border has been very much admired. The ginger border leading from the plant-house to the sheds was re-dug and entirely replanted, as were the Tyersall border and the *bromeliad* beds. The border between the main road and the old cement tank was replanted to hide the tank from the road. This tank is used now as a manure pit. A new border was made between the sloping lawn and the nurseries and makes a bright feature in this part of the Gardens. Many of the larger beds were re-trenched and manured and re-planted, and all the palms and specimen plants were manured. Over 200 palms were planted in the palm valley. The collection of palms now is probably one of the largest in number of species of any garden in the world.

A large piece of secondary scrub below the Assistant Curator's house was cleared and turfed.

Plant-Houses.

The flower house was kept bright throughout the year, and was very attractive. Flowers in this part of the world last for a very much shorter period than they do at home, and this entails a great deal more work in keeping the house bright than would be the case in an English hot-house, as constant renewal is necessary.

A superb exhibition of Burmese *dendrobiums* which was on view from January to February attracted many visitors, whose attention was called to it by mention of it in the local papers. The *adiantums* also were highly admired, and an article on the cultivation of these plants published in the "Bulletin" stimulated the demand for these ferns.

A small collection of *mamillarias* and other succulents, mostly presented, was also a source of interest.

Deaths from Lightning.

Three valuable trees were killed by lightning during the year, the storms being unusually severe. One of these was the fine *Shorea leprosula* near the band-stand. This tree was 150 feet tall and 10 feet 3 inches girth at 4 feet from the ground, and was one of the show plants of the Gardens. It was connected with an adjoining *Terminalia subspathulata* by a liana of *Spatholobus*. The portion of this connecting the two trees was killed as well. The *Terminalia* though touched by the lightning was unhurt. The *Shorea* slowly died apparently from shock and was felled some months later. Shortly after this the best durian tree in the Gardens, near the stables, was killed instantaneously by a flash of lightning. This tree used to produce as many as 30 durians a day during the season.

The fine *Sindora wallichiana* on the lawn by the lake was found to be quite dead towards the close of the year and though it bore no lightning marks, no other cause of death could be suggested.

New Ornamental Plants.

The collection of maidenhair ferns was increased, and large stocks kept up to meet the demand. Six new hybrids were obtained this year and named, respectively, *Beauty of Singapore*, *Bidadari*, *Tanglin*, *Mrs. Napier*, *Standard*, and *Shamrock*. The *adiantums* are raised from spores by sprinkling the spores on the coral tables on which the pot plants are grown; the spores germinate, and in the prothallus stage occasionally become cross fertilized, and hybrids are thus produced; of the new hybrids the *Beauty of Singapore* is perhaps the finest and has been much admired. *Standard* and *Shamrock*, the latter with three-lobed leaflets, are quaint and commendable.

A paper on the cultivation of ferns especially *adiantums* was published in the "Bulletin" and was in much demand by cultivators of these popular plants.

Among the ornamental foliage plants introduced was *Phrynium Jagoratum* from Temango, Perak. *Strobilanthes albostratus* introduced by the Director from Telom, Perak, last year was propagated and found to be easy of cultivation and to form an attractive pot plant; the leaves of a dark green are veined with white above and deep purple beneath.

A small collection of *cacti* was obtained from Mr. TAN BENG CHIANG and proved very attractive. Large numbers of succulents were raised from seed received from La Mortola in the glass houses chiefly *Gasteria*, *aloes*, etc.

It is not at all easy to grow succulents in this wet country, but under glass they can be raised, and, being kept in the drier parts of the plant-house, may do very well.

A fine series of new *cannas* was presented by Father GEX containing many handsome forms.

Mussaenda erythrophylla was magnificent all through the year and was in much request. *Hosea lobbiania*, a most beautiful and striking plant from Sarawak, was remarkably showy, and numerous cuttings were made from the two plants in the Gardens, and it is hoped to distribute this superb climber this year.

A fine show of *achimenes* was staged in the flower house in May, and the exhibition of Burmese orchids in the early part of the year was the finest for very many years and attracted a large number of visitors.

During the year 384 plants were presented and 759 bulbs and other plants purchased, and 640 packets of seeds were presented, and 150 packets purchased. The donors were Mr. MICHOLITZ, Mr. MANNERS (Tirhoot), R. LITTLE, M. ROBERTSON-PROCHOWSKY, Messrs. HERB, M. BUYSMAN, PEREIRA, TRELEASE, MACHADO, TAN BENG CHIANG, M. ISENBERG, Mr. LONG, Messrs. WILLIAM BROS., A. BURN-MURDOCH, LEWIS, Colonel MURRAY, Mr. MARSHALL (Brunei), Mr. HOBSON, Father GEX, and the Botanic Gardens of Cambridge, Buitenzorg, La Mortola, Mauritius, Durban, Yokohama, Manila, Kew, Washington, Berlin, Jamaica, Hanoi, Seychelles, Sydney, Grahamstown, Costa Rica, Calcutta, Taiping, Kuala Lumpur, Albany, Trivandrum, and U. S. A. Department of Agriculture. Among the most important introductions were the Zapupe, *Gomphocarpus semilunatus*, *Machilus nanmu* (the Chinese Coffin tree), *Bleekrodea tonkinensis*,—Tonkin rubber, *manihot dichotoma*, *heptaphylla* and *picuhyensis*, *Piper longum*, Costa Rica coffee, a new fine large series of succulents from La Mortola, and some new *cannas* from Father GEX.

Plants Exported.

One hundred and thirty plants were sent to Kew, Taiping Gardens and elsewhere, and 315 packets of seed chiefly to the West African Colonies, Honduras and Christmas Island.

New or Noteworthy Plants.

The following plants flowered or fruited for the first time in Singapore:—

I. Malay Peninsula.

- Didymocarpus ascendens*.—Tapah.
- Disporum pullum*.—Telom, Perak.
- Bulbophyllum trichoglottis*, *n. sp.*—Telom, Perak.
- Do. *coniferum*, *n. sp.*—Telom, Perak.
- Sarcochilus anceps*, *n. sp.*—Johore.
- Begonia pavonina*, *n. sp.*—Johore.
- Begonia robinsonii*, *n. sp.*—Johore.
- Do. *roxburghii*.—Johore.
- Staurogyne arcuata*.—Johore.
- Impatiens sarcantha*, *n. sp.*—Johore.
- Do. *exilipes*, *n. sp.*—Tapah.
- Lepidagathis wightii*.—Johore.
- Eria bidens*.—Perak.
- Sarauja tristyla*.—Kelantan.
- Collabium nebulosum*.—Gunong Kerbau, Perak.
- Bæica*, *n. sp.*—Gunong Kerbau, Perak.
- Cardiopteris lobata*.—Perak.
- Zalacca wallichiana*.—Fruited (Singapore.)

Plectocomiopsis scortechinii.—Singapore.
Iguanura malaccensis.—Fruited (Singapore.)
Raphidophora beccarii.
Aeschynanthus stenophylla.—Johore.
Bulbophyllum flammuliferum.—Johore.

2. **Malay Islands.**

Coleospadix oninensis.—New Guinea.
Impatiens holstii.
Pinanga arundinacea.—Borneo.
Desmanthus virgatus.

3. **India.**

Licuala peltata.
Ptychoraphis augusta.
Eranthemum wattii.

4. **Africa.**

Kigelia pinnata.—(Fruited.)
Crinum giganteum.—Accra.
Tabernanthe iboga.
Asparagus madagascariensis.
Gomphocarpus (asclepias) semilunatus.
Pachyrrhizus angulatus.
Pavetta caffra.
Garcinia livingstonei.—(Fruited.)

5. **Europe.**

Myosotis welwitschii.
Dianthus capitatus.
Lupinus hirsutus.
Solanum villosum.

6. **China.**

Rehmannia angulata.
Perilla laciniatus variegatus.
Perilla gigantea rubra.

7. **South America.**

Pogonopus exsertus.—Mexico.
Catasetum tridentatum.
Angelonia grandiflora var alba.
Diacrium bicornutum.
Gliricidia maculata.
Castilleja elastica.—Flowered and fruited.
Tropæolum minus.
Zea mays quadricolor perfecta.
Solanum villosum.
Epidendrum ciliare.
Prestœa montana.
Cosmea sulphurea.
Erythrina aurantiaca.—Introduced in 1888 (FERNANDO DE NORONHA.)
Nicotiana glutinosa.
Heliconia psittacorum.—Guiana.
Couroupita guianensis.—Cannonball tree.

Expeditions.

The Director visited Penang in the early part of the year and in July went on an expedition to Temengoh in Upper-Perak, with Messrs. ROBINSON and KLOSS. The locality was unhealthy and there was much sickness in the expedition, but a good

number of new and interesting plants were obtained. The most important was a new species of *Stichoneuron* (*Roxburghiaceæ*); the only species previously known was a Himalayan one. The locality was richest in *Acanthaceæ*, a number of novelties being obtained. About fifty new species of plants were collected and some living plants of cultural interest obtained. It was intended that, after returning from Temengoh, the Director should attend the Agri-Horticultural Exhibition at Penang and go on to collect the flora of Setul, this northern Peninsula region being almost unknown botanically, but unfortunately he was unable from fever and poisoned wounds to progress further, and after a stay of a fortnight in Taiping Hospital returned to Singapore. The plant collector during the stay at Taiping collected many plants, some of importance, in the hills, and besides collecting at Temengoh, made a considerable collection at Lenggong on the return journey, where the limestone rocks provided a considerable number of additions to the flora.

Herbarium.

The Herbarium was largely increased during the year and the Director worked through the collection, making a record of localities and distribution numbers, and recording species not included in the materials for a Flora of the Malay Peninsula, with additional notes on points of importance not previously recorded. This work, which occupies a long time, owing to the great amount of material, was finished as far as the end of the *Polypetalæ* by the end of the year.

The *Piperaceæ* which had been sent some years ago to M. C. DE CANDOLLE for identification were returned and a considerable portion of new species found to be among them.

Considerable additions to the herbarium were made from the Director's expedition, and specimens from the Malay Peninsula were made by Mr. BURN-MURDOCH, Mr. HOBSON, Mr. KLOSS (120 specimens) and, from the Calcutta Herbarium, Malayan and Indian plants (318).

From Borneo Mr. C. J. BROOKE presented 13 specimens, from Bidi, Mr. MOULTON, Sarawak Museum, (25), Malay Islands, ZOLLINGER, CUMING, etc., from the British Museum (93), Buitenzorg Herbarium (128), Philippines, Mr. W. T. HUTCHINSON (840). There were sent out of duplicates to the British Museum (1,504 specimens), to Kew (664), Manila (223), Calcutta (399), Berlin (587), Buitenzorg (150), Dr. CHRIST, Ferns for identification (83), Prof. BECCARI, Palms for identification (4), Mr. LILLY, Mosses for identification (79).

The Herbarium is indebted to Dr. CHRIST and Colonel BEDDOME, Prof. BECCARI, Mr. BROTHERRUS, Mr. MATTHEW, Mr. MASSEE and others of the Kew Gardens staff and M. DE CANDOLLE for identification of difficult groups.

Library.

The usual large numbers of journals and pamphlets was obtained from various Botanic Gardens and Institutions in exchange for the "Bulletin," and a few journals and books purchased, and a large number were bound. Of presentations the most important were the "Annals of the Botanic Gardens, Calcutta;" volume of *Calameæ* by Dr. BECCARI; the "Flora of Tropical Africa," vol. XI, Royal Gardens, Kew; "Notice sur les plantes interessantes de la Flore du Congo," by E. WILDEMAN.

Publications.

The "Bulletin" was published regularly throughout the year and there was a considerable increase in the number of subscribers. It was found advisable to transfer the seat of its printing to the office of the "Straits Times" mainly with a view of securing more advertisements. The grants of the Government and Federated Malay States, and the subscription from planters and others, are quite inadequate to pay for the cost of printing, postage, etc., and the reserve fund was drawn on for the deficit. This, however, was being rapidly depleted, and without the aid of advertisements it would have been necessary for its publication to cease in two or three years. The Director published with notes a manuscript of the plants and cultivation of Prince of Wales Island, written by Surgeon HUNTER in 1806, giving records of the first fruiting of the nutmeg and the early cultivation of the pepper and gambir in Penang. The manuscript was found in the British museum, and published in the "Journal of the Straits Branch of the Royal Asiatic Society." The paper on Philippine *Scitamineæ* referred to last year was published. The types of this paper are in the Botanic Gardens herbarium.

An account of the Flora of the Telom valley expedition in 1908 is being printed off in the "Journal of the Federated States Museum." The account of the Flora of

Temengoh collected this year was compiled and will shortly be published. A further instalment of the new plants of the Malay Peninsula has also been printed in the "Journal of the Royal Asiatic Society, Straits Branch."

An article on the relationship of ants to plants has been written and sent to be printed in the "Annals of Botany." In the Kew "Bulletin" (1909-5) Mr. G. MASSEE of Kew described 17 species of fungi new to science (*Boleti*), found in the Botanic Gardens, Singapore, and preserved in spirits, with coloured drawings made by the Garden Artist in 1907.

A new fungus attacking the shoots of para rubber trees and eventually killing the tree was sent to Kew and identified by Mr. MASSEE as a species of *Diplodia*, and an account of it was published in the "Bulletin."

A plate and account of *Peliosanthes violacea*, var. *clarkii*, sent to the Botanic Gardens, Kew, appeared in the "Botanical Magazine." A note on the fruiting of *Burbidgea* was also published in the "Journal of the Straits Branch of the Asiatic Society."

The botanical lectures to the medical students were given by the Director at the Medical School from September to December.

ECONOMIC GARDENS.

Buildings.

During the year a large rubber-curing shed was built, several new seedling sheds and the old nursery sheds were also rebuilt. The wood for the smaller works was obtained in the Gardens. All the atap buildings were re-covered.

Extension Work.

A considerable area was cleared and planted with a collection of leguminous plants, *crotalaria*s, *tephrosia*, *desmodium*s, *cajanus*, *clitoria*, etc., all plants known to be valuable as nitrogenous plants and suitable in various degrees for covering and improving the soil of rubber and other estates. There was a considerable demand for seeds of all these plants.

A considerable area was prepared for pepper planting and planted through with betel-nuts to serve as supports.

A path was cut round the ground parallel to the Cluny and Bukit Timah Roads so as to get quickly round the rubber plantation to the end of that part of the Garden. It was hedged from the road with *coca* (*Erythroxylon coca*) and *Hibiscus*; a *coca* hedge was also run from the coolie lines to the entrance of the Economic Gardens.

Maintenance.

The greater part of the work with the small staff allowed is naturally upkeep or maintenance of the ground opened in an ordinarily presentable and decent condition. All the stock plants of *sansevieria*, *ramie*, nutmegs, cloves, gutta-percha, rattans, citronella and lemon grass were re-dug, cleaned, and in some cases replanted. A great deal of work was done in cleaning and deepening drains, planting and weeding intermediate crops in the plot lying between Cluny and Bukit Timah Roads, where there are 526 trees of para rubber, of which many will be tappable in a year's time. A great deal of time was occupied in mowing and cutting grass under the rubber trees in order to gather the seed crop and also in the arboretum which had got much overgrown. A number of old dead or useless trees were removed and the stumps dug out.

A large number of useful plants were raised from seed for export or planting out, and many young trees, camphor, cloves, *ficus elastica*, gutta-percha, etc., planted out. Several thousands of seeds of fruit trees and other plants in demand were planted for stock.

Arboretum.

Part of this, the section including the orders from *Nyctagineæ* to *Urticaceæ*, was manured, the trees cleaned and a number of additional ones added. The ground was mown also several times. But the press of the work prevented as much as being done here as was hoped.

Demand.

The chief demand for plants other than rubber was for fruit trees and ramie and for nitrogenous plants. With the present boom in rubber planting it is not to be expected that planters will pay attention to anything else. However, it is essential to keep up a good stock of all economic plants likely to come into demand.

Rubber Seeds and Plants.

The demand for seeds from the old trees of the Gardens still maintained its height, and there was no difficulty in selling all that were procurable, 271,000 seeds were sold from the garden and 102,300 were purchased from outside. The price of the garden seed, viz., ten dollars a thousand, was maintained, although seed from estates was selling at a much lower figure. The chief recipients of the seed were:—the Governments of Papua, British Guiana, British Honduras, Dominica, and Sierra Leone, the Liberian Corporation, Mabira Forest Rubber Company, Kelantan, and Singapore plantations. Of para rubber seedlings 20,500 were also sold locally.

The collecting of the seed, packing, export and all the business connected with this trade is naturally a great strain on the staff, and much ordinary work had to be put aside for it. However, it is only by such sales that the gardens can be kept up at all. The whole rubber ground had to be mown twice during the year employing the whole time of most of the men for a long period, and seed collectors and packers were employed for a considerable period every month. The floods were more frequent this year than formerly for some unexplained reason, entailing more maintenance of paths and drains and more constant weeding in the rubber ground.

General.

The balance at the end of the year appears to be a large one, but it must be remembered that the gardens are to a large extent maintained by sales and that the money thus received does not come in till towards the end of the year. It is therefore essential to have a balance sufficient to maintain the Gardens in the first half of the year. The Government grant for upkeep, \$8,000, pays only for the minimum amount of labour required to keep the Gardens in a respectable condition, all improvements, tools, stores, etc., have to be paid for by sales. The revenue thus obtained is received from sales of para rubber seeds, crude rubber made during experiments, and a little from sales of ornamental plants, etc. The rubber seed has hitherto been sold at ten dollars a thousand, and to the present date there have been sufficiently large orders to take all the seed we have. Plantation seed, however, is so abundant and for sale at so low a price, that we could not maintain the high price of the garden seed were it not for the great reputation it has got. The sale of para rubber seed at any price which would pay is not likely to continue much longer and perhaps in a year may cease to be a source of revenue to the Gardens. Sales of other economic and ornamental plants bring in a revenue which is practically negligible, and is also very unreliable. In past years it has fallen as low as three hundred dollars in the year.

The only thing left is the sale of crude rubber to make up a deficit of at least four thousand dollars a year on the most economical lines. This source of revenue it might be suggested might be increased by concentrating the work of the staff on the ground as a rubber plantation. But this would be very unadvisable. The competition of a Government gardens, with outside plantations has long been shown to be eventually a disastrous failure in every case. The staff instead of doing its legitimate work in aiding by experiment and propagation the agriculture of the country, would be employed as planters only, for it would be impossible to carry on both works at the same time and the trees now valuable for experiments would probably deteriorate and in any case be spoilt for research work.

At the present time the Department is making as much revenue as can be made by its sales of rubber seed in order to be prepared at a later date to continue its work by what may be called a reserve fund when the sales fall off. This is the reason for so large a balance at the end of 1909.

BOTANIC GARDENS, SINGAPORE, REVENUE AND EXPENDITURE FOR THE YEAR 1909.

REVENUE.			\$	c.
By balance in bank on 1st January	...	...	1,475	61
Government Grant	...	...	7,950	00
By sale of Seeds and Plants	...	...	4,303	55
By sale of prepared Rubber	...	...	3,843	48
Bank Interest	...	...	35	92
Total			\$17,608	56

EXPENDITURE.				\$	c.
Salaries	...	...	...	...	5,994 34
Bills	...	...	...	...	7,221 05
Crown Agents	...	...	...	...	315 79

EXPENSES IN CONNECTION WITH RUBBER TAPPING.

				\$	c.
(a) Salaries	...	...	...	...	1,414 19
(b) Buildings, Acid, Mangle, Plates, etc.	...	...	...	...	702 90
Balance in bank on 31st December	...	...	...	...	1,960 29

Total ... 17,608 56

BOTANIC GARDENS,
19th April, 1910.

HENRY N. RIDLEY,
Director of Gardens, S. S.

Annual Report on the Botanic Gardens, Penang, 1909.

Staff.

The only changes in the staff was the resignation of Mr. RATNA RAJ, the Assistant Overseer, who obtained a better position in the Public Gardens, Kuala Lumpur. He was replaced by MAHMOOD, from the Telephone Office. The Clerk, Mr. AERIA, died on March the 10th and was replaced by Mr. L. S. INGRAM on March the 9th. The health of the coolies was better than usual, and this I attribute to better housing arrangements.

Weather.

The year under review was even wetter than 1908, which was characterized as a very wet one, the rainfall at the Criminal Prison being no less than 130 inches, as against 111 inches in 1908, and 70 inches in 1907; out of this total 58 inches fell in September and October. The result of this abnormal fall was disastrous. The enormous volume of water rushing down the waterfall stream carried away two of the weir dams, and making fresh channels wore away the banks bringing down several large trees, and many smaller shrubs. The canna beds planted near the stream were entirely washed away, and tons of boulders and sand strewn over the lawns on the right and left banks of the stream.

Roads and Paths.

As usual these suffered severely during the heavy rains and it was not until the end of the year that the necessary repairs were effected.

The Year's Work.

No new work of importance was undertaken during the year, chiefly on account of my time being taken up with organizing the Agricultural and Horticultural Show as Honorary General Secretary. The first meeting in connection therewith was held on January the 15th and from that date onward, I attended every meeting except one, (when I was ill) of the General Purposes Committee, and the various Sub-Committees, till December the 16th, the date of the last one. When it is mentioned that there were nearly two thousand exhibitors, it will be understood that the correspondence in connection therewith was very heavy. Special efforts were made to have as large a collection of flowering plants as possible from the Gardens at the Show. These were grouped in various parts near the entrance and were duly admired especially the white *Cleomes*.

It is satisfactory to record that the Show was considered one of the most successful of the series. I submitted a separate report on the Show to the Government.

The chief work involving the most labour was the removal of the avenue of rain trees from the entrance gates to the office; these trees had become old and worn out, besides which they were spoiling the permanent avenue of *Polyalthia* trees planted between them.

The ordinary routine of manuring and renewing the beds and borders was attended to.

Upkeep and Buildings.

The fern-house was entirely re-roofed during the year, and the side tables replaced in stone with cement facings. The Public Works Department erected new quarters for the overseer and watchmen at the Chetty Temple Nursery.

Library and Herbarium.

The whole of the Herbarium specimens were gone over and poisoned and restrapped where necessary. The excessive rainfall necessitated the daily use of charcoal fires to keep out the damp. Duplicates of the division of the *apetalæ* comprising 29 natural orders, were forwarded to Mr. GAMBLE at Kew in connection with the flora of the Peninsula. 197 sheets of specimens were presented by the Superintendent of the Royal Gardens, Calcutta, and various types were sent to the Director of Gardens for comparison. By the kindness of Mr. BARNARD, Deputy Conservator of Forests, I was able to send the Overseer to accompany him on a collecting trip to Gunong Kerbau, a mountain some 7,000 feet high on the borders of Kelantan. The herbarium specimens collected were poor owing to few things being in flower at the time, but a few interesting live plants were obtained.

The usual periodicals were received. Thanks are due to the Government of India for the presentation of Volume XI, Parts 1 and 2, of the "Annals of the Botanic Gardens, Calcutta." The following were also presented:—"Journal and Proceedings of the Asiatic Society of Bengal," Volume LXXIV, Parts 2 and 3: The "Kyoto Imperial University Calendar:" "Trees and Shrubs" by Professor SARGENT: and various Annual Reports of the Botanic Gardens and Forests.

Sale of Plants.

The nursery made last year has been useful to the extent of supplying 1,547 plants for sale. It is at present fully stocked with a mixed collection of plants useful for planting out and for sale.

Para Rubber.

The success of this marvellous product reached a height little dreamt of a few years ago, prices well over 9/- per pound being realized. The result has been one of eagerness to turn any piece of ground into a rubber plantation; and the number of these irregular plantations is surprising; especially is this so in Kedah, where many of the Estates formerly under tapioca are now exclusively or partly planted up with rubber. On the invitation of Mr. NATHAN, District Officer, Balik Pulau, I visited his District and gave a field lecture and demonstration on the best methods of tapping rubber trees. The many squatters who attended have more or less planted up their holdings with para rubber, and from the questions asked, and the keen interest they showed in what I said, proved how greatly they were interested in this cultivation. The old tree in the Gardens was tapped during the year and yielded 8 pounds and 4 ounces making the total yield, since the first tapping in 1885, 52 pounds and 6 ounces. A small parcel of rubber was sent home in October, but as the sales were unfavourable at the time, the Brokers held for the next sale, consequently the account sales will only appear this year, 1910. They further suggested keeping our supplies till they reached at least 2 cwt. I anticipate that during the next few months a sufficient sum will be realized to liquidate the loan advanced by the Treasury to purchase the Nursery site in 1906.

Governor's Hill Gardens.

These have been maintained in good order during the year, the very heavy rainfall has been against them. The hon'ble Resident Councillor presented 40 rose plants which I ordered for him from Messrs. CHATTERJEE of Calcutta, these have been planted out and should in time replace those that are old and worn out.

Coconut Trees Preservation.

I append returns showing that in Penang 331 notices were served calling on owners to destroy 480 dead coconut trees, 332 trunks, 12 heaps of manure and refuse. There were five cases of prosecution which resulted in small fines amounting to \$10. It is worthy of note that 60 of the 480 dead trees are supposed to have been killed by lightning.

In the Province the Inspector reports that the Districts of Simpang Ampat, Matang Tinggi, and Jungong were most attacked during the year. Malakoff Estate was badly attacked by the larvæ of a small moth. For a few months the trees presented the appearance of having been burnt. They eventually recovered and now appear little the worse for their attack. During the attack I twice visited the estate and suggested remedial measures. In the Province 303 notices were issued to destroy 749 dead trees, 1,077 trunks, six heaps of manure and rubbish. There were six prosecutions with small fines amounting to \$8.

W. FOX,

Superintendent of Forests and Gardens, Penang.

Expenditure of the Botanic Gardens, Penang, 1909.

Government Grant.	Estimated, 1909.	Expenditure.
	\$ c.	\$ c.
		Wages ... 4,032 08
		Tools and materials ... 468 62
		Manure and Cartage ... 70 25
		Flower pots ... 150 14
Maintenance of Waterfall		
Gardens ...	4,900 00	Freight ... 24 00
Extension ...	200 00	Plants ... 38 44
		Petty Expenses and
		Miscellaneous ... 94 73
		Superintendent of Immi-
		grants ... 200 00
		5,078 26
		Balance ... 21 74
		\$5,100 00
		Wages ... 1,142 44
		Tools and Materials ... 113 14
Upkeep of Ground's of Gov-		
ernor's Hill Bungalow ...	1,600 00	Flower pots ... 174 70
		Seeds ... 41 04
		Miscellaneous ... 37 00
		1,508 32
		Balance ... 91 68
		\$1,600 00
		Horse Allowance ... 300 00
Travelling and Personal		
Allowance ...	400 00	Field Allowance ... 48 97
		348 97
		Balance ... 51 03
		\$ 400 00
		Allowance to Inspector ... 369 23
Expenses of carrying out the		
Provision of the Coconut		
trees Preservation Ordi-		
nance ...	450 00	Destruction of dead coconut
		trees ... 4 00
		373 23
		Balance ... 76 77
		\$ 450 00
		Purchase of Books and Perio-
Purchase of Books and Perio-		dicals ... 39 81
dicals ...	100 00	Balance ... 60 19
		\$ 100 00

Revenue Collected and paid into the Treasury during the Year 1909.

					\$	c.
Sale of plants	...	...	...	...	551	58
Sale of Coconuts	...	...	...	...	2	50
Miscellaneous Receipts	...	...	...	...	32	67
					<hr/>	
					\$586	75

No. of Notices issued during the year 1909.	No. of dead Coconut trees destroyed.	No. of Coconut trunks destroyed.	No. of heaps of Cattle dung destroyed.	No. of heaps of rubbish destroyed.	Amount of fines recovered.		REMARKS.
					\$	c.	
Penang District 331	480	332	...	11	10	00	5 Prosecutions.
Prov. Wellesley.—							
Central District 148	510	561	...	2	...	...
Northern District 121	136	368	6	...	8	00	6 Prosecutions.
Southern District 34	103	148	...	...	...	...
Total ... 634	1,229	1,409	6	13	18	00	11 Prosecutions.

Return of Rainfall for the Criminal Prison, Fort Cornwallis, and Government Hill during the Year 1909.

MONTHS.			Prison.		Fort.		Government Hill.	
			Ins.	cts.	Ins.	cts.	Ins.	cts.
January	...	...	3	39	4	33	4	41
February	...	...	5	19	4	65	6	22
March	...	...	3	32	5	30	4	54
April	...	...	2	32	2	16	7	98
May	...	...	3	11	4	42	8	04
June	...	...	14	67	12	95	19	88
July	...	...	6	86	5	50	10	05
August	...	...	14	76	14	23	17	85
September	...	...	26	57	27	84	27	77
October	...	...	32	11	28	76	33	28
November	...	...	15	63	14	86	19	38
December	...	...	2	38	1	67	4	38
Total	...	...	130	36	126	67	163	78

STRAITS SETTLEMENTS.

ANNUAL REPORT
ON THE
BOTANIC GARDENS
SINGAPORE,
FOR THE YEAR

1910

BY

H. N. RIDLEY, M.A., F.R.S., F.L.S.,

Director of Gardens, Straits Settlements.



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1911.

Annual Report of the Botanic Gardens, Singapore, for the Year 1910.

Staff.

There were considerable changes in the staff of the Gardens this year. Mr. T. W. MAIN left in May, and was succeeded by Mr. J. W. ANDERSON who arrived on July 29th. Mr. FOX retired from the service on pension in March after a service in the department of thirty-one years. Immediately on his retirement the Penang Botanical Gardens were put under the charge of MOHAMED HANIFF, the Overseer, and finally abolished in the middle of the year, the ground being presented to the Municipality for a water reservoir. The apprentice, PAUL, was dismissed and one MARIANI was taken on in his place. A Label Printer, DANIEL, was taken on at the end of the last year and has remained on till the present year. The Clerk of the Rubber Experiments, I. SANDOSUM, left in October and POONOSAMY replaced him in the Economic Gardens and a new Bill Collector, DURAISAMY, was taken on in place of the latter.

There was a great scarcity of labour in the early part of the year and only very inferior coolies could be obtained at any price; Javanese of any use were very difficult to procure, and recourse had to be had to Boyanese and Tamils. Towards the end of the year matters became better and a sufficient supply of labour, chiefly Tamil, was obtained. This shortage was due to the great demand for the rapidly increasing rubber estates in the vicinity.

In order to induce as far as might be the Tamils to settle down and stay in garden employ it was necessary to build a suitable set of lines for them. This was a wise step in the present state of the labour market. The Gardens have gradually become a dumping and training ground for Javanese. The younger ones came to learn Malay, the old and sick ones to earn a little and die. Whether they come as coolies with the intention of becoming gardeners or rubber tappers, they come merely for a training or to be able to say they have been employed in the garden so that they can easily find posts at a higher salary, when they are more or less efficient. This results in our getting only the rawest and often most useless material, who are trained here for the benefit of every part of the Peninsula except ourselves and these men when worth their salary leave for a billet on a rubber estate either of themselves or by the seductions of a crimp. We hope that the new Tamil coolie lines will form an inducement to these men to form a permanent settlement, but it should be noticed that their cost is a heavy one on the Gardens where it would be more desirable to spend all the hard earned balance in progressive work.

The better class of planters in the neighbourhood refused to take on men from the Gardens who had not received permission to leave, but natives and others were not so considerate. One Dutch crimp was found soliciting the men to run away. It is regrettable that there is no law capable of dealing with these nuisances.

There was comparatively little sickness among the coolies during the year but one elderly man died of phthisis and a child of about two years of age died of atrophy and weakness. Twins were born to a Malay in the lines, a very unusual circumstance, but only one of them survived its birth many days.

Visitors.

A very large number of botanists and agriculturists of note visited the Gardens during the year as well as very many planters from the Native States and elsewhere and the usual stream of tourists.

Among the best known visitors were the GRAND DUKE and DUCHESS of Brunswick; SULTAN OF LUBWA, Shan States; Dr. WILLIS (Ceylon); E. GEDGE; Prof. ROBERT WALLACE; Mr. STRICKLAND (Mysore); Dr. GUNNING (Leicestershire); G. P. WILDER (Honolulu); E. A. KORN (New York); A. S. HARDY (New York); I. E. FRASER (Sydney); E. DE KRUYFF (Department of Agriculture, Buitenzorg); A. W. PRAUTCH (Manilla); I. VAN BRERO (Batavia); H. E. WESTENDORP (Java); OTIS BARRETT (Washington); Baron C DE S LOHMAN (Inspector of Native Agriculture, N. Indies); Dr. SCHLECHTER (Kgl. Bot. Museum, Dahlem); M. C. COISPELLIER (French Indo-China); A. LEGRAND (Phuquoc); Mr. BEEBE; Dr. GEORGE KLEBS (Heidelberg); GEORGES VERNET; Capt. C. A. LITTLER (Commercial Agent for Tasmania); R. SPANGENBERG (German New Guinea); Prof. G. SENN (Basel); Dr. S. V. SIMON (Gottingen); Dr. OSKAR WALTHER and Dr. N. MAXIMOW (St. Petersburg); Dr. BARTHELS; M. E. M. LEPLAE (Brussels); Dr. HENKEL (Darmstadt); Dr. HAYATA; Y. KAGAMI (Director Horticultural College, Chibaken, Japan); KUWAGARO HAGA (Bureau of Production, Formosa); Dr. TSUKIDA (Tokio); H. IBARA (Osaka).

The band of the Middlesex Regiment played on numerous occasions by moonlight and the Fifes and Drums every Wednesday. These entertainments proved very popular.

There were many complaints about reckless driving of Motor Cars in the early part of the year, and one car containing a man and woman drove over one of the ducks belonging to the gardens lake and killed it. The culprits who were driving at a dangerous speed on seeing what they had done merely drove away faster and it was regrettable that they could not be detected. Steps, however, were taken by the police and several bad drivers were cautioned with the result that the nuisance much abated. There were no thefts of any importance.

Buildings, Etc.

The new bungalow for the Assistant Curator was built by the Public Works Department. The old watchmen's quarters was pulled down and new ones built on a more convenient site. A special vote was given for this. The cooly lines were repaired and re-atapped and two insanitary houses in the lines destroyed and rebuilt in better position. A new cooly lines for Tamils with a well and out-houses was built at a cost of 1,000 dollars from Garden funds. The floor of the rubber-curing house was laid down in cement, and a new packing shed built and the potting shed in the Economic Gardens was rebuilt. The Garden store house was repainted and whitewashed.

Telephonic communication has been established between the Botanic Gardens and the Economic Gardens, which has saved a great deal of waste of time in communication formerly done by messenger.

Beds and Borders.

Owing to the large demand for shrubs, etc., a small addition was made to the nursery, while new rose beds have also been made on ground adjacent to the nursery. This entailed a lot of work as a bamboo stump proved very difficult to extricate and ultimately two oxen with the help of a large gang of coolies were requisitioned to remove it.

The ground behind the Herbarium on which the old Aviary stood has also been attended to. A few of the large boughs overhanging the Herbarium were removed in order to keep the building drier, while the soil was well manured and suitable plants planted therein.

Tree cutting occupied a considerable amount of time, one in particular (*Adenanthera bicolor*) being very awkward to remove. The wood was extremely hard and the stump took fully three weeks to dig out and remove. The last of the old original clove trees on the band stand had to be removed, having succumbed to old age.

Throughout the year the troublesome waterweeds have had to be removed from the lake several times, while fresh Nymphæas were planted round the margins to replace the ones which had become worn out.

A small jungle path was also made leading from the flower house by the back of the fernery and propagating houses, joining the older rockery at the entrance to the jungle.

The ground round the Assistant Curator's quarters was cleared of bracken and scrub, beds and borders being made and suitably planted.

New or Noteworthy Plants.

The following plants flowered and fruited in the Botanic Gardens for the first time:—

Malay Peninsula.

- Strobilanthes albostrigata*.—Pahang.
Thysanotus siamensis, n. sp.—Setul.
Cladium glomeratum.—Singapore.
Fimbristylis longispica.—Setul.
Dendrobium serpens.—Perak.
Euphorbia synadenium, n. sp.—Penang.
Ceratostylis linearis, n. sp.—Penang.
Hoya lasiantha.—Perak.
Didymocarpus, n. sp.—Gunong Kerbau.
Ottelia alismoides.—Penang.
Gastrochilus acutus, n. sp.—Setul.

Malay Islands and Polynesia.

- Cœlogyne concinna*, n. sp.—Sumatra.
Dendrobium, n. sp. near *D. crumenatum*.—New Guinea.
Cyrtandra mammillata.—Borneo.
Saccolabium fragrantissimum, n. sp.—Borneo.
Dendrobium spectabile var.—Solomon Islands.
Eria ramulosa, n. sp.—Sumatra.
Kentia Woodfordi.—Solomon Islands.
Licuala grandis.—New Britain.
Acacia Auriculæformis.—Australia.
Dendrobium Donckærti.—Annam.
Primula gigantea.—Siberia.

India and Ceylon.

- Dendrobium moschatum*.—Assam.
Lagenandra toxicaria.—Ceylon.
Hibiscus cannabinus.

Africa.

- Apicra aspera*.
Ochna Kirkii.
Oberonia equitans.—Seychelles.
Kalanchoe Kirkii.

America.

- Solanum sisymbriifolium*.—Brazil.
Aechmæa Mariæ-Reginæ.
Muntingia calabura.—West Indies.
Oenothera Drummondii.—N. America.
Spathiphyllum longirostre.
Aristolochia fimbriata.
Catasetum, sp.
Læliocattleya La France —(Hybrid).
Anthurium digitatum.
Lobelia syphilitica.
Tagetes signata var *pumila*.—Mexico.
Anemia rotundifolia.—(Produced spores)

Europe.

Silene penduliflora, compacta.

Alyssum maritimum.

Tanacetum vulgare.

Salvia glutinosa.

Plant and Seeds Sent Out.

Excluding Para rubber seeds, 211 packets of mixed seeds and 244 packets of palm seeds were distributed throughout the year. The recipients were:—The Botanic Gardens of Brussels, Berlin, British Guiana, Buitenzorg, Calcutta, Cambridge, Ceylon, Durban, Edinburgh, Formosa, Glasnevin, Hongkong, Kew, Manila, Nishigawara, Japan, Ogasawara, Japan, Saigon, Seychelles, Tonga, South Pacific, Uganda, Washington, Victoria, Department of Agriculture, Federated Malay States, Damman & Co., Dreer & Co., Philadelphia, and the Department of Agriculture, Mysore.

Plants were also supplied to Government House Domain, the Resident, Malacca, General Hospital, Military Gardens at Blakan Mati, A. J. SIMONS, Pontianak (in exchange), TAN BEN CHIANG (in exchange), and the Botanic Gardens of Kew and Mysore.

Herbarium.

The herbarium was largely increased by the collections made in the expeditions of the Director, and the Penang herbarium made by Mr. CURTIS was transferred to Singapore, and such plants as were required from it to complete the Singapore collection were incorporated therein. The following additions were made by exchange:—from Manila 59; Sarawak 8; from Calcutta chiefly Malayan plants of Wray and Kunstler 297; British Museum 10; from Mr. KLOSS, Malayan plants 21; and specimens were also received from Mr. BURN-MURDOCH, and MOHAMED HANIFF.

The following were the plants sent out: to Kew Gardens 675, British Museum 620, Calcutta 266, Berlin 193, Manila 99, Buitenzorg 14, to Mr. LILLY a number of mosses for identification.

The Singapore collection of *Laurineæ* and the *Loranthaceæ*, *Proteaceæ*, and *Thymeleaceæ* were sent on loan to Mr. GAMBLE for the materials for a Flora of the Malay Peninsula, a number of palms also to Dr. BECCARI for his work in the *Lepidocaryeæ*, and some ferns to Colonel BEDDOME to whom we are indebted for identification of the *Selaginellæ* and many ferns. Some injurious fungi attacking rubber trees were sent to Kew for investigation and one of them proved to be a new species of *Eutypa*, described as *Eutypa caulivora* by Mr. MASSEE in the "Kew Bulletin."

Several specimens of timbers of interest were added to the collection including those of Balau Betul, *Shorea materialis* Ridley and Balau Bukit, *Shorea collina* Ridley, described from specimens sent by Mr. A. M. BURN-MURDOCH.

Expeditions.

The Director visited Penang to take over the herbarium, library and such plants as were required for the Singapore Gardens in view of the abolition of those of Penang. After this he made an expedition to Kedah, Perlis and Setul. The object of this botanical expedition was to discover the boundary line between the Siamese flora and that of the Malay Peninsula. Large collections of herbarium specimens and living plants were made and brought to Singapore. These with the collections from Lankawi Islands made by Mr. CURTIS and the Director, the collections of Dr. KEITH in Bangtaphan and by other collectors in Trang, Tongka and such localities show that there is a complete change of flora at Alor Sta in Kedah and prove that at no distant date the Malay Peninsula south of Kedah peak was isolated from Tenasserim by a large tract of sea dotted about with islands of limestone rock, abounding in seabirds whose guano still remains in the caves of these islands. The flora of this new settled region was derived from Burmah and Siam, and contains hardly any purely Malay element. A full account of the expedition and the flora of this country is prepared for the press. Many thanks are due to Mr. W. G. MAXWELL and Mr. MEADOWS-FROST for great assistance to the Director in making these researches.

A short expedition was made earlier in the year to Kota Tinggi in Johore where aided by Mr. LEDOUX the Director obtained a large series of river bank plants, among which were a remarkable new *Utricularia* with extremely long stems and a new species of *Medinilla*. A number of interesting plants were also obtained in a

short stay at Kukub in Johore. The Director also visited Kuala Lumpur for a few days in December to consult with other members of the Committee as to steps to be taken for the International Rubber Exhibition to be held in London this year.

Publications, etc.

The "Bulletin" was published every month as usual, and there was an increased demand for it. Besides articles written for it by the Director there were published the following: Symbiosis of Ants and Plants, *Annals of Botany* ix p. 457. Note on the Flora of the N. W. States, Malay Peninsula (letter to Sir J. HOOKER) in "Kew Bulletin" 1910, 202. Poisonous principles of *Anacardiceæ*, *Pharm. Journ.*, vol. 84, 360. The account of the expedition to Temengoh was printed also in a volume of the Straits Branch of the Royal Asiatic Society which, however, was not actually published by the end of the year.

Figures and descriptions of three plants sent from the Botanic Gardens to Kew and flowered for the first time in Europe were published in the "Botanical Magazine;" they were *Gamogyne pulchra* n. sp. from Borneo, *Chirita rupestris* Ridl. from Lankawi and *Tristellateia Australasica* from Singapore. The fungus *Eutypa caulivora* was also figured and described from Singapore in the "Kew Bulletin." The usual course of lectures on Botany was given to the Medical students in the latter half of the year, and the Director also delivered a lecture on *Fomes* and *Diplodia* at the Agricultural Exhibition in August.

Agricultural Exhibition.

The last of the continuous series of Exhibitions of Agriculture and Horticulture was held in August. Till he resigned his post at the Gardens Mr. T. W. MAIN held the position of Honorary Secretary, and was then succeeded by Mr. RODESSE. The exhibition attracted a large number of foreign visitors as well as local residents, and was very successful. As usual the Garden staff acted as committee men and judges. Some remarkably fine samples of rubber prepared in the Botanic Gardens were shown and a collection of historical rubbers, showing the earliest samples of cultivated rubber ever made, from the Botanic Gardens collections attracted much attention. A very large number of palms, aroids, and other ornamental plants were also supplied by the Gardens for decoration.

At the suggestion of the Director a scheme for legislating against the spreading of the dangerous fungus *Diplodia rapax* in rubber estates was devised. The disease seems to be very prevalent in some parts of the Peninsula and might easily become extremely destructive.

Bhang.—As there is no known chemical test for Indian Hemp (Bhang or Ganja) which drug is prohibited in the Straits, the Director had to attend the courts on several occasions to identify the drug botanically.

ECONOMIC GARDENS.

The greater part of the work of these gardens was connected with the rubber industry. This work has increased to such dimensions that the whole of the staff of this garden was occupied nearly the whole time, and is not sufficiently large to make any great progress in other directions. The very large demand for rubber seed chiefly in the African Colonies entailed a vast amount of work in clearing under the trees, gathering, sorting, packing, parcelling and shipping. A large number of seed had to be supplied from other plantations, to the various Colonies, but for some unexplained reason these seeds did not possess the amount of germinative power of those of the Singapore Gardens which therefore are in high demand and still keep up the price of ten dollars a thousand.

A serious flood in January destroyed thirty Para rubber trees, mostly of large size, and swept away a large number of seed, causing a considerable loss to the garden. The plot referred to in last year's report as cleared for planting has been redug and well drained and planted with 414 rubber trees and 32 plants of *Raphia Ruffia* and 32 plants of *Raphia Hookeri* both palms of value as fibre plants. The rubber plot between Cluny and Bukit Timah Road has also been kept clean and the drains kept open. This plot has cost much labour and constant attention but as the rubber trees get up, the cost of weeding will be less.

Experimental tapping.—Tapping and curing by different methods was carried on throughout the year, and 2,429 lbs. of all grades of rubber was cured and mostly disposed of within the year. A fair proportion of the rubber was sold locally. A sample sold in London obtained a record price at that day sale. A large number of

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samples of latex and rubber treated with formalin, etc., were submitted to various analysts for investigation and report.

The third Annual Report on the experiments of the previous year was published and has attracted much notice and been in steady demand by planters.

In the matter of plant disease, observations on *Fomes* which has been troublesome in the gardens, *Eutypa caulivora* and *Diplodia* and *Corticium* have been continued. A case of dieback of a young rubber tree due to *Eutypa* was observed in the gardens, the first definite evidence of its attack on living plants.

A large number of samples of trees attacked by various fungi were sent during the year to the Director for report. The fungi were chiefly *Diplodia* and *Corticium*, the former mostly from the Malay States, the latter from Borneo. *Corticium* seems to be more injurious in Java and Borneo than it is in the Federated Malay States.

Other plants.—The chief demand has been for shade and fruit trees and trees for windbelts, about 1,000 having been sent out. There has been an increasing demand for seed and plants of fruit trees but there has been some trouble in getting these at a reasonable rate owing to the poverty of the fruit crops for the last few years. The wild mania among natives in Singapore for planting rubber in every corner seems to have produced a great falling off in the supply of fruit, vegetables, poultry and even pigs, all being neglected or abolished to make way for Para rubber. It is highly desirable that the cultivation of fruit trees, neglected for some years, be encouraged.

There has been a considerable demand also for Leguminous cover crops, for green soiling and *Passiflora foetida* seed; also a small demand for Coca for hedging in estates and chocolate for New Guinea.

The largest demand for miscellaneous economic plants has been from Formosa where the Japanese have begun to start systematic tropical agriculture. Seeds of *Brucea sumatrana* have been sent from time to time to London for experiment and investigation.

Outside work.—A plot of ground at Goodwood Estate measuring seven-and-a-half acres was cleared, drained, fenced and planted with five hundred and seventy trees of Para rubber.

A plot of reclaimed land below Mount Zion also seven-and-a-half acres in extent was cleared and planted with 810 coconuts.

The rubber from the trees in Government House park was smoked and finished off and sold for the benefit of the Government House funds.

PARA RUBBER SEEDS AND PLANTS EXPORTED DURING 1910.

Seeds from the Botanic Garden trees	...	...	321,300
Seeds purchased elsewhere	..	...	1,005,000
			<hr/>
Total seeds	...	...	1,326,300
			<hr/>

The following were the localities to which the seeds were sent :—

	Seeds.	Plants.
Singapore ...	15,500	35,029
Seremban ...	5,000	
Sarawak ...	2,000	
Kelantan ...	129,000	
Dutch Borneo ...	2,000	
Burma ...	5,000	
China ...	600	
Uganda ...	513,600	
Australia ...	400	
Sierra Leone ...	10,000	
Southern Nigeria ...	150,600	
British Guiana ...	84,600	
Papua ...	30,000	
British Honduras ...	1,800	
Liberia ...	273,000	6,000
C. Curtis (Barnstaple) ...	103,200	
	<hr/>	<hr/>
	1,326,300	41,029
	<hr/>	<hr/>

Coconut Trees Inspection.

Notices were served on ninety-seven persons to clear away stumps, dead trees and rubbish and 200 dead trees and 154 stumps and logs and 74 piles of rubbish likely to or containing beetles were destroyed.

The number of dead trees is small showing the effects of legislation in exterminating the red beetle. All or almost all the destruction of palms was caused by the black beetle; the red beetle is really nearly extinct, at least in Singapore. It will now be comparatively easy in future to guard the estates from any loss, though of course continued inspection will be necessary. The great and increasing importance of the coconut industry thoroughly justifies the care taken and the small expenditure employed in protecting the coconut trees by inspection.

Cost of Up-keep.

						\$
Inspector	...	...	...	...	...	324
Cooly	...	...	...	...	...	120
Transport	...	...	...	...	...	210
Total						<u>\$654</u>

REVENUE AND EXPENDITURE FOR THE YEAR 1910.

Up-keep of Botanic Gardens, Singapore.

REVENUE.				\$	c.
By balance in Bank on 1st January	...	...	...	1,960	29
Government Grant	...	...	...	7,950	00
By sale of plants and seeds	...	...	...	15,400	95
By sale of prepared rubber	...	...	...	7,551	07
Total				<u>\$32,862</u>	<u>31</u>

EXPENDITURE.				\$	c.
Salaries of Mandor, Coolies, etc.	...	...	...	11,344	12
Bills	...	...	...	15,878	68
Crown Agents for Tools, etc.	...	...	...	866	07
Balance remaining in Bank on 31st December	...	...	...	4,773	44
Total				<u>\$32,862</u>	<u>31</u>

BOTANIC GARDENS,
SINGAPORE, 6th February, 1911.

HENRY N. RIDLEY,
Director of Gardens, S. S.

STRAITS SETTLEMENTS.

ANNUAL REPORT
ON THE
BOTANIC GARDENS
SINGAPORE,
FOR THE YEAR

1911

BY

H. N. RIDLEY, M.A., F.R.S., F.L.S.,

Director of Gardens, Straits Settlements.



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1912.

Annual Report of the Botanic Gardens, Singapore, for the Year 1911.

Staff.

The Director of the Botanical Gardens, Mr. H. N. RIDLEY, was on leave for six weeks in November and December, and after taking leave in the latter half of January, 1912, till the end of February, retires from the service after a period of over 23 years of service, *i.e.*, from November, 1888, till the present year.

The Curator, Mr. R. DERRY, was away on special duty in England for four months, from January to June, arranging for the patenting of his new rubber-smoking machine.

The apprentice, MARIANI, was dismissed and a new man DAVID was appointed in his place. An overseer for Tamils was also taken on by name of EDWARD. The Bill Collector, DURAISAMY, was discharged and RAPHAEL, the former Bill Collector, was reinstated. The Printer who had been employed in the Gardens for over thirty years, retired with a gratuity of three hundred dollars.

There was a great scarcity of labour throughout the year, and a rise of wages was found necessary. As mentioned in the report of the previous year, the class of coolies now procurable is very poor as the demand for labour on the estates is still very great.

During the first part of the year there was a good deal of malaria among the coolies, as there was all over Singapore, but the latter end of the year showed a marked improvement in health all round. Two young children died in the coolie lines. Owing to the unusual drought the water supply of the coolie lines failed at one time and water had to be brought to the coolie lines from outside by cart. The attention of the Public Works Department was called to this state of affairs, surveys and plans were made, and it was agreed by the Government that next year water should be laid on to the coolie lines and the quarters of the staff.

Weather.

The weather was unusually hot and dry during the months of February, March, April, June and July, entailing much extra work in watering the gardens and causing the death of a number of palms, which curiously in many cases only actually died after the rains had come.

On November 25th, there was a most unusual fall of ten inches of rain in six hours producing a heavy flood which upset a large number of trees in the Economic Gardens.

Visitors.

As usual, a large number of agriculturists and botanists visited the gardens, besides the ordinary travellers. Among the former were:—Mr. N. HOLTZ (Australia); Mr. T. KAWAKAMI (Formosa); M. LEMAIRE (Chef de Culture Congo Belge); Mr. SOMMER (New Guinea); M. BRENIER (Hanoi); M. KELWAY BAMBER (Ceylon); Mr. DEWEY (Washington); Prof. VAN ITERTSON (Delft, Holland); Mr. EVANS (Trinidad); Dr. BUCHER (Buea, German Cameroons); Dr. MILLSAUGH (Department Botany Field Museum); M. VERNET and many others.

There were no complaints of damage done or prosecutions by visitors or others during the year.

The Five and Drums' Band of the East Kent Regiment played every Wednesday, in the afternoon, and was much appreciated. The full band played also by moonlight on two occasions.

Plants and Seeds received.

There were 843 plants and 550 packets of seeds received.

The contributors were as follows:—

TAN BEN CHIANG, Dr. Y. FUGINI (Formosa), B. KAWAKE, Messrs. J. CARTER & Co., (purchased), Commander E. DERIJ, Mr. NEUBRONNER, Yokohama Nursery, ALBERT SCHULIE (Hamburg), Mr. N. FISCHER, Mr. SEAH LEANG SEAH, M. HERB (Naples), and the Botanical Gardens of Jamaica, Edinburgh, British Guiana, Calcutta, La Mortala, Kew, Paris, British Honduras, Missouri, Sydney, Darwin, Natal, St. Petersburg, Trivandrum, Gold Coast and Saharanpur.

Plants and Seeds distributed throughout the Year.

Excluding Para rubber seeds, 160 packets of mixed seeds and 60 packets of palm seeds were distributed throughout the year.

The recipients were as follows:—

The Botanic Gardens of Adelaide, Bangalore, British Guiana, Brussels, (Eala), British Honduras, Baroda, Calcutta, Cambridge, Ceylon, Edinburgh, Formosa, Glasnevin, Jamaica, Kew, Lahore, Madras, Manila, Natal, Port Darwin, Seychelles, Sydney, New South Wales, Tonga (South Pacific), Washington, Uganda, (Entebbe), Christmas Island, Damman & Co., M. Herb & Co., F. HENKEL (California), and H. WRIGHT (London).

Plants were also supplied to Government House Domain, Raffles Girls' School, the Bureau of Agriculture, Manila, Military Gardens at Blakan Mati, Commodore DERY (in exchange), J. VAN BRERO (Samarang, in exchange), TAN BEN CHIANG (in exchange), Experimental Plantations, Taiping, and the Botanic Gardens of Kew, Port Darwin and Entebbe.

New Plants, flowered.

Among the interesting plants which flowered this year for the first time were:—

- Decaschistia pulcherrima*, n. sp.—Setul.
- Bulbophyllum*, sp.—Zamboanga.
- Areca glandiformis*.
- Ardisia linearifolia*, n. sp.—Perak.
- Shorea bracteolata*.—Malay Peninsula.
- Careya arborea*.—Indo-Chine.
- Payena grandiflora*.—Sumatra.
- Chlorocodon Whitii*.—Uganda.
- Wallichia disticha*.—Assam.
- Pittosporum pentandrum*.—Australia.
- Cestrum salicifolium*.—South America.
- Bignonia hirtella*.—South America.
- Cocos campestris*.—South America.
- Acanthorhiza aculeata*.—South America.
- Cattleya*, (*Brassio-cattleya*).—Minerva.
- Dombeya*, sp.
- Buckinghamia celsissima*.—Fruited.

Expeditions.

The Director visited Semangkoh Pass, Selangor, in the spring and obtained a large number of new plants and then made an expedition with Mr. H. C. ROBINSON and Dr. HANITSCH to the Pulau Adang group of islands off Lankawi, also in February in the *Seabelle*. A considerable collection of plants were made on these islands which had never before been botanically examined. In July, he visited with Mr. ROBINSON and Mr. KLOSS the mountain of Gunong Tahan, in Pahang, where six years previously Messrs. ROBINSON and WRAY had made an important collection of the flora showing the great interest attaching to this, our highest mountain. The ascent was made up the Tahan river and the whole expedition occupied seven weeks. A

very complete collection of the plants from the upper ranges was made, including one new genus of *Rutaceæ* and many new species. The flora showed a marked affinity with that of Mount Kinabulu in Borneo. Besides the dried plants a considerable number of living plants were brought down. Unfortunately the plant collector broke down with fever on reaching an altitude of 3,000 feet and had to be sent back, together with the Director's boy who was also too ill to proceed; but the loan of two Dyak collectors was obtained from Mr. ROBINSON and these proved indispensable.

The Director also visited several rubber estates in Johore to advise in cases of outbreak of disease.

Herbarium.

Besides the collection made in the expedition above mentioned, plants were received from MOHAMED ANIFF, 206 from Lankawi Island and Gunong Kerbau, from Berlin 320 specimens from German East Africa, from Calcutta 78, and from Manila 132 Philippine plants.

There were distributed to Kew 543 specimens, to the British Museum 355, to Calcutta 102, to Berlin 28, to Buitenzorg 57, to Dr. CHRIST (ferns 13), to the Rev. W. LILLY 37 mosses, and a collection of economic plants to the Tokio Botanic Gardens, Japan. Specimens were sent on loan for examination to Dr. BECCARI (palms), to Mr. BURKILL of Calcutta (*Dioscoreaceæ*) and some specimens to Buitenzorg.

Publications.

The "Agricultural Bulletin" was published regularly throughout the year, but owing to the uncertainty of the future after the retirement of the Director, it was found necessary to announce to the subscribers that it would cease at the end of the year.* This is regrettable as it had become a journal very much in demand and there was a continuous rise in the number of subscribers. A pamphlet on the history of the rise of the rubber industry in Malaya by the Director with additional statistics by Mr. LEWTON BRAIN was written and published at the Rubber Exhibition in London, and over five thousand copies were disposed of at the Exhibition. A paper on the flora of Lower Siam was published in a volume of the Straits Branch of the Royal Asiatic Society by the Director and papers on the flora of Pulau Adang and on the plants collected at Gunong Tahan, and one on new and rare plants of the Malayan region and on the plants collected by Mr. MOULTON at Batu Lawi in Borneo were completed and sent for printing. The Handbook on Tropical Agriculture dealing with spices was finally revised for publishing by Messrs. MACMILLAN. Figures and descriptions of three plants sent from the Botanic Gardens of Singapore and Penang and flowered for the first time in Europe, were published in "Botanical Magazine" during the year. They were:—*Pseuderanthemum Malaccense*, *Torenia atropurpurea*, Ridl., and *Cirrhopetalum longissimum*, Ridl.

A very fine climber which had been over twenty-five years in the plant house without name, and supposed to be *Chonemorpha macrophylla* was by Colonel PRAIN identified as one of the three species confused under this name, and was named *Ch. Rheedei* in a paper on the Chonemorphas published in the Bulletin. It was a native of Ceylon and Southern India and *Ch. penangensis* new species from Penang.

A new fungus discovered on fruits of pepper in Singapore and Borneo was sent to Kew and named *Colletotrichum necator* by Mr. MASSEE. The usual course of lectures on botany to the medical students could not be given this year owing to the absence of the Director on leave during the session.

Beds and Borders.

There has been an increasing demand for palms, flowering and ornamental shrubs throughout the year and consequently much time was occupied in lifting and packing those plants. A good supply of such plants is being maintained, but this has not been such an easy matter as in former years owing to the exceptional drought experienced.

One of the largest plants of *Brownea grandiceps* was killed by the persistent attacks of a shot-borer. Repeated attempts were made to save the tree by applications of coal-tar and a mixture of Jeyes fluid and soft soap consecutively but without avail. As all the roots and branches were burnt on the spot, no other tree in the immediate vicinity seems to have been attacked.

A large selection of Nymphaeas were obtained from Messrs. Dreer of Philadelphia and planted in the Garden Lake, from which a good display was obtained during the earlier months of the year. *Hydrocleis commersoni* or Water Poppy

* The "Bulletin" has been continued.

(previously thoroughly established in tubs) when placed in the open lake failed to grow and gradually disappeared. Another attempt will be made to establish this plant as its flowers are of exceptional beauty.

As the *Wormias* on the small island in the upper lake had grown to such an extent as to completely hide the curious aerial roots of *Pandanus Kaida*, it was found necessary to severely prune them. It is a debatable point whether all or at least a large part of the *Wormias* ought not to be removed from this part of the Garden as their roots spread rapidly and are gradually filling up the lake.

Advantage was taken of the prolonged drought to deepen the lower lake. Owing to its surroundings this lake has never been a great success and it is doubtful if the deepening carried out this year is of a permanent nature as the lake readily silts up again owing to the fact that one of the sewers from the main road empties a large part of its sand and rubbish into it. A large quantity of the mud and soil from the lake was used in strengthening the banks while the rest was stored for future use as it was found to be extremely rich in humus. This soil when mixed with a little sand has been largely used as a mulch and also as a compost for potpalms yielding excellent results.

Troublesome water weeds in the upper Garden lake were removed as in former years. As there are few suitable places for climbers to be seen to the best advantage, tall growing palms were utilised for this purpose by placing wirenetting round the stem to a height of 6 or 8 feet. A pleasing effect was thus obtained and during the coming year an endeavour will be made to utilise many more palms for this purpose.

The only remaining specimens of *Michelia Champaca* and *Manicaria saccifera* died and were removed.

Owing to the drought, the keeping of beds and borders bright with annuals, etc., was a matter of considerable difficulty. Dahlias were planted in beds this year for the first time and thoroughly justified themselves. Mention may also be made in this respect of *Lobelia syphilitica* which has proved a valuable acquisition.

Many plants were severely pruned during the year and most of the plants thus treated have improved greatly in appearance and floriferousness.

Economic Section.

The Curator was absent from January 31st to June 4th.

With the gradually increased area of previous years very little new ground has been opened and indeed, none could have been attempted except for extra labour paid from revenue by sales of rubber and rubber seeds. All the rubber ground lies on shallow soil with water in most parts at one foot below the surface and, as will be understood, in such situations weeds are prolific. Apart from other considerations it is necessary that this land be kept clean so as to clean-pick fallen rubber seeds. For this purpose—excepting two men in the nursery—the rest of the permanent band of 32 men were employed whenever available.

To keep the arboretum in fair order eight mowers were estimated as necessary, but for several months during the year the band was included with the rest of the employés on the rubber ground.

For collecting and packing rubber seeds; cultivation of other crops and maintenance of plots; general maintenance including repairs, damages—men have been drawn from maintenance work as the necessity occurred.

Despite the phenomenal drought which necessitated a small band of water carriers, considerable damage was done in January and December of the year under review by floods, through the loss of 60 Para rubber trees mostly large trees, in fact, some of the oldest, in low-lying parts of the garden.

New work includes clearing, draining and opening a small area (which it is intended to extend as labour permits) about two acres for the reception of various economic plants and fruit trees.

The rubber plot between Cluny and Bukit Timah Roads, containing over 500 trees planted 22 feet by 20 feet has been improved by opening cross drains between the rows of trees. Altogether 37 drains 2 feet by 1 foot six inches averaging 80 yards long were completed. The mere excavation of soil was a light task but the amount of hard wood cut through and removed represented occupation for a long time with a small band of men.

Owing to the paucity of fruit crops and consequent difficulty of obtaining seeds, the stock of fruit trees had become low but advantage had been taken of the 1911 abundant crop and all the fruit seedlings most usually in demand have been re-stocked.

Sale of Plants and Seeds.

The demand for various economic plants and seeds, including fruit trees, has been above the average but does not call for special remark under the heading of rubber. Altogether 837,599 Para seeds were distributed. Of these 372,500 were garden seeds and the remainder purchased or packed to order.

The seeds were despatched as follows:—

Government of Nigeria	...	...	...	355,000
British Guiana	...	...	...	60,000
British Honduras	...	...	...	1,800
Uganda	...	...	...	54,000
Papua	...	...	...	53,400
Sylhet	...	...	...	5,400
Mexico	...	...	...	2,400
Port Darwin	...	...	...	500
Saigon	...	...	...	10,200
Christmas Island	...	...	...	2,000
Kelantan	...	...	...	75,400
Destination unknown, Messrs. Boustead & Co.	...	...	...	100,000
C. Curtis	...	...	...	117,400
Total				837,500

Seeds consigned outside Malaya are packed in special tins locally made, each tin is capable of containing 600 seeds and with the packing material (padi arang) rice husk burnt to charcoal, comes under the 11 lb. limit of parcel postage. Seeds are placed in the tins, one by one, in 12 layers of 50 each and the rice charcoal is carefully filled in so that the 600 seeds, in effect, lie in compartments. The tins are then stitched in canvas coverings on which the address is hand-printed and declaration form affixed. In this way after an interval of ten weeks, good results have been obtained varying from 50 to 90 % of germination.

It will be, however, apparent that the work involved is considerable. Out of the seeds there were 1,055 parcels posted (mostly distributed *via* Brindisi) containing 603,000 seeds; 262 parcels or 157,000 seeds consigned by freight and 77,400 seeds packed in boxes for despatch by coasting steamers.

The sale of Para seedlings only reached 5,000 plants.

Rubber Experiments.

Tapping different group of trees was continued throughout the year except on very wet days, but owing to loss of trees through floods it may be necessary to re-arrange the groups on a new basis.

During the year 2,326 lbs. of sheet and biscuit were prepared, making a total of 3,230 lbs. all grades including scrap, old and new. Sales amounted to 2,415 lbs. realizing \$4,919.51. The rubber obtained is slightly in excess of previous years, but the value is slightly less due to the fall in price of raw rubber. Small quantities of rubber and some latex were as usual supplied for analytical purposes.

Goodwood Estate.

Considering the disadvantage of situation Para trees have grown well on Goodwood Estate and the seven-acre block was maintained in good order up to the end of October. Since then weeds are rife, but with fair weather this will be remedied. It should be remarked that, there is very little fall in the drains, and during very wet weather the flooded ground is unworkable.

Mount Zion Plantation.

A fire occurred on this coconut block and did slight damage. The trees destroyed have been replaced and all are now growing fairly well.

Penang Gardens.

The scheme for converting the Penang Gardens into a reservoir having fallen through, the Gardens have been, it is understood, re-transferred to the Government. It

will be remembered that the Gardens were handed over to the Municipality in 1910 immediately after the retirement of Mr. FOX. During the intervening period they were under the charge of MOHAMED ANIFF who maintained them in as good a condition as was possible under the circumstances. Their resumption by the Government as Botanical Gardens again will be received with much gratification by the numerous botanists and horticulturists in all parts of the world who constantly expressed their regret that these fine and celebrated gardens should be destroyed. No Curator has as yet been appointed to take charge.

Rubber Exhibition.

A series of specimens were prepared and sent from the Botanic Gardens to the Rubber Exhibition held in London in June.

They included specimens of the trunks of adult trees showing forms of tapping, samples of rubber and specimens showing leaves, flowers and fruit, and a case of historical specimens, illustrating the development of the industry, and comprising the first biscuits, and sheet, and the first tyres made from cultivated rubber. They proved a very attractive exhibit at the Show. The Director also attended meetings in Kuala Lumpur to arrange about the Planters' exhibits.

Bhang.

There were a number of cases of smuggling of Indian hemp into Singapore contrary to regulations, and as usual the Director attended Court on these occasions, to identify the drug.

Government House Domain.

The Government House grounds and Domain were again, in November, placed under the control of the Botanic Gardens Department and steps were taken to get them into good condition again as soon as possible. Upwards of two thousand ornamental plants and shrubs were supplied by the Botanic Gardens. An additional number of Para trees were planted by an extra gang of ten coolies employed for this purpose. Repairs were done to the bank of the croquet lawn damaged by the rain, and the gully which had become a jungle of weeds was cleaned in part, and planted with ornamental plants. A great deal of work will have to be done next year, before the grounds are in a fit condition.

Inspection of Coconut Trees.

Notices were served on 75 persons.

Two hundred and fifty-four trees, 95 stumps and 50 heaps of rubbish removed.

					\$	c.
Estimate	...	...	...	...	210	00
Transport	...	...	...	...	209	96
					<hr/>	
Balance	...	...	...	...	\$0	04
					<hr/>	

Revenue and Expenditure.

RECEIPTS.

					\$	c.
By balance in Bank	...	...	...	...	4,773	44
" Government Grant	...	...	...	...	7,950	00
" Sale of plants and seeds	...	...	...	...	8,613	77
" Sale of prepared rubber	...	...	...	...	4,919	51
" Bank Interest	...	...	...	...	66	53
					<hr/>	
Total	...	...	...	...	\$26,323	25
					<hr/>	

EXPENDITURE.

					\$	c.
Salaries	...	...	...	...	11,131	01
Bills	...	...	...	...	12,677	55
Balance in Bank on 31st December, 1911	...	...	...	...	2,514	69
					<hr/>	
					\$26,323	25
					<hr/>	

HENRY N. RIDLEY,
Director of Gardens, S. S.

Conserved by



